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Compensating for Memory Losses throughout aging: Validation and Normalization of the Memory Compensation Questionnaire for Non-Clinical French Populations

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Abstract

The MCQ is a seven-factor scale that measures individual differences in the tendency to select particular strategies and to overcome perceived or real memory losses. Our aim was to establish a French version of the MCQ and to evaluate its psychometric properties in a lifespan perspective. We first tested the underlying factor structure of the MCQ in a large sample of 749 adults from aged from 18 to 92 years. Results showed that the factor structure of the French version corresponded well with the one obtained in English-, Dutch- and Spanish-speaking samples, supporting the cross-national robustness of the MCQ. We confirmed a seven-factor order model that supports the construct validity of the questionnaire. The reliabilities of the scales were good ($\alpha > .70$) to acceptable ($\alpha = .66$ and $.62$). Criterion validity was verified by means of significant correlations between health composites and MCQ subscales. Gender and Age affected most of the MCQ subscales but not the level of education. The MCQ revealed to be a heuristic tool for assessing daily compensatory behaviors that are developed in order to achieve successful aging. Thus, regression-based normative data and a user-friendly computer program were provided to facilitate scoring and norming by clinicians and researchers dealing with aging.

Keywords

Aging; Memory; Compensation; Adaptation; Psychometric analyses; Life-span normative data

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Conflict of interest statement

The authors declare that there are none conflict of interest known. All authors disclose any financial and personal relationships with other people or organisations that could inappropriately influence (bias) their work.

Introduction

Memory impairments due to pathological aging, brain injury or stroke are major causes of disability in our society. These impairments may be seen in the reduced ability to function adequately in everyday life. For aging people, coping with these memory problems is therefore of major importance in maintaining one's level of independence. Memory impairment often results in an increase in memory compensation strategies use that gives room to elderly to be flexible and adapt to change course (Dixon & Bäckman, 1995; Dixon, Garrett, & Bäckman, 2008). Indeed, compensation is defined as a collection of related but different mechanisms that may be used to overcome cognitive deficits and promote cognitive health. It refers to a set of adaptive mechanisms that serve to overcome transient or permanent losses (Bäckman & Dixon, 1992; Dixon et al., 2008). Bäckman and Dixon (1992) developed a model of memory compensation which offers four behavioral mechanisms: remediation, substitution, accommodation and assimilation. Nevertheless, there is a lack of available tools for operationally defining and evaluating memory daily compensation (Garrett, Grady & Hasher, 2010). Indeed, performance on objective memory tests are useful for diagnostic purposes but do not predict everyday memory compensation as such objective measures have suboptimal ecological validity (Chaytor & Schmitter-Edgecombe, 2003 ; Van der Elst et al., 2007). Performance on cognitively demanding everyday living abilities (such as shopping, cooking or performing social and vocational activities) are only slightly related to objective cognitive performance as the day-to-day use of memory is incorporated in an ecological context that affords, at any time, an environmental support (Hertzog et al., 2002; Meulemans & Seron, 2004, Seron & Van der Linden, 2000).

In order to the lack of available tools for operationally evaluating daily memory compensation, Dixon, de Frias and Bäckman (2001) developed a reliable and comprehensive self-report tool to collect information on the nature and the extent of memory compensation use. Two advantages of the MCQ are that it includes questions that are specific to everyday-life memory-related behaviors and that memory compensation is measured as a multifaceted construct through multiple understandable questions pertaining to related but separate domains of the construct. Thus, in this paper, we establish a French version of the MCQ and evaluate its psychometric properties in a lifespan perspective. Indeed, no French translation and normative data currently exist for the MCQ while English-, Dutch- and Spanish versions are available for clinical practice and research dealing with aging. It is unknown to what extent a French version of the MCQ would produce equivalent measurement and structural characteristics.

Specifically, the Memory Compensation Questionnaire (MCQ) contains seven scales that were devised to investigate the use of five strategies and two general aspects of everyday memory compensation. (F1) The External scale contains eight items regarding the use of external aids and devices for supporting remembering (e.g., shopping lists, notes, putting things in a specific place). (F2) The Internal scale contains ten items regarding the use of strategic mnemonic strategies to facilitate or improve memory efficiency. (F3) The Reliance (or Recruitment) scale contains five items regarding the recruitment of other people for memory assistance. These first three scales relate to the Substitution mechanism of

compensation theory (Dixon et al., 2008), which is replacing a declining technique by a new one or doing something in a different way. (F4) The Time scale contains four items regarding the extent to which the respondent invests more time in performing memory tasks. (F5) The Effort scale contains six items regarding the investment of more effort when performing a memory task such as rehearsing or retrieving information. The Time and Effort scales relate to Remediation mechanisms which require investing more time and effort to adapt and overcome losses. Finally, two scales investigate general aspect of memory compensation. (FG1) The Success scale contains five items regarding the use of Accommodation strategies which aim to reduce the mismatch between environmental demands and personal skills by adjusting one's goal. It assesses the extent of commitment to memory performance and the motivation to maintain a given memory competence. The higher the commitment, the less a person will tend to accommodate to his/her losses as he/she will maintain the same criterion of success and sense of control. Finally, (FG2) the Change scale contains five items regarding the extent to which the respondent is aware of changes in the need of compensation (i.e. external, internal, reliance, time and effort) over the 5–10 years prior to testing. This last scale reflects personal insight and beliefs regarding memory losses.

The MCQ is useful for examining the effectiveness of cognitive rehabilitation. Research of the impact of cognitive training on daily-life functioning is often inconclusive, in part due to methodological issues, but also because there is a lack of ecologically valid tools. Indeed, “although most studies of cognitive rehabilitation have relied on neuropsychological measurement to evaluate the effectiveness of treatment, evidence exists that persons with acquired neurocognitive impairments can improve in their life functioning [in the absence of] major changes in their specific cognitive faculties” (Cicerone et al., 2000, p. 1608). Compensation is thereby a challenge for clinical neuropsychology (Wilson & Watson, 1996) as it contributes crucially to enhancing resilience during pathological aging: behavioral regulation allows the maintenance of a certain level of functioning despite the presence of transient or permanent loss. To understand compensatory mechanisms, one needs to explore how an individual adapts his resources to his/her environment in order to gain, maintain and increase his/her autonomy. As written by Cicerone *et al.* (2000), cognitive impairments are a major cause of failure to cope with novel situations. Specific approaches of rehabilitation programs for vulnerable elderlies consist of establishing new patterns of (a) cognitive activity through compensatory cognitive mechanisms and (b) activity through external compensatory mechanisms (such as personal orthoses or environmental structuring and support). In this context, the MCQ provides indications of both an evaluation of a wide range of everyday behaviors and an awareness of deficit insight. Understanding patients' awareness and beliefs of their everyday memory monitoring of practical utility in that compensating mechanisms preserve autonomy by enhancing individual adjustment to threatening situations.

