Effect of age and level of education on the Dutch Naming Test (DNT)

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Abstract

Title: Effect of age and level of education on the DNT.

Background: Word finding difficulties, also known as anomia, are assessed with picture naming tests. Several studies show a decrease in naming ability with increasing age and lower education. Both variables have not been taken into account in the development of the current norms of the new Dutch Naming Test (DNT). This needs to be studied in order to be able to diagnose word finding difficulties more adequately.

Aims: To determine the effect of age and level of education on the performance on the DNT in healthy Dutch adults. A prediction model will be developed to generate correction tables for the DNT for age and education.

Methods: A cross-sectional psychometric study was performed in a sample of 193 healthy Dutch native speakers. To identify to what extent the variables age and level of education could predict the score of the DNT, multiple linear regression analyses were applied.

Results: There was a significant relationship between age and level of education on the score of the DNT. Both variables contribute significantly to picture naming ability in healthy adults. Moreover, gender was identified as a significant predictor in both regression models.

Conclusion & Recommendations: This study shows that age and level of education contribute significantly to the performance on the DNT and emphasizes the importance of correcting the normative data on these variables to diagnose word finding difficulties more accurately. Moreover, further research is needed to study the effect of gender.

Keywords: Dutch Naming Test, normative data, adults, aphasia, anomia

Samenvatting:

Titel: Het effect van leeftijd en opleidingsniveau op de NBT.

Achtergrond: Een benoemtest kan helpen bij het identificeren van woordvindstoornissen. Verschillende studies laten achteruitgang in het benoemen zien als mensen ouder worden en bij een lager opleidingsniveau. Bij de ontwikkeling van de nieuwe Nederlandse Benoem Test (NBT) is er geen rekening gehouden met het effect van leeftijd en opleidingsniveau. Het is van belang dat dit wordt onderzocht om woordvindstoornissen accurater te diagnosticeren.

Doel: Het bepalen van het effect van leeftijd en opleidingsniveau op de prestatie op de NBT bij gezonde volwassenen met Nederlands als moedertaal. Er wordt een predictiemodel ontwikkeld om correctietabellen te genereren.

Methoden en procedures: Een cross-sectioneel psychometrisch onderzoek werd uitgevoerd in een steekproef van 193 gezonde volwassenen met Nederlands als moedertaal. Om de relatie tussen leeftijd en opleidingsniveau op de score van de NBT te onderzoeken werden correlaties berekend. Om vast te stellen in hoeverre de variabelen leeftijd en opleidingsniveau de score van de NBT kunnen voorspellen is er een multiple lineaire regressieanalyse uitgevoerd.

Resultaten: Er was een significante relatie tussen leeftijd en opleidingsniveau en de score van de NBT. Beide variabelen leveren ook een belangrijke bijdrage in het voorspellen van de score, gebaseerd op de multiple regressieanalyse. Een onverwachts resultaat was dat geslacht als significante voorspeller in het regressiemodel werd opgenomen.

Conclusie & aanbevelingen: Deze studie benadrukt dat leeftijd en opleidingsniveau een belangrijke bijdrage leveren aan de prestatie op de NBT en toont het belang aan voor het gebruik van normgegevens om op individueel niveau nauwkeuriger te kunnen diagnosticeren. Verder onderzoek is nodig om de bijdrage van geslacht te bestuderen.

Kernwoorden: Nederlandse Benoem Test, normering, volwassenen, afasie, woordvindstoornissen.

Introduction

The process of retrieving words from the mental lexicon has been a topic of great interest in psycholinguistic research for several decades.[1–5] The mechanisms involved in word retrieval, often assessed by (picture) naming, have been captured by various language production models. These language production models address the different steps of naming.[6] Even though these models vary in several aspects, they all agree that naming involves four main processing steps: conceptual preparation, lexical selection, word form encoding, and articulation.[1–6] Naming starts at the conceptual level, with a preverbal message. In the second step semantic information is retrieved to form a lexical semantic representation. The third step involves specification of the phonological properties of the lexical representation. Finally, the word is articulated.[4,6]

Break-down in the process of word finding is a common feature of patients with brain damage.[7] People with aphasia for instance, frequently suffer from word finding difficulties, also known as anomia (literally "without name"; the inability to name items) which seriously affects communication and is seen as the most striking problem of aphasia.[8,9] Anomia is usually assessed with picture naming. The performance on a picture naming test has been related to the ability to use nouns in everyday communication for people with aphasia.[10] In the Netherlands a new naming test was published in 2017: the Dutch Naming Test (DNT).[11]

The DNT has shown to be a reliable and valid tool to diagnose anomia in people with aphasia.[12] The items are selected based on two psycholinguistic factors: age of acquisition (AoA) and word frequency (WF). AoA and WF both have an essential impact on speed and accuracy of naming. Words acquired early in life and words that occur more frequently in a language tend to be easier to retrieve.[13] It is suggested that AoA is related to the semantic process of word retrieval.[14] Word frequency is associated with retrieval of the phonological representation.[15,16] As a result, the DNT is a sensitive diagnostic tool to diagnose anomia and has the ability to determine which step(s) of the word retrieval process is/are impaired.[17] However, according to literature more factors have a significant influence on picture naming.

