

Cognitive tests and norms in the diagnosis of developmental dyslexia in adults.

(Presented at Conference for Neuropsychologists, Copenhagen May 24, 2006)

934 adults "with difficulties in reading and writing" have been individually interviewed and tested (3-hour sessions) in the period of 2000-2006. They were 434 men and 500 women aged 15-62 years (median 26.2), primarily from Copenhagen. 133 were categorised bi-lingual, and their results separately analysed. Demographic and anamnestic variables were systematically registered, and each was given 12-16 tests (from a larger pool) of their reading, spelling and selected cognitive functions.

The actual linguistic tests chosen for each participant necessarily varied, but the large majority were given:

Reading aloud:

Text	T-tests, level 1-7
Words	O-tests, level 1-7
Words/Nonwords	Carsten Elbro's matched lists

Silent reading and -comprehension:

Text	VPG's cloze-test: 'Læsetekst II'
Words	DiaVok's multiple choice of correctly spelled words
Pseudohomophones	DiaVok's multiple choice of correctly sounding words

Spelling of words:

Writing	ST-tests, level 3-9
Verbal (words)	A1
Verbal (nonwords)	A2

Pronunciation: THI's Repetition of words & quantified observations

More than 98% of the participants also completed the cognitive tests:

Auditive/phonological memory-span:

Digits	WAIS' Digit span forwards & backwards
Sentences	THI's Sentence span

Thinking & Problemsolving:

Linguistic/concepts	WAIS' Similarities
Visual/logic analysis	Raven SPM

A general problem is the lack of relevant norms or reference-data for most tests, and this poster presents the distribution of scores in the cognitive tests, and focus some problems of their interpretation and use in the diagnosis of dyslexia.

"Norms" are always relative to some more or less well specified population, and their use for specific subgroups is questionable.

To illustrate this, some examples of the differences between subgroups of participants in the present study are also shown.

A detailed report of the administration, scoring and simple distribution of results for the first 530 participants was previously given but the sample is now considerably enlarged, and more detailed analyses are in progress.

(Jepsen, Michael 2004: Om tests for ordblindhed: Undersøgelser af 530 voksne personer med læse- og stavevanskeligheder. Del I. Infosafe Consult, ISBN 87-990033-0-9.)

A comprehensive program "TestAnalyse" has also been developed- and used in this study to input, analyse, present, and store the results of individual participants on a large number of typical tests of reading-, writing-, phonological-, and cognitive skills.

The automatic analysis and immediate presentation of individual results as "Profiles" has been found very useful by some practitioners, and the program can be demonstrated on request. (A free trial-version is available).

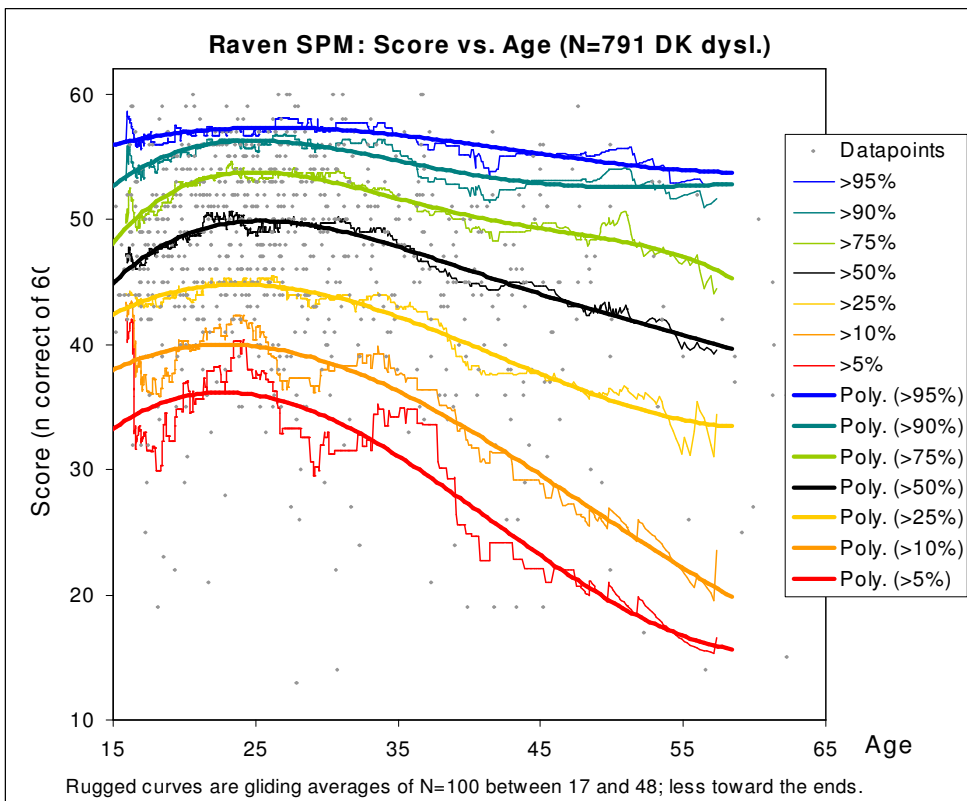
For more detailed information about the report and the program TestAnalyse, see www.infosafe.dk .

