The Dutch Memory Compensation Questionnaire: Psychometric properties and regression-based norms

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Abstract

The Memory Compensation Questionnaire (MCQ) is a psychometrically sound instrument, which assesses the variety and extent to which an individual compensates for actual or perceived memory losses. Until now, only an English version of the MCQ has been psychometrically evaluated. The aim of the present study was to establish a Dutch version of the MCQ and evaluate its psychometric properties. The MCQ data of $N = 556$ cognitively healthy adults (61.8% females) aged between 50.1 and 95.3 years ($M = 73.9$ years, $SD = 8.0$) were analyzed. The results showed that the factor structure of the Dutch version of the MCQ corresponded well with that of the English version of the MCQ. The reliabilities of the scales of the Dutch version of the MCQ were all high (all Cronbach's α-values $\geq .77$). Demographic variables (especially age and gender) affected most of the MCQ scale scores. Regression-based normative data, which take these demographic influences into account, were established.

Introduction

Aging is associated with a decrease in episodic memory abilities (Craik & Salthouse, 2000; La Rue, 1992; Van der Elst, Van Boxtel, Van Breukelen, & Jolles, 2005, 2008) and an increase in memory complaints (Ponds, Commissaris, & Jolles, 1997). To cope with these actual or perceived memory problems, compensation strategies are often initiated (Unverzagt et al., 2007). Memory compensation refers to the use of strategies to overcome or mitigate declines in memory functioning (De Frias, Dixon, & Bäckman, 2003). Several memory compensation strategies have been distinguished, including substitution (for example, the use of a new technique to overcome memory losses), remediation (for example, the investment of more time or effort to overcome memory losses), and accommodation (for example, the matching of memory demands and memory skills by adjusting one's goals) (Bäckman & Dixon, 1992; Dixon & Bäckman, 1995).

The Memory Compensation Questionnaire (MCQ; De Frias & Dixon, 2005) is a self-report instrument which was especially devised to assess everyday memory compensation strategies (De Frias & Dixon, 2005; De Frias et al., 2003). The MCQ contains seven scales. The first three scales assess memory substitution mechanisms. The *External* scale contains eight items regarding the use of external memory aids to enhance everyday memory performance (e.g., "Do you use shopping lists when you go shopping?"). The *Internal* scale contains ten items regarding the use of mnemonic strategies to improve memory performance (e.g., "When you want to remember something from a T.V. program, do you use 'memory tricks' like grouping or repeating yourself?"). The *Time* scale contains four items regarding the extent to which respondents invest more time in performing valued everyday memory tasks (e.g., "Do you ask people to speak slowly when you want to remember what they are saying?"). The next two MCQ scales assess memory remediation mechanisms. The *Reliance* scale contains five items regarding the extent to which the respondents recruit other people as memory aids (e.g., "When you want to remember an important appointment, do you ask somebody else (for example, spouse or friend) to remind you?)". The *Effort* scale contains six items regarding the investment of more effort in performing memory tasks (e.g., "Do you put in a lot of effort when you want to remember an important conversation with a person?"). The final two MCQ scales assess more general aspects of memory compensation strategies. The *Success* scale contains five items regarding the use of accommodation strategies (e.g., relaxing the criteria of success) to cope with memory losses (e.g., "When you want to remember a newspaper article, is it important to you to remember it perfectly?"). The *Change* scale contains five items regarding the extent to which the respondent believes that changes in the External, Internal, Time, Reliance, and Success dimensions of memory compensation behavior have occurred over the last 5 to 10 years (e.g., "Do you spend more or less time learning important things today compared to 5-10 years (for example, reading things more slowly or reading them more than once?)".

The psychometric properties of the MCQ (including its construct validity, test-retest reliability, internal consistency, and discriminant validity) were shown to be good to excellent (De Frias & Dixon, 2005; Dixon, de Frias, & Bäckman, 2001). These sound psychometric characteristics have been confirmed only for the English version of the MCQ. It is unknown to what extent a non-English version of the MCQ would produce equivalent measurement and structural characteristics, and be generally applicable to non-English speaking populations. The main aims of the present study were to establish a Dutch version of the MCQ, evaluate its psychometric properties (i.e., construct validity and reliability), and establish normative data. Previous research with the English version of the MCQ has shown that demographic (and other) variables affected several of the MCQ scale scores (De Frias & Dixon, 2005; De Frias et al., 2003; Dixon & de Frias, 2007; Dixon et al., 2001). Thus we also evaluated the effects of age, gender, and level of education on the scale scores of the Dutch version of the MCQ, so that the normative data could be appropriately corrected for the relevant demographic influences. These normative data provide an empirical frame of reference to understand what constitutes a "normal" test score for an individual. The norms facilitate interpretation of the test scores, and allow for a direct comparison of the different MCQ scale scores of an individual (as all measures are expressed in percentile units).