Healthy older individuals often complain about word finding difficulties.[18,19] Numerous studies indicate that changes in naming ability occur with age. These differences manifest when individuals reach their 70s.[20,21] The performance on the Boston Naming Test for example, decreased with two percentage points per 10-year period, with a slightly increasing negative slope.[20] The decline in naming ability due to age has been attributed to modifications in cognitive function associated with changes in the brain across the life span.[18,22] In addition, the decline in word retrieval is suggested to be caused by age-associated weakened connections between a word's semantic and phonological representations.[23]

Paradoxically, research shows that older adults have a larger lexicon than younger adults. Older adults show higher scores on vocabulary tests than younger adults.[24] This suggests that the size of the lexicon increases from younger adults to older age. It is suggested that a large and rich lexicon helps older adults to overcome defects in word retrieval.[25,26] In contrast, younger adults perform better when tasks performance depends on speed of retrieval or the inhibition of irrelevant information.[24]

In addition to age, evidence is also found for the effect of level of education on naming. Multiple studies found that a high score on a picture naming test, is associated with a higher level of education.[20,27–30] The BNT-score for example, decreased with level of education.[30] Although, the variability in BNT-score increased for people with lower levels of education, implying greater heterogeneity in naming for participants with lower levels of education.[30] These findings show that, level of education is an important variable to consider in the development and validation of naming tests.

The effect of age and level of education have not been studied yet for the DNT. These results enable more accurate and refined diagnostic capacity of the DNT in order to diagnose word finding difficulties more adequately in Dutch people, who suffer from word finding difficulties.

Aim

The aim of this study is to determine the effect of age and level of education on the performance on the Dutch Naming Test (DNT) in healthy Dutch adults across the Netherlands. In addition, a prediction model will be developed based on age and level of education to generate correction tables for the DNT.

Method

Study design

A cross-sectional psychometric study was carried out in the Netherlands between January and June 2019.

Population & domain

The study population is a representative sample of healthy Dutch native speakers. In order to be eligible to participate in this study, participants had to be: 1) aged over 18 years and 2) native Dutch speakers. Participants were excluded from participation in case of 1) history of neurological damage, 2) language disorder during childhood, 3) visual problems resulting in the inability to recognize pictures, and/or 4) hearing problems resulting in the inability to understand instructions, even with hearing aids. A sample of 140 participants was needed determined by a sample size calculation with a two-sided $\alpha = 0.05\%$ (z-value of 1.96) and a power (1-β) of 80% (z-value of 0.84). To ensure an appropriate distribution of the variables age and level of education, 140 participants were divided into nine groups. Thus, a total of approximately 16 participants per group was pursued. The participants were recruited in three defined age groups: 18-49 years old, 50-69 years old, and 70 years and older. Each age group was classified by level of education: low, medium and high. The categories regarding level of education are based on the Central Agency for Statistics (in Dutch: Centraal Bureau voor de Statistiek (CBS) (see appendix 2).[31] Other parameters such as gender and handedness were also included to get a complete description of the study population.

Data collection

Potential participants were recruited throughout the Netherlands to ensure a representative sample of the Dutch population. Data collection took place between February 2019 and April 2019. Younger people with a lower educational background were recruited from secondary vocational education and older people were recruited from senior residences. Younger people with higher educational background and the middle age group were mainly recruited among acquaintances. Recruitment strategies consisted of (news)letters, flyers, e-mails to different networks in which SLTs participate. In addition, the researcher joined several events, which were attended by older healthy people. Colleague speech-language therapists (SLTs) were asked to participate in this study as research-assistants.

Procedures

Each participant was tested once with the DNT by the main researcher or by a research-assistant (SLT). The DNT was administered either on paper or digitally on a laptop. The participants were instructed to name the picture in one word. The DNT was administered following the instructions stated in the manual and was recorded on a voice recorder. The test

administration was standardized by a test protocol (appendix 3). The measurement took place in a standardized, low-stimulus, and quiet environment. All audio recordings were transcribed and analyzed according to the DNT manual guideline. The research assistants submitted the complete test forms to the main researcher, who checked all the scores and corrected when necessary.

Data-analysis

Data was analyzed using IBM SPSS Statistics 23.[32]

To evaluate the interrater reliability of the scoring of the DNT, an independent SLT scored randomly 8% of the total sample. The level of agreement between the researcher and the SLT was determined by calculating the intraclass correlation coefficient (ICC). The calculation was based on the total score. The ICC and the 95% confidence interval were calculated using SPSS based on an agreement, two-way random effect model. It was preferable to use ICC instead of Kappa, as the parameters can be considered as continuous and an ICC gives more reliable information then a Pearson correlation.[33] An ICC greater than 0.7 is found to be very strong.[32]

The data was explored based on scatterplots and descriptive statistics. The relationship between age and score of the DNT was determined by calculating Pearson correlations, as these variables are continuous. A Kolmogorov-Smirnov test was performed to check the assumption of normality. To explore the relationship between level of education and the total score of the DNT, a boxplot was created to evaluate the distribution of this variable. The relationship between level of education (an ordinal variable) and score of the DNT was determined by calculating the non-parametric Spearman correlations.

Regression analysis is normally performed with variables at interval/ratio level. Since the variables level of education and gender are categorical, dummy variables (dichotomous) were created. In this case, women and educational level ‘high’ were categorized as 0, the reference category. To identify to what extent the variables age and level of education significantly predict the score of the DNT, multiple linear regression analyses were applied. Correlations and variance inflation factors (VIF) were assessed to examine collinearity between the predictors. Normality plots and residual plots were used to evaluate whether the assumptions of normality and homoscedasticity were met. Backward linear regression was carried out until the remaining variables had a significance level below 0.1. The dummy variables were manually selected to ensure that dummy variables of the same variable remain together. Regression lines were plotted and the proportion of variance that age, level of education and gender could explain, was explored with R-squared (R^2).