Any comments, questions or suggestions of projects or cooperation to make further use of the large body of data from this study, will be welcome!

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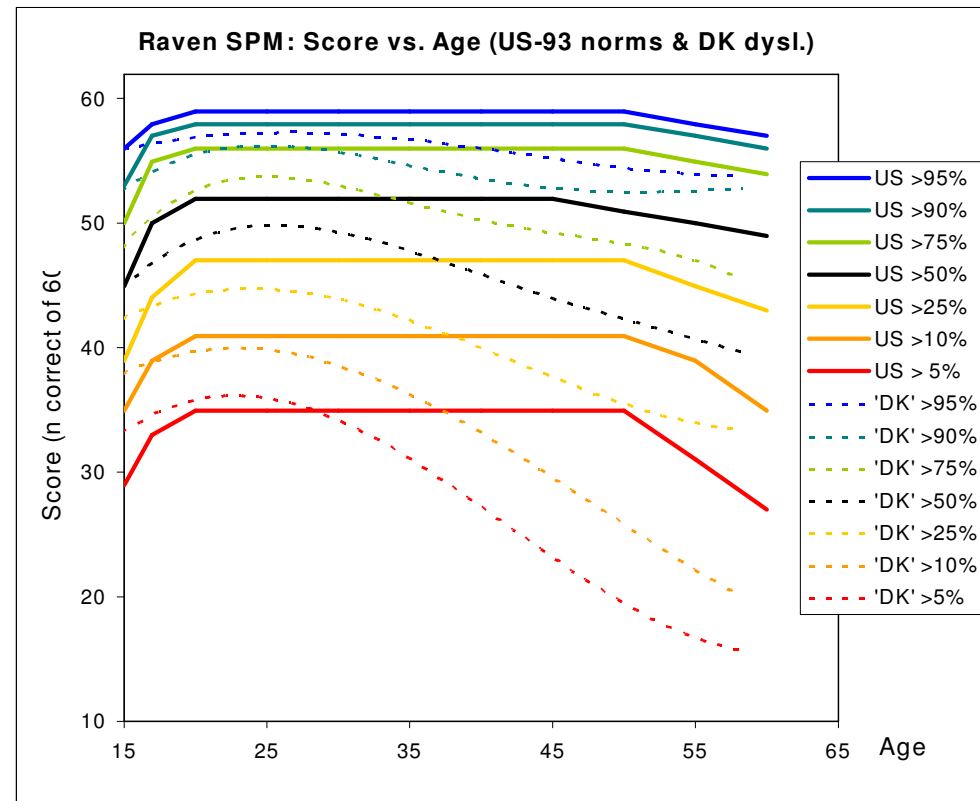
Diagnosing dyslexia, the (supposedly non-linguistic-) Raven SPM is used for comparison, to ensure that a low performance in the linguistic tests cannot primarily be attributed to a more general mental weakness.

Continuous curves are simply non-theoretical approximations to averages. (There is a limited but significant 'dip' in scores around 40-45 years which may distort curve-fitting somewhat. It re-occurs more clearly in other tests and is probably caused by a random variation in the sample.)

The performance in this population is highest at 23-30 years and then decreases gradually. There is a small 'ceiling-effect' (7 men and 1 woman score 60), but generally the scale is acceptable for this population.

But:

- Where are the actual danish norms to compare with? (Non-existing!)
- Is this sample representative of adult dyslexic danes ?
- Does a dyslectic impairment also cause difficulties in Raven?