In that context, Dixon, Hopp, Cohen, de Frias & Bäckman, (2003) have demonstrated that the MCQ can be administered successfully and produce psychometrically meaningful data with people who have neurological disease such as Alzheimer disease or Mild Memory Deficit (Dixon & de Frias, 2007). Dixon et al. (2003) showed that individuals suffering from

Alzheimer disease reported using less external aids than healthy elderlies (External Scale). Moreover, patients reported an increase in reliance on others over a 6-month period whereas the control adults reported a slight decrease in the use of this strategy (Reliance Scale). The authors conclude that there is an increasing awareness on the part of the Alzheimer patients that others may be helping them cope with everyday lives demands: the social world becomes some sort of conscious external living memory aids as decline is increasing gradually. The reliance on others is an essential and common technique of coping with memory decline for vulnerable older adults. Indeed, in Dixon and de Frias' study (2007), Mild Memory Deficit Population (MMD), as Alzheimer adults, stated that a) they recruited collaborative memory assistance more than did the control group and b) they used less external aids than normal memory skills elderlies. In both studies, longitudinal evaluations established temporal processes in memory compensation uses, reflecting differential dynamic changes in cognitive resilience. The authors conclude that those with the most to lose do the least over the long-term and perhaps lose the most. The least frequently used compensatory techniques (such as external aid) could be available for future training and enhance motivation for coping with memory losses. In that context, the MCQ demonstrated to be a useful tool to provide a reliable representation of a broad set of self-reported memory compensation behaviors with vulnerable population.

In the same way, Prigatano and Kime (2003) investigated the use of memory compensation strategies through the MCQ after memory compensation training for 29 patients of which 86% faced unequivocal memory impairments following brain disorders (traumatic brain injuries, ruptured aneurysms, arteriovenous and cavernous malformations, cerebrovascular accidents, tumors, hydrocephalus, cerebral anoxia and bipolar disorder). Following rehabilitation, patients reported a change in memory compensation strategies, such as spending more time to remember information. It is of interest to note that the mean age of the tested population was 43 years (with a range of 26 to 60 years), and both males and females participated in the research. In the absence of a control group, Prigatano and Kime (2003) compared their data to the normative data published by Dixon *et al.* (2001) on males who were aged between 58 to 64 years. This example illustrates that it would be useful to have normative MCQ data available for the entire adult life. Indeed, robust results demonstrated a persistent impact of age and gender on the report of compensation strategies to improve day-to-day functioning (de Frias, Dixon & Bäckman, 2003; Dixon, de Frias & Bäckman, 2001; Van der Elst *et al.*, 2011). De Frias *et al.* (2003) indicated that age, gender and level of education accounted between 2% to 9% of the variance in strategy use. In this context, Prigatano and Kime (2003) concluded that their results should to be replicated with a control group composed of people of the same age range and characteristics as their patients. Thus, to fill this gap, we establish in this paper a French version of the MCQ and evaluate its psychometric properties in a lifespan perspective.

Finally, researchers from a life span perspective state that adaptation does not follow a predetermined developmental path (Baltes, 1997; Dixon & Bäckman, 1995; Meléndez *et al.*, 2012). There is high variability regarding the opportunities for compensatory achievement as individuals may enact means and tools depending on a diversity of personal characteristics. Several covariates of day-to-day memory compensation have thus been

explored through the Memory Compensation Questionnaire. For example, de Frias et al. (2003) observed that memory compensation is related to health indicators. Persons with infirmities (disabilities) invest more time and effort and report an increased use of compensatory behaviors. Consequently, low scores on respiratory illness correlate with an increased effort engagement. Therefore, objective infirmities and respiratory illness are two significant predictors of memory compensation behavior (estimated to account for between 2% to 5% of the variance) – in contrast to subjective health indicator that did not account for any additional variance. These authors (de Frias et al., 2003) also investigated whether having a greater sense of control over cognitive performance results in a greater effort to apply compensation strategies (Miller & Lachman, 2000). They also examined personality characteristics as specific factors that may influence the nature and the frequency of self-reported compensation strategies. The results showed that anxiety and vulnerability (neuroticism) were robustly related to the reported use of compensation strategies: some degree of neuroticism generated potentially effective compensatory behaviors. The authors concluded that “feeling preoccupied, anxious, and depressed about one’s level of functioning in tandem with being relatively high on agreeableness may be a combination that is strongly related to everyday efforts to compensate for memory deficits or declines” (Miller & Lachman, 2000, p.19). In the same line, Garrett *et al.* (2010) recently reported that the relationship between perceived difficulties and strategy implementation is moderated by a high level of perceived stress: the tendency to experience negative emotions and to interpret the reality as highly threatening may lead to the abandonment of attempts to compensate. Taken together, those results indicate that successful compensation during aging and rehabilitation is linked to a network of covariates such as age, gender, health indicators, feeling of control, stress and anxiety, any one of which may facilitate or constrain resilience. Those covariates define contexts in which compensation may or not occur (Dixon et al., 2008; Garrett et al., 2010). For that reason, we studied in this work the influence of perceived stress, anxiety and locus of control as factors that may influence compensation perception.

In summary, the main goals of the present study are to (a) establish a French version of the MCQ and to evaluate its psychometric properties (i.e., construct validity and reliability), and (b) to establish demographically-corrected French normative data in a life span perspective. Previous works have shown that demographic (and other) variables affected several of the MCQ scale scores (de Frias et al., 2003; Dixon & de Frias, 2007, Van der Elst et al., 2011). Thus, we also evaluated the effects of age, gender, and level of education on the scale scores of the French version of the MCQ, so that the normative data could be appropriately corrected for the relevant demographic influences.

Method

Participants

We contacted local councils and seniors associations in order to propose participation on a voluntary basis. Volunteers were invited to talk about the study to their friends and family. In return, a member of our laboratory held a conference on aging memory thanking them for their work. All participants were recruited for the study between January and April 2012.

They all received a cover letter or email that detailed the aim and procedure of the study. In total, $N = 932$ finalized the complete questionnaire (34 % response rate). Participants were not invited to participate if they reported a known neurological disease or cognitive loss following medical conditions (e.g., epilepsy, stroke, brain injury or cancer). Participants were all free of motor impairments. These data were based on the self-report of the participants since medical records were not available for review. To further screen for cognitive impairment, the clock-drawing test was administered. Moreover, we excluded respondents: (a) if their age was unknown or could not be established (e.g., some participants self-reported the year of the study instead of their birth year, $n = 72$), (b) if they did not complete or scored below their age and gender corrected threshold on the clock-drawing test following the scoring rules outlined by the authors ($n = 44$) (Paganini-Hill & Clark, 2007; Paganini-Hill, Clark, Henderson, & Birge, 2001), and (c) if they did not complete four or more items on the MCQ ($n = 73$). The data of the total sample of $N = 749$ were analyzed in the present study. There were about 70 % female and 30 % male participants. The mean age of participants was 43.5 years (range, 18 – 92.2 years, $SD = 19.77$), with 48.5 % below 50 years and 51.5 % older than 50 years (see Table 1). Demographic characteristics of the participants, including their Level of Education (LE) in number of years, are presented in Table 1. For the analyses, we later classified this formal LE according to the French taxonomy of education levels (from level 6: low to level 1: high) which defines levels of training in terms of duration and skill rank (<http://www.cncp.gouv.fr>).

Procedure and Instruments

Participants received a battery of tests completed in a fixed order at home or in local councils during approximately 2-hr sessions. Participants were untimed but noted the start and end time of their completion. Participants first read a cover letter that detailed the aim and procedure of the study in order to sign a letter of consent. The tasks were administered in the following order.