Additional analyses

If initial analysis were to show gender significantly contributes in predicting the score, additional analyses would be applied. Specifically an independent samples t-test to examine the differences in total scores and age among gender, and a chi-square test to examine differences in level of education among gender.

Ethical issues

This study was conducted according to the principles of Helsinki and in accordance with the General Protection Regulation (Algemene Verordering Gegevensbescherming).[34] The Medical Research Involving Human Subjects Act (Wet Medisch Wetenschappelijk Onderzoek Met Mensen) did not apply to this project, therefore it was not needed to be assessed by the Medical Ethics Committee (Medisch Ethische Toetsingscommissie). All participants provided written consent before participation (see appendix 1). All data was anonymously processed.

Results

Participants

197 healthy Dutch people were recruited for participation. Four participants were excluded because, in retrospect, they did not meet the inclusion criteria. The characteristics from the remaining 193 participants (68 males, 125 females) are presented in table 1. Age ranged from 18 to 93 years (M= 56; SD = 20). Fifteen SLTs cooperated in this study as a research-assistant and provided data from 79 participants.

[table 1]

Interrater reliability

There was a very strong agreement between the researcher and the SLT in scoring the DNT with an ICC-agreement of 0.982 [CI: 0.950-0.994].

Relationship between age and level of education on the score of the DNT

A Kolmogorov-Smirnov test indicates that the variable age follows a normal distribution, D(193) = 1.253, p = 0.086. A significant correlation was found between age and the score of the DNT (r = -0.40, p <0.001). The scatterplot (figure 1) shows the relationship between the variable age on the total score of de DNT. Also, a significant correlation was found between level of education and the score of the DNT (r_s = 0.29, p <0.001). The boxplot (figure 2) shows the distribution of the variable level of education. There was no significant association between the independent variables age and level of education (r_s = -0.02; p <0.792).

Linearity, collinearity, multicollinearity, and homoscedasticity

The assumption of linearity over the whole age range was not met and a quadratic regression was also questionable. Analysis of the scatterplot of age and the total score of the DNT revealed two linear regression lines. Between the age 18 till 60 years there was, more or less, a straight horizontal regression line and a decline in scores from the age of approximately 60 years with a steepest decline from 70 years of age (figure 1). A single multiple regression would therefore be unsuitable. Two multiple regression lines were created for 18-59 years and 60+ to predict the scores. Correlation coefficients between the predictors were less than 0.9 suggesting that there were no collinearity problems between the predictors.[32] Investigation of multicollinearity with ‘Tolerance’ and ‘Variation inflation factor (VIF) indicated that there was no multicollinearity between the variables. Visual analysis of the normal probability plots, and the residual plots showed that the assumptions of normality and homoscedasticity in both regression models were acceptable.

Prediction of total score of the DNT

Participants of 18-59 years of age

The characteristics of the 102 participants in the younger group are presented in table 2. A backward linear regression model was carried out until the remaining variables had a significance level below 0.1 (table 3). The final model consisted of level of education (low) and gender as significant predictors of the total score of the DNT. The variable 'medium educational level' was also included, because it is from the same main variable; level of education. This model explained 24.6% of the variance in the total score of the DNT. Age did not make a significant contribution to this model.

The following regression equation to predict the total score of the DNT with variables gender and level of education has been derived:

$$Y' = a - b1x1 - d1D1 - d2D2$$

DNT total score = 269.420 – 3.861 (men) – 8.473 (level of education low) – 2.155 (level of education medium).

[table 2]

[table 3]

Correlations

There were no significant correlations between the variables age, level of education and gender indicating that there were no collinearity problems.

Participants 60 years of age and older

The characteristics of the 91 participants in the older group are presented in table 2. At first, the variable age was set at 60 years for the multiple regression analyses. The final model consisted of level of education, gender and age as significant predictors of the total score of the DNT (table 4). These predictors explained 42.5% of the variance in the total score of the DNT.

The following regression equation to predict the total score of the DNT with variables level of education, gender and age has been derived:

$$Y' = a - b1X1 - b2X2 - d1D1 - d2D2$$

DNT total score = 271.074 – 3.575 (men) – 0.668 (age) – 5.736 (level of education low) – 2.995 (level of education medium).

[table 4]

Correlations

In the older group there was a significant negative weak relationship between the predictor variables gender and level of education (r = -0.21, p <0.045).

Correction tables

Based on these prediction models, two correction tables were generated (appendix 4). These correction tables can be used by SLT's to correct raw scores of the DNT for age, level of education and gender. In addition, it provides information about the predicted scores.

Additional analysis of gender (18-59 years)

Independent samples t-tests did not find significant differences in scores between men (M=264, SD=7.6) and women (M=266, SD=6.4) conditions; t(100) = -1.66, p < 0.099. Nor there was a significant difference in age between men (M=41; SD=11) and women (M=39; SD=15) conditions; t(100) = 0.545, p < 0.587.

A Chi square test revealed that level of education was not significantly different between men and women, $\chi^2(2)$=3.140, p > 0.05.

Profile plot

Level of education and gender are significantly associated with the score of the DNT (figure 3). Visual inspection of the graph, reveals a difference in the impact of level of education between men and women. Men and women have similar scores for educational levels medium and high, but there is a substantial difference for educational level 'low'. The average score was lower for men than for women, particularly for men with less education, indicating that the scores of women are less dependent on the variable level of education.

[figure 3]

Additional analysis of gender (60 years and older)

Independent samples t-tests did not find significant differences in scores between men (M=256, SD=11) and women (M=259, SD=8.7) conditions; t(89) = -1.368, p < 0.175. Nor there was a significant difference in age between men (M=73; SD=9.7) and women (M=73; SD=7.5) conditions; t(89) = 0.545, p < 0.790.