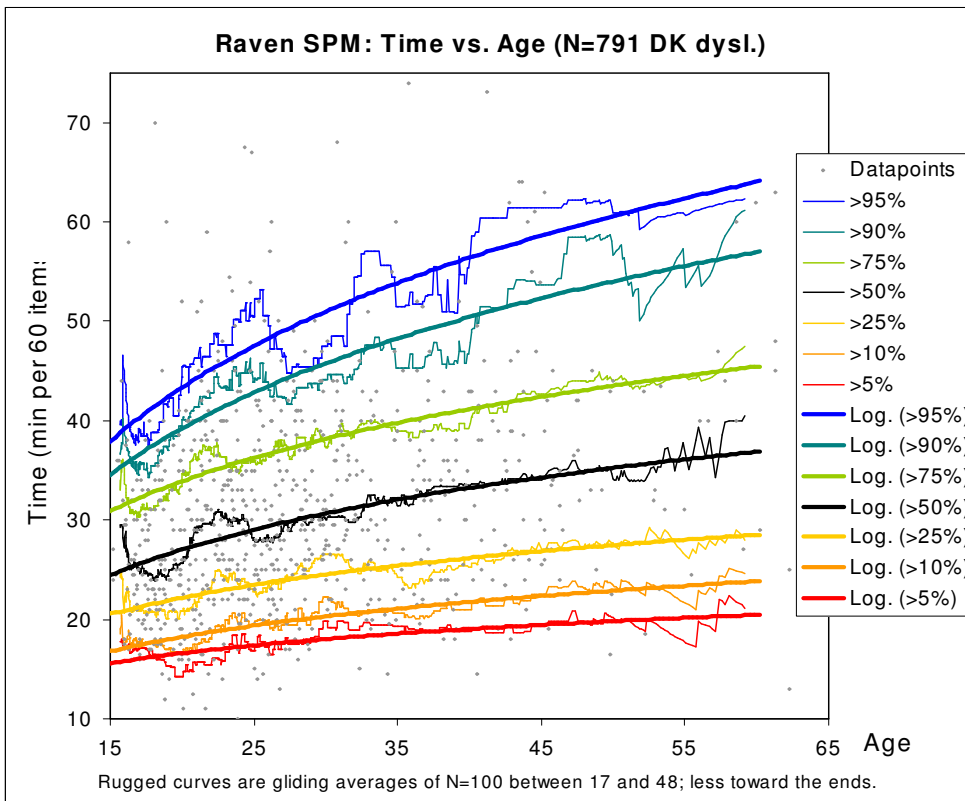
This sample of native Danes with R&W-difficulties scores well below the US-1993 standardisation at nearly all levels and ages above 17. Reduced performance by age also occurs earlier and faster. But:

Are these US-norms inflated? -And how much ? (Jepsen 2004):

- In the US-study only some 70% agreed to participate, and the test was administered 'extremely' at leisure (often left at the residence of the participant and collected later), -as opposed to the 99% participation and strictly controlled, timed and non-assisted conditions of the present study.
- The US-norms below 19 years stem from other (more controlled?) studies, and appear closer to the present data.

But of course it is also possible that:

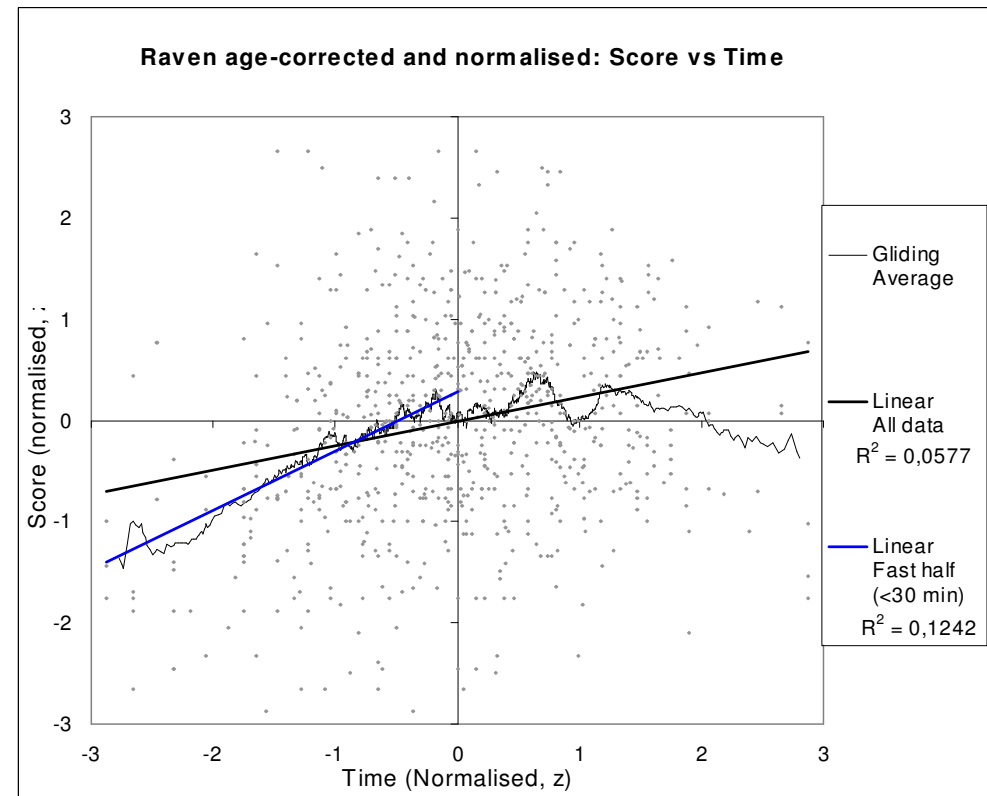
- A dyslectic impairment also causes difficulties in some Raven-items ?
- Dyslexic persons have benefited less from the 'positive' Flynn-effect? (To the degree this effect is mediated through a written culture?)