After completing the *socio-demographic enquiry* (day and location of testing, birthday, gender, actual or last employment, educational level, marital status), participants were asked to examine a list of 9 *health conditions* and to indicate whether they have experienced them at any time during the previous 2 years. The score values for each item of each composite was 0 (no condition), 1 (mild condition), and 2 (moderate condition). The composites were selected from the de Frias *et al.* (2003) study: (a) infirmities (vision, arthritis, and back trouble; score range : 0–6), (b) respiratory illness (three items: asthma, bronchitis, and emphysema; score range : 0–6), and (c) circulatory illness (four items: atherosclerosis, hypertension, heart trouble, and stroke; score range : 0–8). As demonstrated by de Frias *et al.* (2003), those health items loaded significantly onto their respective factors ($X^2(32, N = 512) = 44.78, p > .05, CFI = .95, GFI = .098, RMSEA = .03$).

Memory Compensation Questionnaire (MCQ - de Frias & Dixon, 2005)—As described earlier, the MCQ contains seven scales devised to investigate the use of five strategies and two general aspect of everyday memory compensation: (a) the External scale contains 8 items (e.g., “Do you use shopping lists when you go shopping?”) ; (b) the Internal

scale contains 10 items (e.g., “When you want to remember the name of a person do you try to associate the name with the person’s face?”); (c) the Reliance or Recruitment scale contains 5 items (e.g., “When you want to remember an important appointment do you ask somebody else (for example, spouse or friend) to remind you?”); (d) the Time scale contains 5 items (e.g., “When you want to remember a newspaper article do you read it more slowly”); (e) the Effort scale contains 6 items (e.g., “Do you put in effort when you want to remember the time of an important meeting?”); (f) the Success scale contains 5 items (e.g., “When you want to remember an event that took place when you were a child, is it important for you to remember it as perfectly as possible?”); and (g) the Change scale contains 5 items (e.g., “Do you put in effort and concentrate to remember important things more or less often today compared to 5–10 years ago?”). Participants responded to each item (except for the change scale) on a 5-point Likert scale with the following multiple choice options: 0 = *Never*, 1 = *seldom*, 2 = *sometimes*, 3 = *often*, and 4 = *always*. The Change scale had the following choice options : 0 = *Much less often*, 1 = *Less often*, 2 = *no difference*, 3 = *more often*, and 4 = *much more often*; except for the item “Do you spend more or less time learning important things today compared with 5–10 years ago (e.g., reading things more slowly or reading them more than once” which had the choice options : 0 = *Much less time*, 1 = *Less time*, 2 = *no difference*, 3 = *more time*, and 4 = *much more time*.

The conversion of the de Frias and Dixon (2005) version to the French version of the MCQ followed four steps: (a) the first step consisted of the translation into French by a native English speaker and two bilingual English/French translators of different academic origins. They were selected because they operate in the context of vocational training with adults as English teachers. All translators were informed of the goal of the study; (b) a draft of the French questionnaire was then developed by two researchers and submitted to a back-translation into English by two new English/French speakers; (c) following some lexical and grammatical adjustments, a consensus version was submitted to a sample of the relevant population in order to estimate its meaningfulness; (d) the English and French versions were then submitted to a final comparison in order to assess their degree of similarity. This last step allowed us to achieve the final version available at: <http://www.lab-epsilon.fr/productions/questionnaires-74.html>.

The Clock-drawing Test (Paganini-Hill & Clark, 2007)—In order to further screen participants with cognitive impairments, the Clock-drawing test was administered as in the MCQ Dutch validation procedure. Participants had to draw in the numbers as in a clock face on a presented circle of 8.3 cm in diameter (3 1/4 inches). Following the procedure of Paganini-Hill, Clark, Henderson, & Birge (2001), a total score (ranging between 0–7 points), was calculated by summing : the presence of the 12 numbers without adding extra or omitting numbers, sequencing of numbers, position of numbers, orientation of numbers to circle, consistent number style, tilt of numbers, and superfluous marks. As indicated by the authors, the Clock-drawing Test is an interesting measure of cognitive function for large samples because it is simple, self-administered and easily adapted to mail surveys (Paganini-Hill et al. 2001). It was also appealing in the context of the present validation study, as the Clock-drawing test is rather free of cultural and language factors. It takes about five minutes to complete.

The Perceived Stress Scale (PSS – Cohen et al., 1983)—This scale evaluates the perception of experienced stress by measuring the degree to which respondents find their life uncontrollable and overloaded during the last month. The 14 items are scored on a 5-point Likert scale with the following multiple choices: 0 = *Never*, 1 = *almost never*, 2 = *sometimes*, 3 = *fairly often*, and 4 = *very often*. We used the French version of the PSS, as translated by Quintard (1994). The PSS takes approximately five minutes to complete.

State-Trait Anxiety Inventory (STAI – Spielberger, 1983)—This scale is a commonly used measure of trait and state anxiety. We specifically used the State Anxiety evaluation in order to investigate the temporary condition of state anxiety in our sample. This scale is suitable for individuals who are 15 years old and older. It consists of 20 items scored on a 4-point Likert scale with the following multiple choices: 1 = not at all, 2 = rather not, 3 = rather yes, 4 = very much so. The scale contains 10 reversed items. We used the Gauthier & Bouchard (1993) French adaptation. The STAI State takes approximately five minutes to complete.

Locus of Control Scale (LOC – Rotter, 1966)—The LOC scale is a 29-item questionnaire which measures beliefs about whether rewards are associated with one's action. Although the final score places the participant on a continuum between the two extremes of internal and external locus of control, the LOC scale must be interpreted with regard to the situation. It evaluates an attributional style about the source of responsibility of our successes or failures. The LOC scale contains 7 filler items and 23 scored items on the basis of 1 point for specific responses following a forced-choice between two solutions. Participants must answer by *A* or *B*. We used the French adaptation presented by Cottraux et al. (1985). The LOC scale takes approximately ten minutes to complete.

Statistical Analysis

Factor Structure and Psychometric Properties of the Memory Compensation Questionnaire—Confirmatory Factor Analysis (CFA) was used to evaluate the factor structure of the French version of the MCQ. An *a priori* model was considered in which (a) seven factors underlie the item responses of the French version of the MCQ, and (b) each item loads on one factor only (i.e., the factor model that was obtained by de Frias & Dixon, 2005, and by Van der Elst et al., 2011). Due to the categorical nature of the item responses and the non-normal score distributions of different items, the Diagonally Weighted Least Squares method for polychoric correlation matrices was used (instead of the standard Maximum Likelihood estimation method). 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, 1993), the Comparative Fit Index (CFI; > .90 acceptable, > .95 excellent; Bentler, 1990; Bentler & Bonett, 1980), and the Normed Fit Index (NFI; > .90 acceptable; Bentler & Bonnet, 1980).

The internal consistencies of the items of the established MCQ scales were estimated with Cronbach's alpha coefficients. Intercorrelations and standard errors of measurement of the MCQ scale scores were also calculated. In order to test the criterion validity of the MCQ, we also considered the relation between health composites (infirmities, respiratory illness,

circulatory illness, stress, anxiety and locus of control) and compensation by means of Spearman correlation analyses.