A Chi square test revealed that level of education was not significantly different between men and woman, $\chi^2(2)$=4.146, p > 0.05.

Profile plot

Level of education and gender are significantly associated with the score of the DNT (figure 4). There is no clear presence for interaction between gender and level of education.

[figure 4]

Discussion

The aim of this study was to determine the effect of age and level of education on the performance on the DNT in younger and older healthy Dutch adults in order to diagnose word finding difficulties more accurate with the DNT. Two prediction models and correction tables were developed. The results show a significant association between age and level of education and the score of the DNT. The performance on the DNT significantly decreased with age and this relationship was found to be moderately strong. A positive, though weak, relationship was found for level of education. This suggests increased performance on the DNT with a higher level of education. The regression model for the younger group included level of education and gender as significant predictors with a moderately strong prediction accuracy of 24.6% and in the regression model for the older group age was also added with a relatively high prediction accuracy of 42.5%.

The clear decline in naming abilities with age as reported in this study, are in line with a large body of evidence.[20,27,21,30] Repeatedly, studies found a negative association of age and naming ability. The study from Albert et al. showed that performance on a naming task remained stable throughout the age span until individuals reach their 70s.[21] In the study of Conner et al. a decline was visible from 60 years of age, which corresponds with the current study.[20] In addition, the performance of 50-year-old participants did not clearly differ from that of the 30-year-old participants, a finding that also corresponds with the literature.[21] It could be hypothesized that this decline in lexical retrieval derives from weakened connections among memory traces which may result in weaker activation of words. This hypothesis is supported in the literature and defined by MacKay & James as 'the transmission deficit hypothesis'.[35]

A significant correlation was found between level of education and the score of the DNT. Level of education appears to be a significant predictor of the score. This finding is in line with the results of three other studies,[20,27,36] but contradicts the results from the study by Tsang et al.[18] They posed the differences between their results and other studies is possibly caused by the selected pictures.[18] Furthermore, the authors argue that, as naming ability is related with age of acquisition (AoA) of the item, choosing pictures that are acquired early in life reduces the effect of level of education.[18] In the development of the DNT age of acquisition is taken into account in selecting the items.[17] Although the DNT corrects for AoA, an additional effect of level of education remains.

Somewhat surprising was the influence of gender that was present in both prediction models. Lansing et al. also found a gender effect on the performance on the BNT and observed that particular items were more easily named by men.[27] This is also supported by Zec et al. who found a non-significant trend that men have slightly higher scores.[30] Zhang et al. also found a

greater performance on naming for men.[37] The studies by Tsang et al. and Fastenau et al. however did not found gender differences.[18,38] Conner et al. found an interaction between gender and level of education as a significant predictor of performance on naming and were unable to explain their findings.[20] A recently published study by Moreno-Martínez et al. aimed to provide an explanation for the discrepancy in the effect of gender on naming found in previous studies, by administering naming tasks in a large sample of healthy adults.[39] They found a significant difference in naming pictures from different categories between men and woman, defined by Moreno-Martínez et al. as 'category-related gender asymmetries'.[39] Studies indicate that men are more familiar with animals and women with flowers, fruit, and vegetables.[39,40] Contradictory to previous literature, our study however, does not show the advantage in naming for men, but rather by woman. This could not be explained by the type of categories used in the DNT, but in this study it was remarkable that men used more abstract, low-frequent words which may have resulted in lower scores.

This study knows several strengths. First of all, the study population can be considered as representative for the Dutch healthy population, which increases generalizability. In addition, the required sample size of 140 participants was easily achieved, ensuring reliable results. Secondly, attention was payed to the importance of interrater reliability; 8% of the test forms were also checked by another SLT and showed good to excellent interrater reliability. Furthermore, all test forms were checked by the main researcher to reduce bias in scoring method.

To appreciate the findings of this study, some limitations also need to be considered. It was difficult to classify levels of education, because some educational programs no longer existed, especially for the older participants. Due to changing socioeconomic environment, it was quite difficult to include people in their 20s with a lower educational level. In this study population, a number of students was tested who studied at a secondary vocational school, normally classified as medium educational level. However, because they had not had completed the study yet, they were classified as part of the 'secondary education' group (the lower group). This may have resulted in bias. In addition, some groups were unequal. Of the 24 participants in the low educated younger group, 4 were men. This may have resulted in a big differences in scores, as can be seen in the profile plot (figure 3).

This study shows that age and level of education contribute significantly to the performance on the DNT and therefore emphasizes the importance of using normative data to improve diagnostic accuracy. In addition, this study provides a good starting point for further development of the correction tables using a larger group of participants. The correction tables are an important addition to using the DNT in clinical practice, as an adequate diagnosis of

word finding difficulties is an essential basis for therapy. Further research is needed to investigate the impact of gender on naming tasks, specifically the category-related gender asymmetries.

In conclusion, the findings of this study indicate that age and level of education significantly influence performance on the DNT. Both variables make significant contributions to predict the score. It is recommended to use these findings to create and implement correction tables in the use of the DNT. Further research is needed to study the effect of gender that was seen in this study.