This sample of native Danes with R&W-difficulties shows a continuous increase by age in the time spent on the 60 items in Raven SPM. (Data below 16 and above 52 are limited). Continuous curves are simply non-theoretical approximations to averages.

The total median is 29,5 minutes (near 25 years) but there are no norms to compare with. Participants were informed of 'free time' but also about an average around 30 minutes and sometimes a mild pressure was exerted after 50 minutes.

It is conceivable that some participants could have increased their score if they had spent more time on the task -and maybe had the opportunity to return to the problems later. Because of the interaction with age however, this possibility cannot be illuminated by reference to the 'raw' data here.

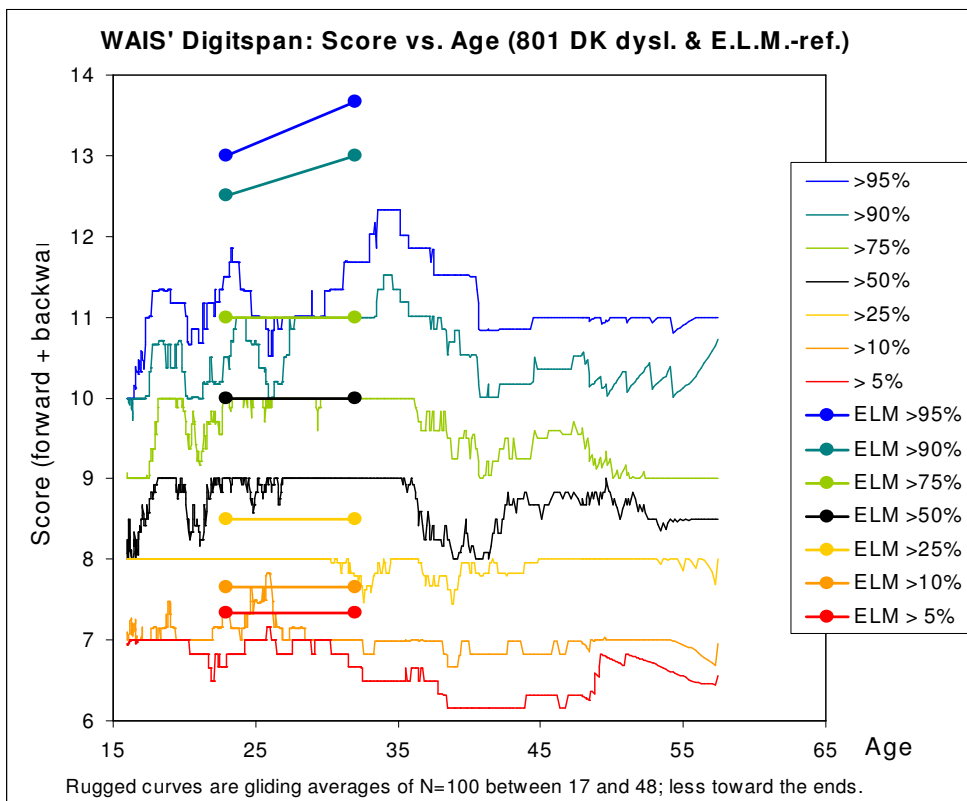


Score and Time for each person were corrected for age and normalised to standard deviations within the sample.

At a first glance the the distribution appears to be relatively random and the total simple linear correlation is also relatively small: $r = 0,24$.

The gliding average however, shows that this is not a fair representation: For the fastest half of the participants (using less than about 30 minutes), the correlation is $r = 0,35$; indicating a possible 'speed-accuracy' trade off for this group.

This is of course only correlational evidence (other factors may be in play) but it doesn't contradict the possibility that some participants could have scored higher, if given more time and/or the opportunity to return to the task later. (As in the US-93 study).



Wais' test of auditive/phonological working memory (Digitspan) was given to all participants.