The Effect of Age, Gender, and Level of Education on the Memory

Compensation Questionnaire Scale Scores—The effects of the demographic variables on the seven MCQ scale scores were evaluated by regressing the scale scores on age, age², gender and educational level. Age was centered (age = calendar age - 45) before the quadratic terms were calculated. This was done to avoid multicollinearity. Gender was coded as male = 1 and female = 0. The original six-level educational variable was recoded into three levels (i.e., high = levels 1 and 2 of the original scale, average = levels 3 and 4 of the original scale, and low = levels 5 and 6 of the original scale). The re-coded three-level variable was subsequently dummy coded using two dummies, i.e., LE low = 1 if the participant had a low educational level and 0 otherwise, and LE high = 1 if the participant had a high educational level and 0 otherwise .

Non-significant predictors ($p > .01$) were excluded from the full models in a hierarchical way (i.e., starting with interactions and quadratic terms, and without excluding main effects that were still contained in a higher-order term). The main assumptions of regression analysis were tested for each model, i.e., homoscedasticity (by grouping the participants into quartiles of the predicted scores and applying the Levene test), normality of the residuals (by conducting Kolmogorov-Smirnov tests on the standardized residuals), multicollinearity (by calculating Variance Inflation Factors (VIFs), which should not exceed 10; Belsley, Kuh, & Welsch, 1980), and influential cases (by calculating Cook's distances).

Regression-Based Normative Data for the Memory Compensation

Questionnaire Scale Scores—Once the final regression model was established, the MCQ scale scores were normed by means of a four-step procedure (Van Breukelen & Vlaeyen, 2005; Van der Elst et al., 2007). In the first step, the user of the normative data calculates the predicted MCQ scale scores of the tested person by means of the final regression models ($\hat{Y}_i = B_0 + B_1X_1 + \dots + B_kX_k$, with $\hat{Y}_i$ = the predicted MCQ scale score for person i , B_0 = the intercept, B_k = the raw regression weight(s), and X_k = the predictor value(s)). Second, the residuals are calculated ($e_i = Y_i - \hat{Y}_i$, with Y_i = the observed MCQ scale score and $\hat{Y}_i$ = the predicted MCQ scale score). Third, the residuals are standardized ($Z_i = e_i/SD(e_i)$, with $SD(e_i)$ = the standard deviation of the residuals in the normative sample). If the homoscedasticity assumption was violated, the $SD(e_i)$ values that are used in the standardization of the residuals depend on quartiles of the predicted values (Van Breukelen & Vlaeyen, 2005). 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), or via the empirical cumulative distribution function of the standardized residuals (if the standardized residuals were not normally distributed).

Results

Factor Structure and Psychometric Properties of the Memory Compensation Questionnaire

The standardized factor loadings for the French version of the MCQ are shown in Table 2. The *a priori* model had an excellent fit with the data, i.e., RMSEA = .046, CFI = 0.95, and NFI = 0.92, supporting the MCQ's construct validity. The average standardized factor loadings of the items were high (i.e., External [$M = .55$], Internal [$M = .52$], Reliance [$M = .64$], Time [$M = .71$], Effort [$M = .54$], Success [$M = .66$], and Change [$M = .54$]). The corrected item-scale correlations were all significantly positive and ranged between .40 and .83 (all $p < .01$; see Table 2, right). Internal consistency was good to high for all MCQ scales (Cronbach's alpha values $> .70$ for External, Internal, Reliance, Time and Success scales and .66 for the Effort scale and .62 for the Change scale; see Table 3, left). The correlations between the MCQ scales scores and the total MCQ score were all significantly positive and ranged between .53 and .79 (all $p < .01$; see Table 4, right).

Concerning the criterion validity of the MCQ, we considered the relation between health composites (infirmities, respiratory illness, circulatory illness, locus of control, stress and anxiety) and compensation by means of Spearman correlation analyses (see Table 4). The results indicate a positive link between Infirmities and the score on the External, Reliance, Effort, Success and Change scales ($p < .05$). The correlation between infirmities and the Internal scale, as well as respiratory illness and Internal scale did not reach significance ($p < .07$). Locus of control is significantly correlated to the Time and Success scales. Perceived stress (SPSS) is linked to all compensation scales except the External one. Finally, anxiety (STAI- State) is positively correlated to the Internal, Reliance, Effort, and Change scales ($p < .05$).

The Effect of Age, Gender, and Level of Education on the Memory Compensation Questionnaire Scale Score

The final regression models are shown in Table 5. All MCQ scale scores were significantly affected by age (with the exception of the Internal scale score). In addition to the linear effect of age, the External, Recruitment, Time, Success and Change scale scores were also affected by a quadratic effect of age. Gender affected most MCQ scale scores: males had higher Recruitment scale scores as compared to females, and females had higher External, Internal, Effort, and Change scale scores. Level of education did not significantly affect any of the MCQ scale scores.

The results of the model assumption checks of each model are shown in Table 6. As shown, the homoscedasticity and normality assumptions were violated for the models of the External, Success, and Change scale scores. The normality assumption was violated for the models of the Internal and Recruitment scale scores. A further examination of the normality and homoscedasticity plots suggested that none of the model violations were problematic. There were no indications of multicollinearity or influential cases (see Table 6).

The mild violations of the normality and the homoscedasticity assumptions were taken into account (for the relevant outcomes) by using empirically distributed standardized residuals

(instead of using values from the standard normal distribution) and by using $SD(e_i)$ values as a function of the quartiles of the predicted scores, respectively. The $SD(e_i)$ values to be used in the normative procedures are shown in Table 7.

Regression-Based Normative Data for the Memory Compensation Questionnaire Scale Scores

Norms for the MCQ scale scores are established by means of the four-step procedure described above. For example, suppose that a 60-year-old male obtained an External scale raw score of 25. The clinician who uses the regression-based norms first calculates the expected External scale score for this person, i.e., $21.6125 (= 22.73 + ((60-45) * 0.09) + ((60-45)^2 * -.0023) + (1 * -1.95))$. Second, the residual is calculated, i.e., $3.3875 (= 25 - 21.6125)$. Third, the residual is standardized, i.e., $0.719 (= 3.3875 / 4.71)$. Fourth, the standardized residual is converted into a percentile value by means of the empirical cumulative distribution function of the standardized residuals. A standardized residual of the External scale score which equals 0.719 corresponds with a percentile value of 73. Thus, about 73% of the “normal” population of 60-year-old males would obtain an External scale score that is lower than the score of 25 that was obtained by this person.

The four-step normative procedure provides accurate norms but lacks user-friendliness because the users of the norms have to actively make the required computations. For that reason, we derived simplified and straightforward normative tables from the four-step normative procedure (see Tables 8–14). For example, Table 8 immediately shows that the External scale score of 25 that was obtained by the 60-year-old male from the example corresponds to a percentile value between 50 and 80. The correct use of the simplified normative tables requires that the clinician round up the client’s age to the closest age given in the table. Moreover, normative tables offer only a limited number of percentile values. Therefore, we also devised an Excel worksheet in which the four-step normative procedure was implemented. In this worksheet, the user of the norms types in the age and gender of the testee together with his or her MCQ item scores. The worksheet automatically computes the MCQ scale scores, converts the scale scores into percentiles using the four-step procedure described above, and graphically presents the results. This worksheet can be downloaded from <http://www.lab-epsylon.fr/productions/questionnaires-74.html>.