Methods

Participants

About N = 3,000 members of a large Dutch community organization for healthy elderly were mailed a questionnaire which was accompanied by the organization's monthly magazine. Based on previous research in a similar population (Mol, Ruiter, Verhey, Dijkstra, & Jolles, 2008), a 20 percent response rate was anticipated (i.e., 500 respondents). We aimed at 500 respondents in view of the sample size recommendations for factor analytic studies in the literature, which range between 300 and 500 participants (MacCallum, Widaman, Zhang, & Hong, 1999; Tabachnick & Fidell, 2001). All questionnaires were sent between April 1st and June 1st 2008, together with a prepaid response envelope and a cover letter, which detailed the aims of the study. In total, *N* = 813 people returned the questionnaire (i.e., 27 percent response rate).

We excluded respondents on the basis of age in the following two circumstances: (1) if they were below 50 years old (*n* = 27) and (2) if their age was unknown or could not be established due to erroneous self-reported birth date information (e.g., reporting a birth year of 2008) (*n* = 6). Moreover, people who reported to suffer from (previous) medical conditions known to interfere with cognitive functioning (i.e., dementia (*n* = 20), stroke (*n* = 63), brain tumors (*n* = 4), central nervous diseases (*n* = 8) and epilepsy (*n* = 10)) were excluded. To further screen for cognitive impairment, the 'questionnaire format' clock-drawing test was administered. The 'questionnaire format' clock-drawing test requires the participants to draw in the numbers as in a clock face on a predrawn circle of 8.3 cm in diameter (Paganini-Hill & Clark, 2007; Paganini-Hill, Clark, Henderson, & Birge, 2001). The clock-drawing tests were scored following a procedure described in Paganini-Hill et al. (2001). People with a clock-drawing test score below an age- and gender-corrected threshold level for cognitive impairment (Paganini-Hill et al., 2001) were excluded (*n*=20). In addition, the data of *n* = 82 and *n* = 17 participants were excluded from the analyses because they did not complete the clock-drawing test or because they had more than four missing values on the MCQ, respectively. Thus the data of a total sample of *N*=556 participants were analyzed in the present study.

The mean age of the participants was 73.8 years (range 50.1 - 95.3 years; *SD* = 8.0). Level of education (LE) was measured by classifying the formal schooling of the participants in one of three groups, i.e., those with at most primary education (LE low; 26.8% of the sample), those with at most junior vocational training or high school (LE average; 45.0% of the sample), and those with at most senior vocational or academic training (LE high; 28.2% of the sample). This LE system is often used in The Netherlands (De Bie, 1987) and is comparable with the International Standard Classification of Education (UNESCO, 1976). These three levels of education correspond with about 9, 11, and 15 years of full-time education (Van der Elst et al., 2005). There were more female than male participants (61.8% females).

Procedure and instruments

Initial development of the English version of the MCQ reduced a large pool of items to 44 items (Dixon & Bäckman, 1992; Dixon et al., 2001; Hopp, 1993). De Frias and Dixon (2005) further evaluated the psychometric properties of this initial MCQ version and dropped one additional item from the Time scale (due to item cross-loadings). The final English version of the MCQ thus contained 43 items (De Frias & Dixon, 2005). This version was translated into Dutch and back translated by a bilingual English/Dutch speaker. The translation closely resembled the original English items.

The English version of the MCQ (De Frias & Dixon, 2005) represents seven dimensions of memory compensation behavior (as was described in the Introduction). The responses for the items of the External, Internal, Time, Reliance, Effort and Success MCQ scales were presented on a 5-point Likert scale with the choice options 0 = never, 1 = seldom, 2 = sometimes, 3 = often and 4 = always. Higher scale scores are thus indicative for more frequent use of the specified compensation strategy. The item "Do you spend more or less time learning important things today compared to 5-10 years (for example, reading things more slowly or reading them more than once?)" of the Change scale had the choice options 0 = much less time, 1 = less time, 2 = no difference, 3 = more time, and 4 = much more time. The other items of the Change scale had the choice options 0 = much less often, 1 = less often, 2 = no difference, 3 = more often, and 4 = much more often. Higher Change scale scores indicate that the respondent believes that more changes in memory compensation strategies have occurred in the last 5-10 years.