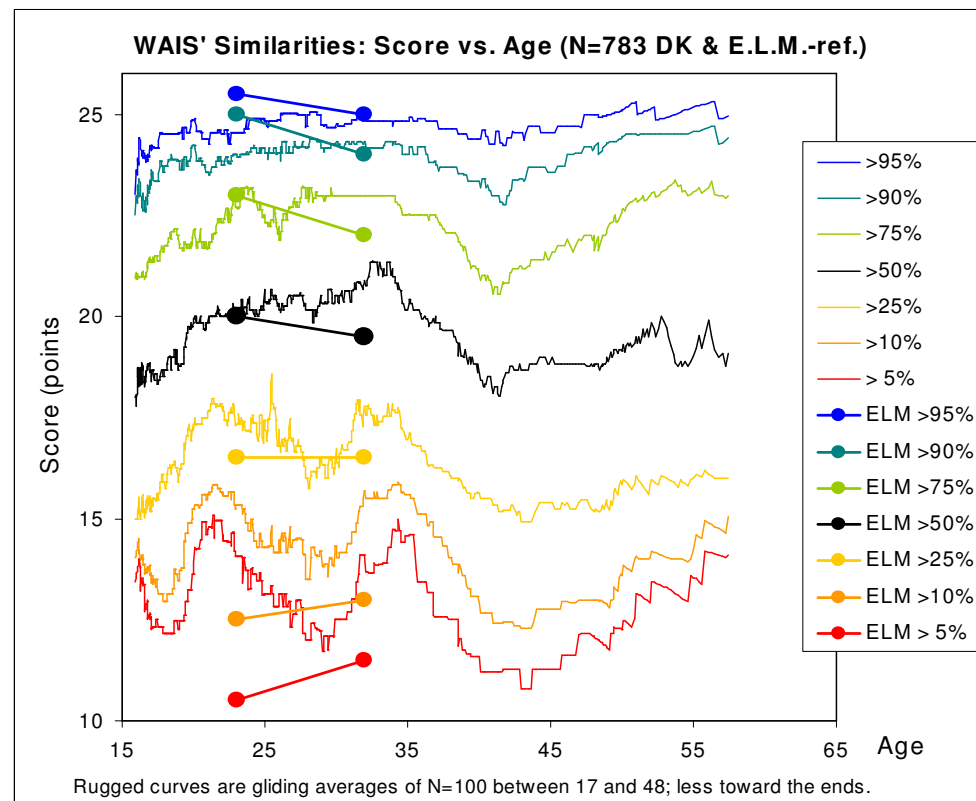
Performance rises up to some 19-25 years of age and (apart from the 'dip' around 40-45) decreases only slightly over the range measured here. (THI's test of 'Sentence-span' yields comparable results but no norms exist.)

At all levels, performance is below the references given by E. L. Mortensen (1993) for two age-groups of 'normals'.

Most pronounced is the limited number of high-scorers in the sample: Only 10% score above- against 72% below the 'normal' score of 10.

- Is a deficiency in auditive working memory a basic symptom of dyslexia?
- Does this also cause difficulties in Raven? (The solution of some items benefits from verbally mediated reasoning.)

The within-sample correlation of scores in Raven and Digitspan is $r = 0,37$ and with Sentence span $r = 0,41$.