Discussion

Taking notes on a piece of paper, repeating information or placing objects in a functional place are typical means of compensating for perceived or real memory failures or deficits. At any age, people are faced with increasing environmental demands that involve a perpetual adjustment to maintain a desired or required level of efficiency. Memory losses and their consequences have been widely documented in the area of pathological aging, brain injury or stroke. Whereas some elderlies perceive compensation as a means of maximizing their everyday memory performance, for others the development and implementation of strategies are the cornerstone of maintaining day-to-day independence. Therefore, the French-MCQ (F-MCQ) appears to be a valuable, reliable and comprehensive

tool for collecting information on the nature and the extent of memory compensation use and to understand patients' awareness and believes of their everyday memory monitoring.

The results of the present study showed that the factor structure of the French version is consistent with the factor structures that were obtained in English-, Spanish-, and Dutch-speaking samples (see de Frias & Dixon, 2005; Van der Elst et al., 2011), supporting the cross-national robustness of the MCQ. The expected seven factors underlie the item responses of the French version of the MCQ (i.e. External, Internal, Reliance, Time, Effort, Success and Change factors), and each item loaded on one factor only. Internal consistency was good to excellent for all MCQ scales (Cronbach's alpha values $> .62$ for all scales). Thus, the reliabilities of the French MCQ were commensurate with -, both English- and Dutch- adaptations (Table 3). The French version of the MCQ appears to be an adequate adaptation of the English scale with similar properties. In addition, pattern of correlations were consistent with the English- and Dutch- versions: all scale scores of the French adaptation were positively correlated with each other (see Table 3); as well as with the total score of the MCQ (all $r > .45$, $p < .01$). Findings indicate that individuals use more than one type of strategies which fit with Van der Elst *et al.* (2011).

Furthermore, several correlates of the dimension of the MCQ were found to be consistent with prior research. These results demonstrate that the French version of the MCQ has good criterion validity and is reliable in this respect with previous research. Available evidence suggested that health conditions are linked with cognitive and compensation functioning in middle-aged and older adults (de Frias et al., 2003). For example, infirmities were related to investing greater time and effort in memory activities and to relying more on others for memory assistance. In addition, the respiratory illness composite was related to applying less effort in daily memory activities (see Introduction). Our results confirmed the links between some health composites and compensation strategies: the more people reported infirmities, the more they tended to use external strategies, to call for others assistance, and to invest effort in memory activities. The presence of infirmities may constitute constraints on compensatory resources and change perceptions of memory competence.

Garrett *et al.* (2010) recently indicated that the relationship between perceived difficulties and strategies implementation is moderated by a high level of perceived stress: people under high stress who exhibit greater memory errors are less likely to compensate for memory problems. An additive effect between life stress and high memory errors might result in a "compensatory ceiling" effect. In the present study, we demonstrated a link between anxiety, perceived stress and sense of control (de Frias et al., 2003). Higher levels of anxiety were correlated with more use of internal, reliance and effort strategies, as well as with a greater perception of change over the previous 5–10 years. High perceived stress was correlated with greater use of all compensatory strategies compensation except for the External memory compensation. Some anxiety and stress may generate a broad range of potential adaptive behaviors by facilitating or constraining resilience (Garrett *et al.*, 2010). Those covariates might define contexts in which compensation may or not occur. However, future studies will have to test the direction of the causal relationship between these variables.

In general, all mean-level scores on MCQ scales were linked to age – except the Internal scale – and gender – except the Success scale. Males endorsed more frequently reliance on others than females, and females obtained a higher score on external, internal and time scales. Moreover, females demonstrated a greater perception of change than males by reporting a greater recent increase in the use of various compensation strategies. However, unlike previous results, level of education was unrelated to any indicators of memory compensation. It may be that our sample hold homogeneous educational level, which did not allow to study whether there are educational differences in the use of compensatory strategies.

This study has several limitations. First, Dixon et al. (2001) estimated the test-retest reliability of the MCQ using a 3-year interval and obtained moderate to high cross-occasion correlations (r from 0.61 to 0.78). They reported that older adults did no change in the use of compensatory strategies over a period of three-years. This result might indicate that they did not perceive a gap between their skills and environmental demands over the longitudinal period. The administration of the MCQ to Alzheimer participants or Mild Memory Deficit show that the scales are reliable and can detect interindividual differences in intraindividual changes (Dixon & de Frias, 2007; Dixon et al., 2003). Our study did not provide estimations of test-retest reliability for the French version, but preliminary results of a 12-month follow-up currently in progress are consistent with Dixon et al. (2001). Second, our sample might not be representative of the general population. Indeed, interest in the advertised topic of the survey might have affected the participation rates and characteristics, as well as some of the subsequent results. Such selection effects may explain in part that level of education did not covary with memory compensation strategies by increasing in the present study.

To conclude, the main contributions of this study lie in having adapted, validated and normalized the MCQ for use in a French population in a lifespan perspective which is of interest from a public health standpoint. Developing a lifespan evaluation of daily compensation is essential to promoting successful aging and recovery after TBI or stroke (Baltes, 1997; Dixon & Bäckman, 1995). Our study allows examining the pattern of change and stability in memory compensatory behaviors from young to late adulthood. It provides a useful tool for clinicians from diverse backgrounds to focus their memory intervention programs on the basis of clients' directed self reports. Moreover, the MCQ increases the objectivity of the measures of compensatory behaviors for a large public as several scales are usable as both self- and informant-ratings (Dixon et al., 2003 ; Snow, Cook, Lin, Morgan, & Magaziner, 2005). The comparison between self-rating and informant- rating is of major interest as the latter corresponds to the observation of spontaneous behavior under natural conditions. Evaluating whether compensation strategies are consciously achieved is essential as individuals who recognize their cognitive limitations and explicitly initiate cognitive behavioral compensations are more likely to adjust to aversive situations (Dixon & Bäckman, 1995 ; De Frias et al., 2001; Dixon et al., 2003.). The Memory Compensation Questionnaire examines specifically those explicit compensatory mechanisms.

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Table 1

Characteristics of the Studied Sample (age, number of years of education, gender).

	Age <i>M (sd)</i>	Number of years of education <i>M (sd)</i>
Population < 50 years old		
M (<i>n</i> =76)	25.91 (6.09)	13.85 (5.62)
F (<i>n</i> =287)	24.77 (5.71)	13.82 (5.16)
Population > 50 years old		
M (<i>n</i> = 123)	60 (8.27)	13 (5)
F (<i>n</i> = 263)	60.07 (8.3)	13.05 (4.54)

Table 2
Standardized Factor Loadings for the Seven-Factor Model of Memory Compensation Questionnaire (MCQ) and Item Descriptives