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Tables

Table 1
Demographic characteristics total study population

Participants (*n*= 193)	n	Percentage (%)
Gender		
Female	125	64.8
Male	68	35.2
Handedness		
Right-handed	166	86.0
Left-handed	24	12.4
Ambidextrous	3	1.6
Unknown	0	0
Level of education		
Low	54	28.0
Medium	67	34.7
High	72	37.3
Age in years, mean (SD) [range]	56 (20) [18-93]	

Table 2
Demographic characteristics older and younger group

Participants 60 years and older (*n* = 91)	n	Percentage (%)
Gender		
Female	54	59.3
Male	37	40.7
Level of education		
Low	30	33
Medium	26	28.6
High	35	38.5
Age in years, mean (SD) [range]	73 (8) [60-93]	
Participants 18-59 years (*n* = 102)		
Gender		
Female	71	69.6
Male	31	30.4
Level of education		
Low	24	23.5
Medium	41	40.2
High	37	36.6
Age in years, mean (SD) [range]	40 (14) [18-59]	

Table 3
Multiple linear regression; predictors of the total score of the DNT (participants 18-59 years; n=102).[a]

	B	*SE B*	β
Step 1			
Constant	266.61	2.09	
Man	-3.74	1.31	-0.25**
Age	0.07	0.04	0.14
Low	-8.09	1.62	-0.50***
Medium	-2.08	1.37	-0.15
Step 2			
Constant	269.42	1.11	
Man	-3.68	1.32	-0.25**
Low	-8.47	1.61	-0.53***
Medium	-2.16	1.38	-0.16

Note: B: Unstandardized regression coefficient; SE: standard error; CI: confidence interval. R^2 *= .266 for step 1,* R^2 *= .246 for step 2 (p < .001). *p < .05, **p < .01, and ***p < .001)*
[a] *Backward multiple linear regression*

Table 4
Multiple linear regression; predictors of the total score of the DNT (participants 60 years and older; n=91).[a]

	B	*SE B*	β
Step 1			
Constant	271.07	1.98	
Man	-3.58	1.67	-0.18*
Age	-0.67	0.10	-0.57***
Low	-5.74	1.95	-0.28**
Medium	-2.30	1.99	-0.14

Note: Variable age was set on 60 years. B: *Unstandardized regression coefficient; SE: standard error; CI: confidence interval.* R^2 *= .425 for step 1 (p < .001). *p < .05, **p < .01, and ***p < .001)*
[a] *Backward multiple linear regression*

Figures

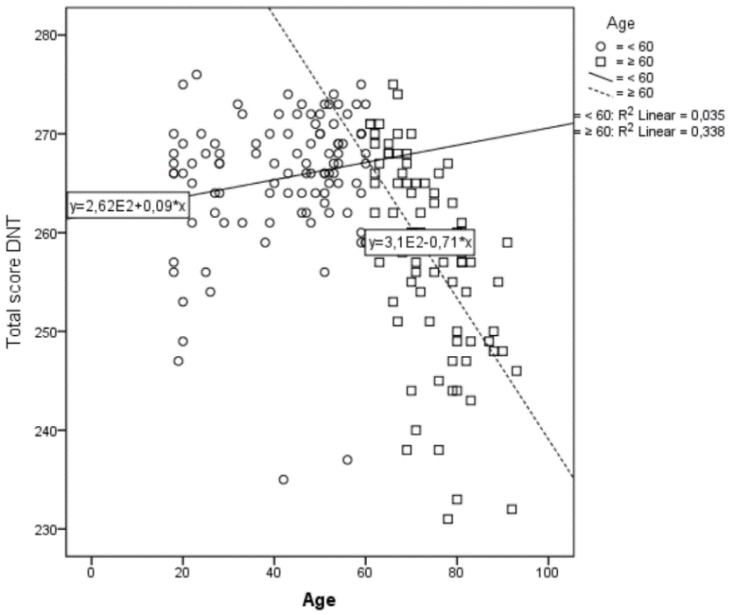

Figure 1. Scatterplot of age and DNT score, with a Pearson correlation coefficient of: -0.40 (p<0.001). Visualization of the two regression lines over the whole age span, with a visual decline in scores from 60 years of age

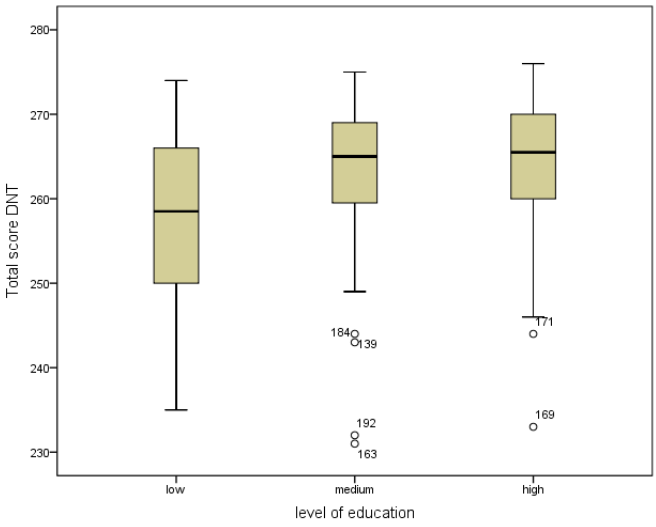

Figure 2. Boxplot that visualizes the distribution of the variable level of education, with a Spearman correlation coefficient: 0.29 (p<0.001)