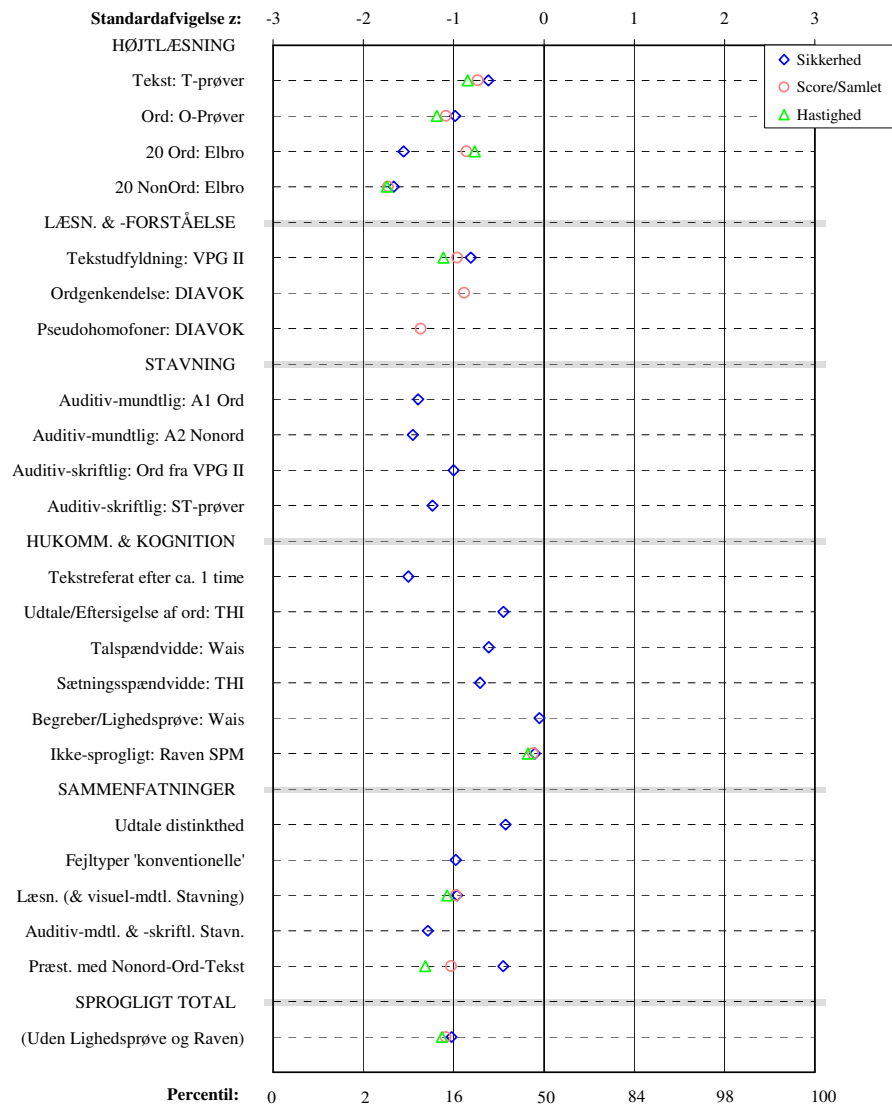


In the diagnosis of dyslexia, WAIS' Similarities is used for the same purpose as Raven. It is more verbal/linguistic demanding than Raven but both are known to yield relatively good estimates of general intelligence. The within-sample correlation of Raven and WAIS' Similarities is $r = 0,57$.

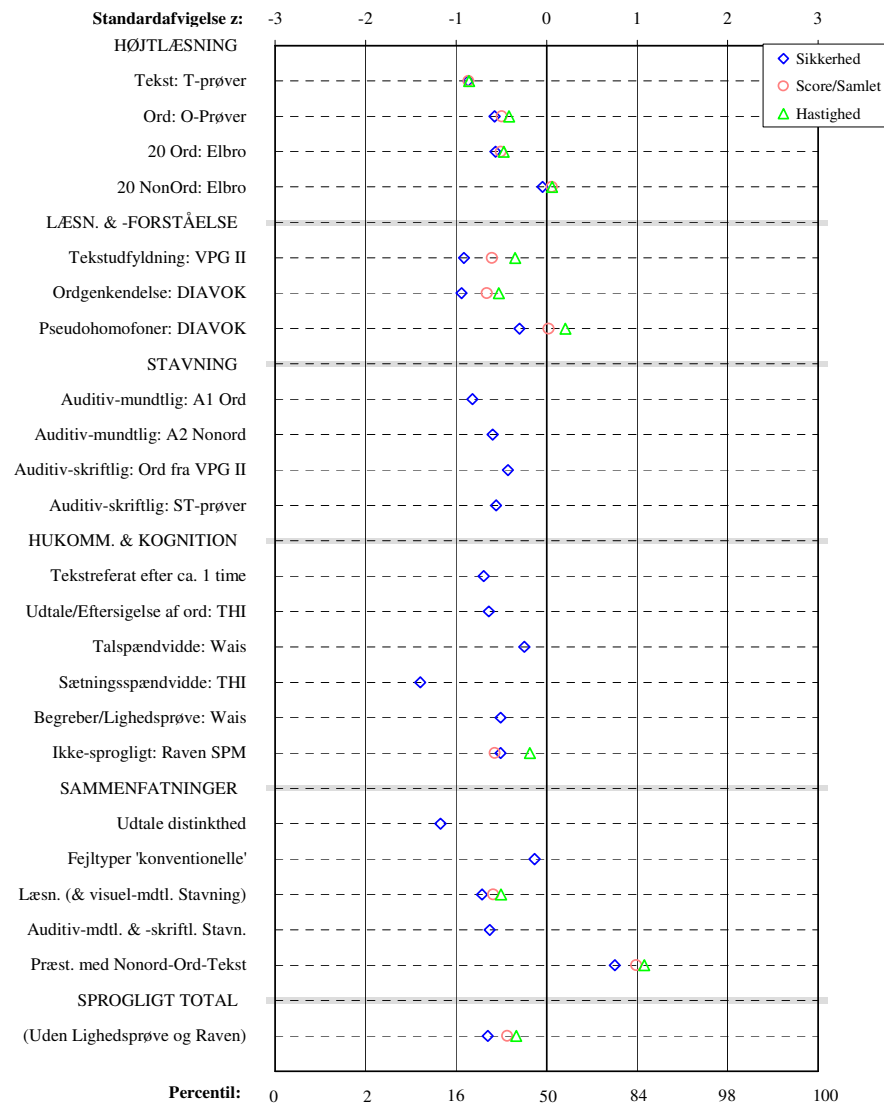
Performance rise up to some 25-35 years of age and (apart from the large 'dip' around 40-45) decreases only a little over the range measured here.