MCQ Item	Standardized factor loadings							Item Descriptives							
	F1	F2	F3	F4	F5	FG1	FG2	rit	Item Score <i>M</i>		Percentage Responses in Each Category				
									<i>M</i>	<i>sd</i>	0	1	2	3	4
Factor 1 : External															
1: Shopping	.57							0.61 *	2.41	1.18	6.14	18.16	23.90	31.78	20.03
6: Bookmark	.43							0.44 *	3.34	1.04	3.34	4.56	8.82	21.20	62.08
13: Post notes	.70							0.64 *	2.20	1.35	16.29	15.35	19.22	30.31	18.83
18: Put things in places	.65							0.53 *	2.55	1.26	9.61	12.95	15.49	36.72	25.23
20: Put things by front door	.78							0.47 *	2.07	1.17	13.48	16.29	28.97	32.44	8.81
23: Mark appointments	.72							0.69 *	3.16	1.20	6.28	5.61	10.28	21.23	56.61
25: Note birthdays	.66							0.64 *	2.18	1.53	22.43	13.34	16.83	18.29	29.11
27: Mark telephone numbers	.65							0.55 *	3.27	1.14	4.67	6.28	8.68	17.89	62.48
Factor 2 : Internal															
21: Memory tricks		.67						0.51 *	1.04	1.05	40.72	26.70	21.76	9.88	0.93
22: Take your time		.63						0.56 *	1.94	0.98	8.41	22.16	41.26	23.77	4.41
24: Think about or plan		.52						0.40 *	2.98	0.97	2.14	6.41	16.42	41.39	33.64
26: Repeat telephone numbers		.64						0.49 *	1.54	1.30	28.04	24.83	22.03	15.75	9.35
28: Name and face association		.68						0.53 *	2.32	1.33	13.62	13.35	23.90	25.90	23.23
30: Review and reconstruct		.69						0.58 *	1.94	1.08	11.48	21.09	34.98	26.57	5.87
32: Letters as cues		.48						0.42 *	0.82	1.14	58.48	15.75	14.02	9.21	2.54
34: Link new and old		.76						0.64 *	1.97	1.08	12.15	18.42	34.45	30.17	4.81
36: Mental images		.66						0.58 *	2.26	1.11	10.28	10.15	34.58	33.78	11.21
38: Repeat appointments		.73						0.57 *	1.33	1.08	26.03	34.18	23.36	14.02	2.40
Factor 3 : Reliance															
3: Ask for help to remember appointments			.82					0.72 *	1.03	1.03	39.39	28.70	22.56	7.88	1.47
9: Ask for help to remember TV program			.82					0.63 *	0.69	0.90	55.01	26.44	13.89	4.14	0.53

MCQ Item	Standardized factor loadings							Item Descriptives							
	F1	F2	F3	F4	F5	FG1	FG2	rit	Item Score <i>M</i>		Percentage Responses in Each Category				
									<i>M</i>	<i>sd</i>	0	1	2	3	4
12: Ask for help to remember event (e.g., birthday)		.84						0.78 *	1.12	1.17	40.99	24.83	19.49	10.81	3.87
14: Ask for help to remember people's names		.83						0.66 *	1.19	1.08	34.71	25.90	27.10	10.41	1.87
17: Ask for help to remember trip		.82						0.69 *	0.82	0.99	50.60	25.63	16.56	6.01	1.20
Factor 4 : Time															
2: Slowdown speech				.66				0.54 *	0.75	0.94	52.71	24.97	17.36	4.14	0.83
5: Story reading repetition				.70				0.69 *	1.83	1.11	13.35	24.43	35.11	20.16	6.94
11: Read newspaper slowly				.83				0.82 *	2.23	1.11	8.41	16.29	30.97	32.84	11.48
15: Slow down reading speed				.79				0.83 *	2.07	1.12	10.55	18.02	34.85	27.24	9.35
Factor 5 : Effort															
4: Effort in conversation				.70				0.60 *	1.25	0.96	24.43	37.38	28.30	8.81	1.07
7: Effort in memorizing story				.61				0.54 *	1.74	1.25	18.69	27.37	25.10	18.42	10.41
10: Concentrate a lot				.60				0.63 *	2.42	1.09	4.94	14.95	31.11	31.11	17.89
19: Try hard to remember phone numbers				.60				0.65 *	1.93	1.19	12.82	23.77	32.84	18.56	12.02
29: Concentrate to learn new person's names				.71				0.58 *	1.81	1.20	16.02	26.30	26.97	22.16	8.54
33: Effort to remember meeting times				.64				0.61 *	1.31	0.97	20.43	41.92	26.30	9.21	2.14
General Factor 1 : Success															
8: Importance of remembering newspaper article					.75			0.64 *	1.37	1.05	22.56	35.91	27.24	10.95	3.34
16: Importance of remembering conversation					.74			0.73 *	1.55	1.09	16.69	36.58	27.24	14.15	5.34
31: Importance of remembering childhood event					.71			0.69 *	2.06	1.20	9.48	26.84	24.57	26.03	13.08
35: Importance of remembering funny story					.76			0.69 *	1.66	1.29	20.03	33.11	19.36	15.62	11.88
37: Importance of remembering things as verbatim as possible					.68			0.76 *	1.53	1.05	16.42	37.12	27.10	15.89	3.47
General Factor 2 : Change (compared with 5–10 years ago)															
39: Ask more or less often to people to remember things					.58			0.63 *	2.12	0.78	4.81	8.81	58.74	25.23	2.40
40: Spend more or less time learning things					.67			0.70 *	2.30	0.78	1.74	10.68	47.53	36.32	3.74
41: Use more or less often memory aids					.65			0.60 *	2.54	0.73	1.20	2.27	45.79	42.32	8.41

MCQ Item	Item Descriptives														
	Standardized factor loadings							Item Score <i>M</i>			Percentage Responses in Each Category				
	F1	F2	F3	F4	F5	FG1	FG2	rit	<i>M</i>	<i>sd</i>	0	1	2	3	4
42: Concentrate more or less often to remember important things							.78	0.52 *	2.36	0.54	0.67	4.81	19.49	72.36	2.67
43: Use more or less “memory tricks”							.78	0.51 *	2.29	0.62	0.53	3.47	66.62	24.97	4.41

Note. = corrected item-scale correlation.

* $p < .01$.

Table 3

Memory Compensation Questionnaire Scale Descriptives and Scale Score Intercorrelations. *M* = Mean, *SD* = Standard Deviation, *SEM* = standard error of measurement

Descriptives										Intercorrelations									
Scales	N	M	Median	SD	SEM	α (de Frias & Dixon, 2005)	α (Van der Elst et al., 2010)	α (Melendez et al., in press)	α (present study)	Standardized α (present study)	Average inter-item correlation	External	Internal	Reliance	Time	Effort	Success	Change	Total
External	749	21.20	22	5.67	0.21	.80	.77	.78	.70	.70	.23*	0.29*	1						0.62*
Internal	749	18.12	18	6.00	0.22	.76	.85	.66	.72	.73	.21*	0.16*	0.26*	1					0.77*
Reliance	749	4.84	4	3.66	0.13	.82	.88	.70	.75	.75	.37*	0.25*	0.47*	0.24*	1				0.48*
Time	749	6.88	7	3.13	0.11	.65	.78	.73	.71	.70	.40*	0.41*	0.54*	0.35*	0.57*	1			0.64*
Effort	749	10.46	10	4.09	0.15	.72	.78	.63	.66	.67	.26*	0.12*	0.38*	0.11*	0.26*	0.32*	1		0.79*
Success	749	8.17	8	4.03	0.15	.82	.82	1	.75	.76	.39*	0.29*	0.26*	0.18*	0.24*	0.32*	0.16*	1	0.53*
Change	749	11.60	11.36	2.19	0.08	.75	.77	1	.62	.62	.25*	0.62*	0.77*	0.48*	0.64*	0.79*	0.53*	0.45*	0.45*
Total	749	81.26	80.41	18.71	0.68														