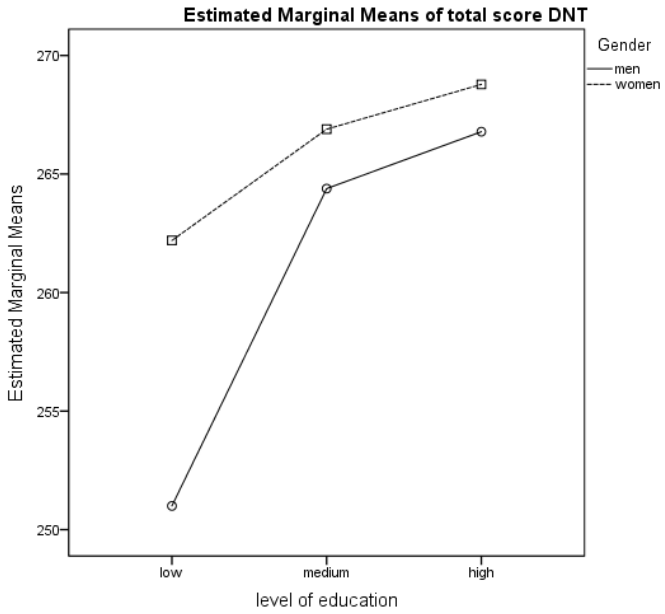

Figure 3. A visual representation of the estimated marginal means of DNT score of men and woman by level of education (younger group); a profile plot.

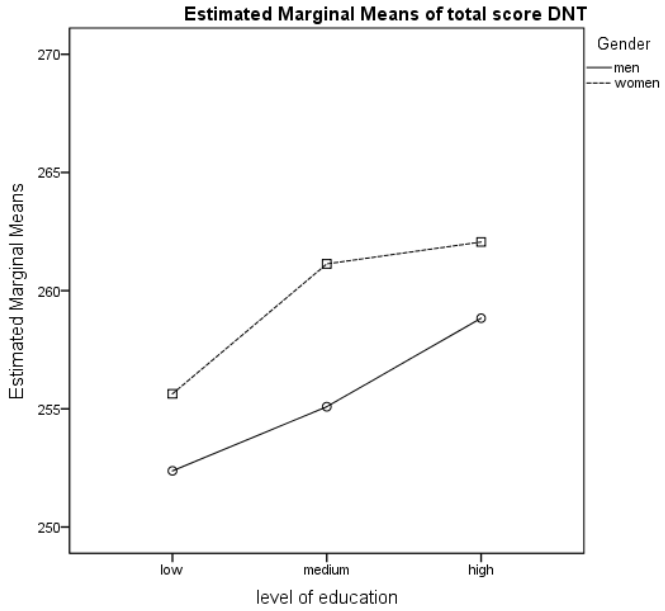

Figure 4. A visual representation of the estimated marginal means of DNT score of men and woman by level of education (older group); a profile plot.

Appendixes

Appendix 1 - Information guide & informed consent

“Het effect van leeftijd en opleidingsniveau op de Nederlandse Benoem Test (NBT)”

Geachte heer/mevrouw,

Wij vragen u vriendelijk om mee te doen aan bovengenoemd onderzoek. U beslist zelf of u wilt meedoen. Voordat u de beslissing neemt, is het belangrijk om meer te weten over het onderzoek. Lees deze informatiebrief rustig door. Bespreek met partner, vrienden of familie. Heeft u na het lezen van de informatie nog vragen? Dan kunt u terecht bij de student-onderzoeker. Op de laatste bladzijde van deze brief vindt u haar contactgegevens.

1. Wat is het doel van dit onderzoek?

Het doel van dit onderzoek is onderzoeken wat het effect is van verschillende leeftijden en verschillende opleidingsniveaus op de score van de Nederlandse Benoem Test. Enerzijds ervaren oudere volwassenen in toenemende mate woordvindstoornissen, maar aan de andere kant groeit ook je woordenschat als je ouder wordt. Daarnaast is bekend dat opleidingsniveau invloed heeft op de score van een benoemtest. Stel dat er een effect is, kan er een correctietabel verkregen worden. Op deze manier is het mogelijk om passend te diagnosticeren, rekening houdend met verschillen in leeftijd en opleidingsniveau.

2. Welke diagnostische test wordt onderzocht?

In dit onderzoek wordt de Nederlandse Benoem Test (NBT) onderzocht bij gezonde volwassen proefpersonen. Het is de bedoeling dat in totaal 92 kleurenafbeeldingen worden benoemd.

3. Hoe wordt het onderzoek uitgevoerd?

U krijgt via een laptop of een testmap afbeeldingen aangeboden. Het is de bedoeling dat u in één woord benoemt wat op de afbeelding staat. Uw antwoorden worden opgenomen. Het gaat om eenmalige testafname bij u thuis of op het werk. Indien mogelijk of gewenst kunt u ook naar de werkplek van de student-onderzoeker komen.

4. Wat wordt er van u verwacht?

Er wordt van u verwacht dat u in een sessie van maximaal 10 minuten 92 afbeeldingen benoemt die u via de laptop of een testmap aangeboden krijgt.

5. Wat zijn mogelijke voor- en nadelen van deelname aan dit onderzoek?

U heeft zelf geen voordeel of nadeel bij deelname aan dit onderzoek. Maar dit onderzoek kan wel nuttige gegevens opleveren, namelijk een test om woordvindsstoornissen te diagnosticeren bij mensen met afasie[1], dementie of andere aandoeningen met woordvindstoornissen.

6. Wat gebeurt er als u niet wenst deel te nemen aan dit onderzoek?

U beslist zelf of u meedoet aan het onderzoek. Deelname is vrijwillig. Als u wel meedoet, kunt u zich altijd bedenken en toch stoppen, ook tijdens het onderzoek. U hoeft niet te zeggen waarom u stopt. Als u besluit niet mee te doen, hoeft u verder niets te doen. U hoeft niets te tekenen. U hoeft ook niet te zeggen waarom u niet wilt mee doen.