Statistical analyses

Confirmatory Factor Analysis (CFA) was used to evaluate the factor structure of the Dutch version of the MCQ. An *a priori* model was specified in which (a) seven factors underlied the item responses and (b) each item loaded on only one factor (i.e., the model that was obtained by De Frias & Dixon, 2005). Due to the categorical nature of the item responses and the non-normal score distributions of a number of items, the Diagonally Weighted Least Squares method for polychoric correlation matrices was used instead of the standard Maximum Likelihood estimation method. Thus, polychoric coefficients and an asymptotic covariance matrix were generated in PRELIS for subsequent analysis in LISREL. The fit of the seven-factor MCQ model was evaluated with the Root Mean Square Error of Approximation (RMSEA; < .08 acceptable, < .05 excellent) (Browne & Cudeck, 1992), the Comparative Fit Index (CFI; > .90 acceptable, > .95 excellent) (Bentler, 1990; Bentler & Bonett, 1980), and the Normed Fit Index (NFI; > .90 acceptable) (Bentler & Bonett, 1980). Corrected item-scale correlations (i.e., correlations between items and scale scores that did not include the items being evaluated) and item descriptives (means, *SD*s, and item response distributions) were provided. The internal consistencies of the items of the established MCQ scales were estimated with Cronbach's *alpha* coefficients. Inter-correlations and standard errors of measurement of the MCQ scale scores were also calculated.

The effects of demographic variables on the MCQ scale scores were evaluated by regressing the scale scores on age, age^2, gender and educational level. Age was centered (age = calendar age - 75) before quadratic terms and interactions were calculated to avoid multicollinearity. Gender was coded as male = 1 and female = 0. Educational level was dummy coded into three levels (with LE average as the reference category). Non-significant predictors ($p > .01$) were excluded from the full models (i.e., the models that included all predictors), but no predictor was removed as long as it was also included in a higher order term in the model (Aiken & West, 1991). The assumptions of regression analysis were tested for each model. Homoscedasticity was evaluated by grouping the participants into quartiles of the predicted scores and applying the Levene test. Normality of the residuals was investigated by conducting Kolmogorov-Smirnov tests on the standardized residuals. The occurrence of multicollinearity was checked by calculating Variance Inflation Factors (VIFs), which should not exceed ten (Belsley, Kuh, & Welsch, 1980). Potential influential cases were identified by calculating Cook's distances.

The MCQ scale scores are normed by means of a four-step procedure (Van der Elst, Van Boxtel, Van Breukelen, & Jolles, 2007). First, the user of the normative data calculates the testee's predicted MCQ scale scores by means of the final regression models (predicted MCQ scale score = $B_0 + B_1X_1 + \ldots + B_nX_n$, with B_0 = the intercept, B_n = the regression weight(s), and X_n = the predictor value(s)). Second, the residuals are calculated (e_i = observed MCQ scale score - predicted MCQ scale score). Third, the residuals are standardized ($Z_i = e_i/SD$(residual), with SD(residual) = the standard deviation of the residuals in the normative sample). Fourth, the standardized residuals are converted into percentiles via the standard normal cumulative distribution function (if the model assumption of normality of the residuals was met in the normative sample), or via the empirical cumulative distribution function of the standardized residuals (if the standardized residuals were not normally distributed in the normative sample). All analyses were conducted with R 2.8.1, PRELIS and LISREL 8.8 for Windows. An *alpha* level of .01 was used in all analyses.

Results

Factor structure and psychometric properties

The seven-factor CFA model is shown in Table 2 (left). The model adequately fitted the data (i.e., RMSEA = .049; CFI = .98; NFI = .96), and all items loaded significantly on the *a priori* expected factors. The average standardized factor loadings of the items were high (i.e., External (M = .65), Internal (M = .65), Reliance (M = .83), Time (M = .74), Effort (M = .64), Success (M = .73), and Change (M = .69)). The corrected item-scale correlations were all significantly positive and ranged between .37 and .78 (all ps < .01; see Table 2, right). Internal consistency was high for the items of all MCQ scales (all Cronbach's *alpha* values ≥ .77; see Table 1, left). The correlations between the MCQ scale scores were all significantly positive and ranged between .20 and .73 (all ps < .01; see Table 1, right).

Table 1 MCQ scale descriptives and scale score inter-correlations

Scales	Descriptives				Inter-correlations						
	M	SD	SEM	α	External	Internal	Reliance	Time	Effort	Success	Change
External	24.75	5.62	2.70	.77	1						
Internal	18.33	7.30	2.83	.85	.49*	1					
Reliance	5.27	4.40	1.53	.88	.29*	.48*	1				
Time	6.42	3.30	1.55	.78	.45*	.56*	.54*	1			
Effort	13.58	4.89	2.29	.78	.53*	.73*	.46*	.63*	1		
Success	9.91	4.18	1.77	.82	.20*	.50*	.28*	.31*	.48*	1	
Change	12.13	2.36	1.14	.77	.34*	.41*	.44*	.41*	.42*	.22*	1

Note. SEM = Standard Error of Measurement.
* $p < .01$