*
p < .01

Table 4
Correlation among the MCQ Subscales and Other Measures (Health indicators, Locus of control, Perceived Stress and Anxiety)

Variables	<i>M (SD)</i>	MCQ Factors							Total MCQ
		F1 External	F2 Internal	F3 Reliance	F4 Time	F5 Effort	GFI Success	GF2 Change	
Infirmities	1.24 (1.35)	0.12 *	0.06	0.08 *	0.05	0.14 *	0.08 *	0.09 *	0.14 *
Respiratory Illness	0.39 (0.89)	-0.06	0.02	0.04	0.00	0.02	0.04	-0.03	0.01
Circulatory Illness	0.28 (0.79)	0.06	-0.06	-0.02	-0.05	-0.04	0.03	0.07	-0.01
LOC	11.37 (3.69)	-0.05	0.02	0.02	0.08 *	0.05	0.08 *	-0.04	0.03
SPSS	37.78 (7)	-0.04	0.12 *	0.12 *	0.11 *	0.17 *	0.10 *	0.11 *	0.14 *
STAI- State	37.61 (10.08)	0.00	0.10 *	0.10 *	0.05	0.12 *	0.06	0.14 *	0.11 *

* $p < .05$

Table 5

Final Regression Models for the MCQ Scale scores with Age = calendar age - 45; Age 2 = (calendar age - 45)²; Gender: female = 0, male = 1.

MCQ Scale	Variable	β	SE β	t-value	R ²
F1 External	(Constant)	22.73	0.35	65.60 *	
	Age	0.09	0.01	9.16 *	
	Age ²	-0.002	0.001	-3.53 *	
	Gender	-1.95	0.45	-4.32 *	.12
F2 Internal	(Constant)	18.55	0.26	71.99 *	
	Gender	-1.75	0.50	-3.50 *	.02
F3 Reliance	(Constant)	4.06	0.23	17.32 *	
	Age	-0.008	0.007	-1.21	
	Age ²	0.001	0.000	3.24 *	
	Gender	0.80	0.31	2.63 *	.02
F4 Time	(Constant)	6.59	0.20	32.83 *	
	Age	-0.010	0.006	-1.63	
	Age ²	0.001	0.000	3.05 *	
	Gender	-0.67	0.26	-2.57 *	.02
F5 Effort	(Constant)	10.83	0.18	61.44 *	
	Age	0.02	0.008	2.70 *	
	Gender	-1.24	0.34	-3.61 *	
	(Constant)	7.68	0.24	31.94 *	
GF1 Success	Age	0.001	0.008	0.12	
	Age ²	0.001	0.001	2.61 *	.01
	(Constant)	12.14	0.13	90.18 *	
	Age	0.035	0.004	8.91 *	
GF2 Change	Age ²	-0.001	0.000	-3.39 *	
	Gender	-0.70	0.18	-3.99 *	.11

* p < .01.

Table 6

Distributional Assumptions of the Final Regression Models. Note. KS = Kolmogorov Smirnov normality test

MCQ Scale	Levene Test	KS D	Max(VIF)	Cook
F1 External	4.07 (p=.007)	.06 (p<.001)	1.03	.04
F2 Internal	.79 (p=.374)	.04 (p=.005)	1.00	.02
F3 Reliance	2.93 (p=.033)	.08 (p<.001)	1.03	.03
F4 Time	1.08 (p=.360)	.03 (p=.199)	1.03	.03
F5 Effort	2.83 (p=.040)	.03 (p=.043)	1.02	.01
GF1 Success	4.59 (p=.003)	.04 (p=.003)	1.01	.05
GF2 Change	7.235 (p<.001)	.05 (p<.001)	1.03	.06

Table 7SD(e_i) Values to be Used in the Normative Procedure.

MCQ Scale	Predicted Value	SD(e_i)
F1 External	19.42	5.83
	>19.42 and 21.48	5.28
	>21.48 and 23.34	4.71
	>23.34	5.39
F2 Internal	all values	5.96
F3 Reliance	4.35	3.23
	> 4.35 and 4.85	3.53
	> 4.85 and 5.20	3.75
	> 5.20	3.89
F4 Time	all values	3.09
F5 Effort	all values	4.05
GF1 Success	7.87	4.48
	> 7.87 and 8.11	3.65
	> 8.11 and 8.42	4.11
	> 8.42	3.74
GF2 Change	10.90	2.43
	> 10.90 and 11.70	1.55
	> 11.70 and 12.38	2.07
	12.38	2.13

Table 8

Normative Data for the External Scale Stratified by Gender and Age. The raw scores that correspond to the percentiles 1, 5, 10, 20, 50, 80, 90, 95 and 99 are presented.

		Females												Males													
		Age in years												Age in years													
percentile		20	25	30	35	40	45	50	55	60	65	70	75	80	20	25	30	35	40	45	50	55	60	65	70	75	80
99		30.4	30.3	31.1	30.8	31.4	31.9	32.3	34.0	34.2	34.2	34.2	34.0	32.4	28.4	29.4	30.3	29.9	30.6	31.1	31.5	31.8	30.9	30.9	30.9	30.7	31.6
95		27.0	27.2	28.1	28.0	28.7	29.2	29.6	30.8	31.0	31.1	31.0	30.9	29.7	25.0	26.0	26.9	26.9	27.5	28.0	28.4	28.7	28.1	28.2	28.1	28.0	28.5
90		25.8	26.2	27.0	27.1	27.8	28.3	28.7	29.8	30.0	30.0	30.0	29.8	28.7	23.9	24.9	25.7	25.8	26.5	27.0	27.4	27.7	27.2	27.3	27.2	27.1	27.5
80		24.2	24.7	25.5	25.8	26.4	26.9	27.3	28.2	28.4	28.5	28.4	28.3	27.4	22.2	23.2	24.1	24.3	25.0	25.5	25.9	26.2	25.9	25.9	25.9	25.7	25.9
50	External Scale	19.3	20.3	21.1	21.8	22.5	23.0	23.4	23.7	23.9	24.0	23.9	23.8	23.5	17.3	18.3	19.2	19.9	20.6	21.1	21.5	21.8	21.9	22.0	21.9	21.8	21.5
20		14.0	15.5	16.4	17.6	18.2	18.7	19.2	18.9	19.1	19.1	19.1	18.9	19.2	12.1	13.1	13.9	15.2	15.8	16.3	16.7	17.0	17.7	17.7	17.7	17.5	16.8
10		11.3	13.0	13.8	15.3	16.0	16.5	16.9	16.3	16.5	16.6	16.5	16.3	17.0	9.3	10.3	11.2	12.6	13.3	13.8	14.2	14.5	15.4	15.5	15.5	15.3	14.3
5		8.6	10.5	11.4	13.2	13.8	14.3	14.7	13.8	14.0	14.1	14.0	13.9	14.8	6.6	7.6	8.5	10.2	10.8	11.4	11.8	12.1	13.3	13.3	13.3	13.1	11.8
1		5.2	7.5	8.4	10.5	11.1	11.6	12.0	10.7	10.9	11.0	10.9	10.8	12.1	3.3	4.3	5.1	7.2	7.8	8.3	8.7	9.0	10.6	10.6	10.6	10.4	8.8

Table 9

Normative Data for the Internal Scale Stratified by Gender. The raw scores that correspond to the percentiles 1, 5, 10, 20, 50, 80, 90, 95 and 99 are presented.