7. Wat gebeurt er als het onderzoek is afgelopen?

Uw gegevens worden geanonimiseerd en geanalyseerd en alleen de student-onderzoeker en onderzoeksbegeleider hebben toegang tot uw gegevens. Als het hele onderzoek ten einde is wordt u hiervan op de hoogte gesteld en desgewenst kunt u een samenvatting van de bevindingen toegestuurd krijgen.

8. Wordt u geïnformeerd als er tussentijds voor u relevante informatie over de studie bekend wordt?

Als er tussentijdse informatie bekend is die mogelijk van invloed is op uw toestemming voor deelname aan dit onderzoek, dan wordt u daarvan tijdig op de hoogte gebracht. U beslist dan zelf of u met het onderzoek wilt stoppen of doorgaan.

9. Wat gebeurt er met uw gegevens?

Om dit onderzoek uit te voeren is het nodig dat uw persoonsgegevens worden verzameld en gebruikt. Deze gegevens blijven vertrouwelijk en uw naam wordt weggelaten en vervangen door een code. Alleen de student-onderzoeker en afstudeerbegeleider weten welke code u heeft en de sleutel voor de code blijft ook bij hen.

10. Hoe lang blijven uw gegevens bewaard?

Wij moeten uw gegevens gedurende een langere periode (15 jaar) bewaren. Mogelijk kunnen we deze gegevens op latere termijn gebruiken voor een voortzetting van dit onderzoek of in

[1] Afasie is een taalstoornis ten gevolge van hersenletsel waarbij iemand in meer of mindere mate moeite kan hebben met het begrijpen en uiten van gesproken en/of geschreven taal.

de opzet van een nieuw onderzoek. Als u dat niet wilt, respecteren wij dat natuurlijk. U kunt uw keuze op het toestemmingsformulier aangeven.

11. Welke medisch-ethische toetsingscommissie heeft dit onderzoek goedgekeurd?

De METC van het UMC Utrecht heeft dit onderzoek goedgekeurd.

12. Wilt u verder nog iets weten?

Via deze informatiebrief bent u op de hoogte gesteld van de inhoud van het onderzoek. Het kan zijn dat u nog vragen heeft of nadere uitleg wilt hebben. U kunt hiervoor contact opnemen met de student-onderzoeker. Onderaan deze brief staan haar emailadres en telefoonnummer.

Als u besluit om deel te nemen aan het onderzoek dan heeft u twee weken bedenktijd. Het is belangrijk dat u deze tijd neemt alvorens eventueel toestemming te verlenen. Indien u besluit deel te nemen aan dit wetenschappelijk onderzoek, dan vragen wij u samen met de onderzoeker het toestemmingsformulier te ondertekenen, te dateren en toe te sturen aan de student-onderzoeker.

Met vriendelijke groet,

Lotti Dijkhuis, student-onderzoeker
l.dijkhuis@students.uu.nl

Onder supervisie van:

Dr. Lizet van Ewijk
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Informed consent

Toestemmingsformulier

Titel onderzoek: “Het effect van leeftijd en opleidingsniveau op de Nederlandse Benoem Test (NBT).”

- Ik heb de informatiebrief gelezen. Tevens kon ik vragen stellen. Mijn vragen zijn voldoende beantwoord. Ik had genoeg tijd om te beslissen of ik meedoe aan dit onderzoek.

- Ik weet dat meedoen vrijwillig is. Ik weet dat ik op ieder moment kan beslissen om toch niet mee te doen of te stoppen met het onderzoek. Daarvoor hoef ik geen reden te geven.

- Ik weet dat sommige mensen mijn gegevens kunnen inzien. Die mensen staan vermeld in de informatiebrief.

- Ik geef toestemming voor het verzamelen en gebruiken van mijn gegevens op de manier en voor de doelen die in de informatiebrief staan.

Door het ondertekenen van dit formulier bevestig ik mijn deelname aan dit onderzoek.

Ik geef ***wel/geen***[2] toestemming om mijn gegevens op de onderzoekslocatie nog 15 jaar na dit onderzoek te bewaren.

Naam: Participant code:

---

[2] Doorhalen wat NIET van toepassing is

Handtekening: Datum: __ / __ / __

Ik verklaar dat ik deze proefpersoon volledig heb geïnformeerd over het genoemde onderzoek.

Als er tijdens het onderzoek informatie bekend wordt die de toestemming van de proefpersoon zou kunnen beïnvloeden, dan breng ik hem/haar daarvan tijdig op de hoogte.

Naam student-onderzoeker (of diens vertegenwoordiger):

Handtekening: Datum: __ / __ / __

De proefpersoon krijgt een volledige informatiebrief mee, samen met een kopie van het getekende toestemmingsformulier.

Appendix 2 - Classification level of education

The classification in low, medium and high educational levels is equal according to the national definitions of the standard format of education (in Dutch: de standaard onderwijsindeling (SOI) 2016) and those according to the international definitions of the ISCED 2011.[31]

Level of education	Low	Medium	High
	Basisonderwijs (1 t/m 8)	Bovenbouw havo (4-5e jaar)	HBO-, WO-bachelor
	VMBO-g/t (alle leerwegen)	Bovenbouw vwo (4-5-6e jaar)	Associate degree
	havo-, vwo-onderbouw	Middelbaar beroepsopleiding (MBO) niveau 2/3/4	4-jarige HBO opleidingen
	MBO 1	Middelbare technische school (MTS)	HBO-, WO-master, doctor
	Huishoudschool	Lagere landbouwschool / Middelbare tuinbouwschool	Vormschool/kweekschool
	Meer uitgebreid lager onderwijs (MULO)	Hogere burgerschool (HBS)	
	Lagere technische school (LTS)	Middelbare meisjes school (MMS)	
	Uitgebreid lager onderwijs (ULO)	Middelbaar economisch en administratief onderwijs (MEAO)	

Appendix 3 – Test protocol

“Het effect van leeftijd en opleidingsniveau op de Nederlandse Benoem Test (NBT)”.