At medium- to high levels, performance is near the references given by E.L.M. (1993) for two age-groups of 'normals', and at low levels it is higher.

Scores in Similarities however, is notoriously influenced by the interviewer, and though internally consistent, the procedures of administration and scoring used in the present study (Jepsen 2004) may have led to slightly inflated results, especially at low levels.

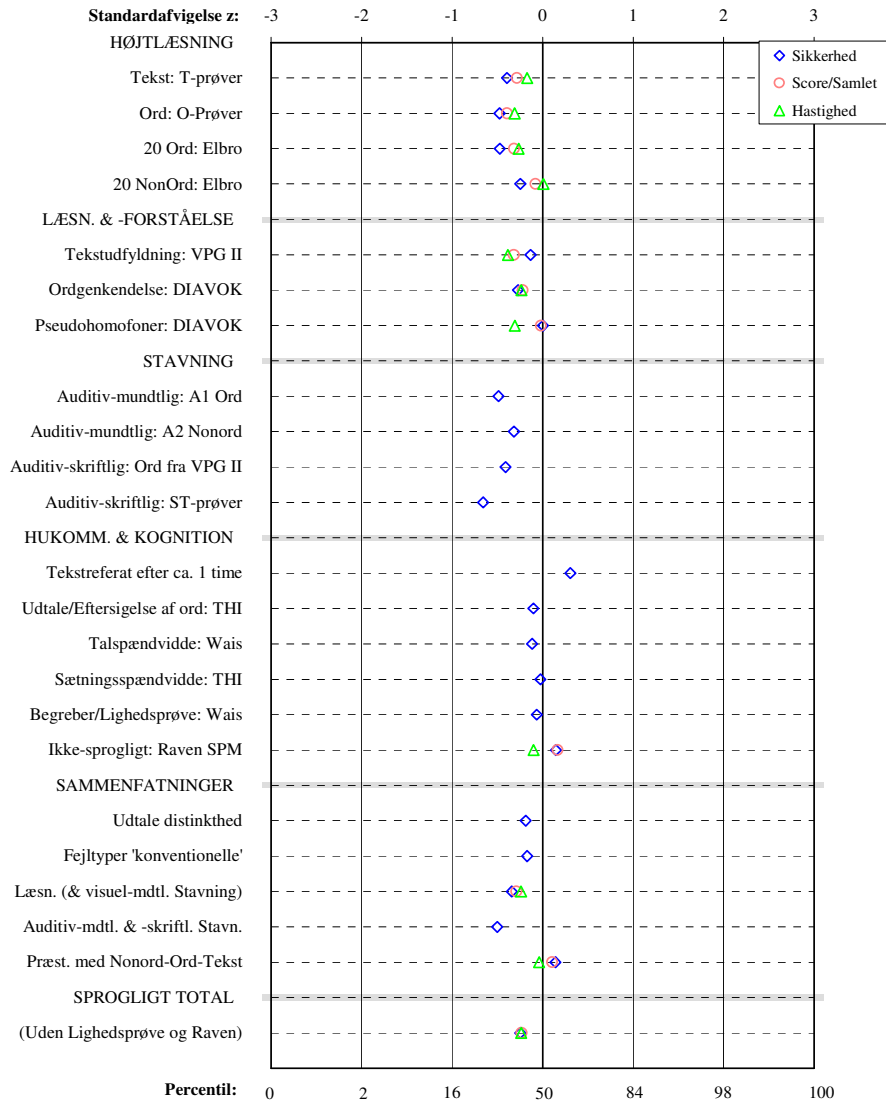


Absolute Norms (widely representative) of adult danes are sparse for these tests. Using the tests however, always implies some reference to an im- or explicit norm. Implicit 'norms' tend to 'drift' over time and should at least be made explicit: This figure shows the 'Profile' of a typical (median) **danish participant**, relative to the more or less hypothetical (but explicit) distributions for **all adult native danes**. (Only the most frequently used tests are shown here.)