Stap 1: Proefpersonen worden geïncludeerd door de student-onderzoeker/de onderzoeksassistenten.

Stap 2: Proefpersonen krijgen een informatiebrief en tekenen informed consent.

Stap 3: Alles wordt klaargemaakt voor de testafname. Onderzoeksruimte wordt opgeruimd, tafel wordt leeg gemaakt. Scoreformulieren en opname apparatuur wordt klaargelegd.

Stap 4: De student-onderzoeker/onderzoeksassistent noteert de volgende gegevens op het bijgeleverd scoreformulier: participantcode, leeftijd, geslacht, opleidingsniveau, handigheid, datum testafname etc.

Stap 5: De NBT wordt afgenomen op locatie door de student-onderzoeker of onderzoeksassistent. Graag de uitingen letterlijk transcriberen op het scoreformulier, luister bij twijfel eventueel de opname terug.

Stap 6: De test wordt gescoord door de test afnemer, voor zover dit nog niet gebeurd is tijdens de testafname. De behaalde scores hoeven niet te worden geïnterpreteerd.

Stap 7: Het ondertekende toestemmingsformulier en ingevulde scoreformulieren (bijgeleverd scoreformulier en formulier van de NBT) overhandigen/sturen naar de onderzoeker. Alleen de participantcode vermelden op de scoreformulieren.

Stap 8: De student-onderzoeker codeert de persoonsgegevens en testgegevens en verwerkt alle gegevens in SPSS.

Contactgegevens student-onderzoeker:

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Contactgegevens supervisor:

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Appendix 4 - Correction tables

Group 18-59 years

Total score DNT = 269.420 – 3.681 (men) – 8.473 (low) – 2.155 (medium)

Level of education	**Low**	**Medium**	**High**	**Men**	**Women**
Age	*+ 8.473*	*+ 2.155*	*+ 0*	*+ 3.681*	*+ 0*
18					
↓					
59					

Example corrected score:

For example: A woman, 33 years old, with educational level ‘low’ has a raw score of 258. The corrected score (based on age, level of education and gender) is: 258 + 8.473 = 266 (rounded).

Example predicted score:

A woman, 33 years old, with educational level ‘low’ has a predicted score (based on the prediction model) of: 269.420 – 8.473 = 261 (rounded).

Group 60 years and older

Total score DNT = 271.074 – 3.757 (men) – 0.668 (age) – 5.736 (low) – 2.995 (medium)

Level of education	**Low**	**Medium**	**High**	**Men**	**Women**
Age	*+ 5.736*	*+ 2.995*	*+ 0*	*+ 3.575*	*+ 0*
60	+ 6.404	+ 3.663	+ 0.668		
61	+ 7.072	+ 4.331	+ 1.336		
62	+ 7.74	+ 4.999	+ 2.004		
63	+ 8.408	+ 5.667	+ 2.672		
64	+ 9.076	+ 6.335	+ 3.34		
65	+ 9.744	+ 7.003	+ 4.008		
66	+ 10.412	+ 7.671	+ 4.676		
67	+ 11.08	+ 8.339	+ 5.344		
68	+ 11.748	+ 9.007	+ 6.012		
69	+ 12.416	+ 9.675	+ 6.68		
70	+ 13.084	+ 10.343	+ 7.348		
71	+ 13.752	+ 11.011	+ 8.016		
72	+ 14.42	+ 11.679	+ 8.684		
73	+ 15.088	+ 12.347	+ 9.352		
74	+ 15.756	+ 13.015	+ 10.02		
75	+ 16.424	+ 13.683	+ 10.688		
76	+ 17.092	+ 14.351	+ 11.356		
77	+ 17.76	+ 15.019	+ 12.024		
78	+ 18.428	+ 15.687	+ 12.692		
79	+ 19.096	+ 16.355	+ 13.36		
80	+ 19.764	+ 17.023	+ 14.028		
81	+ 20.432	+ 17.691	+ 14.696		
82	+ 21.1	+ 18.359	+ 15.364		
83	+ 21.786	+ 19.027	+ 16.032		
84	+ 22.436	+ 19.695	+ 16.7		
85	+ 23.104	+ 20.363	+ 17.368		
86	+ 23.772	+ 21.031	+ 18.036		
87	+ 24.44	+ 21.699	+ 18.704		
88	+ 25.108	+ 22.367	+ 19.372		
89	+ 25.776	+ 23.035	+ 20.04		
90	+ 26.444	+ 23.703	+ 20.708		
91	+ 27.112	+ 24.371	+ 21.376		
92	+ 27.78	+ 25.039	+ 22.044		
93	+ 28.448	+ 25.707	+ 22.712		

Example corrected score:

For example, a man, 67 years old, with educational level ‘high’ has a raw score of 255. The corrected score (based on age, level of education and gender) is: 255 + 3.575 (men) + 5.344 (age-education) = 264 (rounded).

Example predicted score:

A man, 78 years old, with educational level ‘high’ has a predicted score (based on the prediction model) of: 271.074 – 16.267 = 255 (rounded).