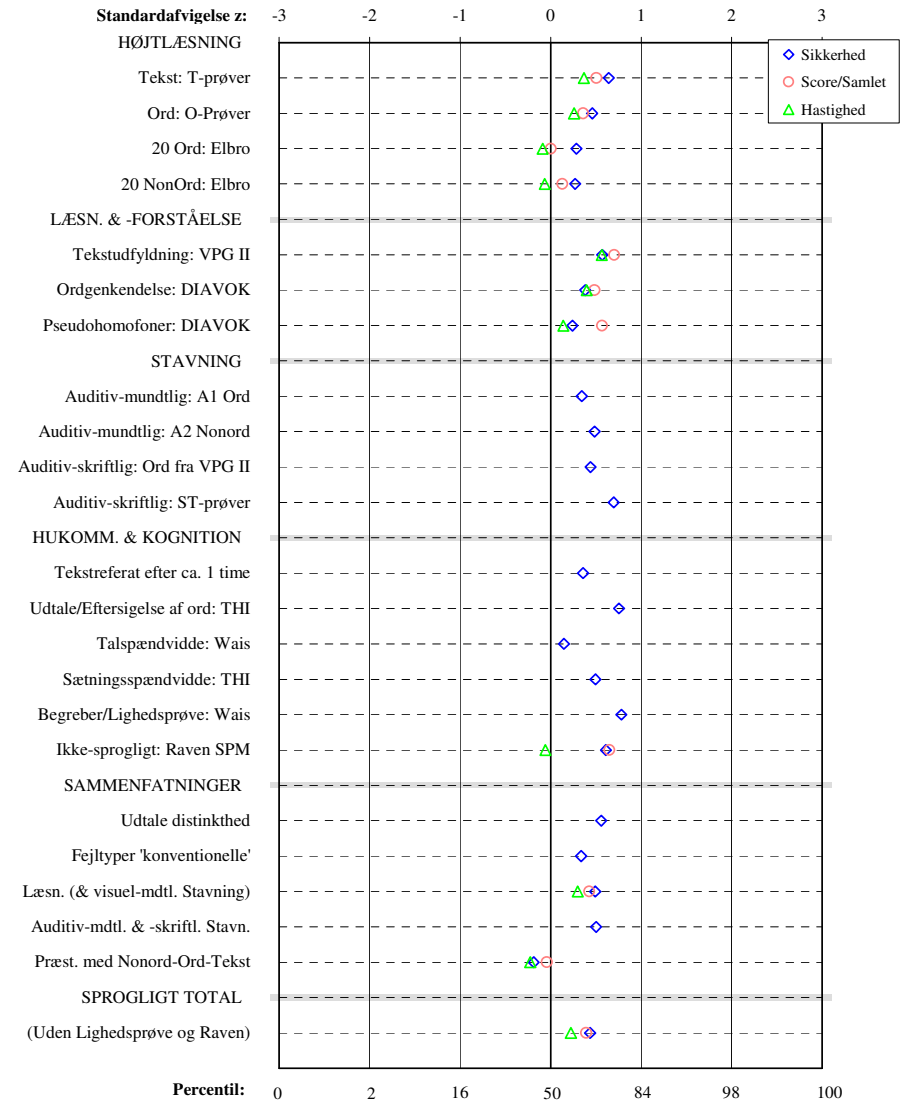
Relative Norms (referring to specific subgroups) narrow the population represented but can gain in precision and -sometimes in the relevance of their use. But which subgroups should be identified and given separate evaluation? This figure shows the 'Profile' of a typical (median) **bi-lingual participant**, relative to the distribution of the **native danish** participants. The differences are generally so large, that this group is handled separately.

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Relative Norms (referring to specific subgroups) narrow the population represented but can gain in precision and -sometimes in the relevance of their use. This figure shows the 'Profile' of a typical (median) **danish male** participant, relative to the distribution of the native **danish female** participants. Males score below females in most language-dependent tests but least with nonwords and not in the cognitive tests. (Should these subgroups be handled separately?)

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Relative Norms (referring to specific subgroups) narrow the population represented but can gain in precision and -sometimes in the relevance of their use. This figure shows the 'Profile' of a typical (median) danish participant with- or undergoing a **higher education** , relative to the distribution of participants with a **lower educational level**. Many students depend upon a diagnosis as 'dyslexic' to get special support, so- is it fair to evaluate their performance against the 'norms' for all?