All ages			
percentile	F	M	
99	32.5	30.8	
95	28.0	26.2	
90	26.0	24.2	
80	23.7	22.0	
50	18.0	16.3	Internal Scale
20	13.7	12.0	
10	11.0	9.3	
5	8.8	7.0	
1	5.2	3.5	

Table 10

Normative Data for the Reliance Scale Stratified by Gender and Age. The raw scores that correspond to the percentiles 1, 5, 10, 20, 50, 80, 90, 95 and 99 are presented.

		Females													Males												
		Age in years													Age in years												
		20	25	30	35	40	45	50	55	60	65	70	75	80	20	25	30	35	40	45	50	55	60	65	70	75	80
Internal Scale	99	14.1	13.2	12.9	12.0	11.8	11.8	11.7	11.8	11.9	12.9	13.1	14.0	14.7	15.2	14.9	14.6	14.0	13.9	13.8	13.8	13.9	14.0	14.5	14.8	15.1	15.6
	95	11.4	10.7	10.4	9.7	9.5	9.5	9.4	9.5	9.6	10.4	10.6	11.3	12.0	12.4	12.1	11.8	11.4	11.2	11.1	11.1	11.2	11.3	11.8	12.0	12.4	12.8
	90	10.1	9.4	9.1	8.5	8.4	8.3	8.3	8.4	8.5	9.1	9.4	10.0	10.6	11.1	10.7	10.4	10.0	9.9	9.8	9.8	9.8	10.0	10.4	10.6	11.0	11.4
	80	8.3	7.7	7.4	7.0	6.8	6.8	6.7	6.8	6.9	7.4	7.7	8.2	8.7	9.2	8.8	8.6	8.2	8.1	8.0	8.0	8.1	8.2	8.5	8.8	9.1	9.5
	50	4.5	4.2	3.9	3.8	3.6	3.5	3.5	3.6	3.7	3.9	4.2	4.5	4.9	5.3	5.0	4.7	4.5	4.3	4.3	4.2	4.3	4.4	4.6	4.9	5.2	5.7
	20	2.1	1.9	1.6	1.6	1.5	1.4	1.4	1.5	1.6	1.5	1.8	2.0	2.3	2.7	2.4	2.4	2.1	2.0	1.9	1.8	1.8	2.0	2.1	2.3	2.7	3.1
	10	1.0	0.9	0.6	0.7	0.6	0.5	0.5	0.5	0.7	0.6	0.8	0.9	1.2	1.6	1.3	1.0	0.9	0.8	0.7	0.7	0.8	0.9	1.0	1.2	1.6	2.0
	5	0.4	0.3	0.1	0.2	0.1	0.0	0.0	0.1	0.2	0.0	0.3	0.4	0.6	1.1	0.7	0.4	0.4	0.2	0.1	0.1	0.2	0.3	0.4	0.6	1.0	1.4
	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.8

Table 11

Normative Data for the Time Scale Stratified by Gender and Age. The raw scores that correspond to the percentiles 1, 5, 10, 20, 50, 80, 90, 95 and 99 are presented.

Females															Males														
Age in years																													
percentile	20	25	30	35	40	45	50	55	60	65	70	75	80	20	25	30	35	40	45	50	55	60	65	70	75	80			
Time Scale	99	14.7	14.4	14.2	14.0	13.9	13.8	13.8	13.9	14.0	14.2	14.5	14.8	14.0	13.7	13.5	13.3	13.2	13.1	13.1	13.1	13.2	13.4	13.6	13.8	14.1			
	95	12.6	12.3	12.1	11.9	11.8	11.7	11.7	11.8	11.9	12.1	12.4	12.7	11.9	11.6	11.4	11.2	11.1	11.0	11.0	11.0	11.1	11.3	11.5	11.7	12.0			
	90	11.5	11.2	10.9	10.8	10.6	10.6	10.5	10.6	10.7	10.8	11.0	11.3	11.6	10.8	10.5	10.3	10.1	10.0	9.9	9.9	10.0	10.1	10.3	10.6	10.9			
	80	10.1	9.8	9.6	9.4	9.3	9.2	9.2	9.2	9.3	9.4	9.6	9.9	10.2	9.5	9.2	8.9	8.7	8.6	8.5	8.5	8.6	8.8	9.0	9.2	9.5			
	50	7.5	7.2	7.0	6.8	6.7	6.6	6.6	6.6	6.7	6.8	7.0	7.3	7.6	6.8	6.6	6.3	6.1	6.0	5.9	5.9	5.9	6.0	6.2	6.4	6.6	6.9		
	20	4.9	4.6	4.4	4.2	4.1	4.0	4.0	4.0	4.1	4.2	4.4	4.7	5.0	4.2	4.0	3.7	3.5	3.4	3.3	3.3	3.3	3.4	3.6	3.8	4.0	4.3		
	10	3.6	3.3	3.0	2.8	2.7	2.6	2.6	2.6	2.7	2.9	3.1	3.3	3.6	2.9	2.6	2.4	2.2	2.0	2.0	1.9	2.0	2.1	2.2	2.4	2.7	3.0		
	5	2.4	2.1	1.9	1.7	1.6	1.5	1.5	1.5	1.6	1.8	2.0	2.2	2.5	1.8	1.5	1.2	1.0	0.9	0.8	0.8	0.9	0.9	1.1	1.3	1.5	1.9		
	1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

Table 12

Normative Data for the Effort Scale Stratified by Gender and Age. The raw scores that correspond to the percentiles 1, 5, 10, 20, 50, 80, 90, 95 and 99 are presented.

		Females													Males												
		Age in years													Age in years												
	percentile	20	25	30	35	40	45	50	55	60	65	70	75	80	20	25	30	35	40	45	50	55	60	65	70	75	80
Effort Scale	99	19.7	19.8	19.9	20.0	20.1	20.2	20.4	20.5	20.6	20.7	20.8	20.9	21.0	18.5	18.6	18.7	18.8	18.9	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7
	95	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	18.0	18.1	18.2	15.7	15.8	15.9	16.0	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	17.0
	90	15.5	15.6	15.7	15.8	15.9	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15.0	15.1	15.2	15.3	15.4	15.5
	80	13.7	13.8	13.9	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.8	14.9	15.0	12.5	12.6	12.7	12.8	12.9	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7
	50	10.3	10.4	10.5	10.6	10.7	10.8	10.9	11.0	11.1	11.2	11.3	11.4	11.6	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.0	10.1	10.2	10.3
	20	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9
	10	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.1	6.2	6.3	6.4	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1
	5	3.6	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.6	3.7
	1	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9

Normative Data for the Success General Scale Stratified by Age. The raw scores that correspond to the percentiles 1, 5, 10, 20, 50, 80, 90, 95 and 99 are presented.

Table 13

		Females and Males												
percentile		20	25	30	35	40	45	50	55	60	65	70	75	80
Scale Success	99	18.3	19.0	17.5	19.5	19.5	19.4	19.5	19.6	17.6	19.0	18.3	18.7	19.1
	95	15.6	16.0	14.9	16.4	16.3	16.2	16.3	16.4	15.0	16.1	15.7	16.0	16.4
	90	13.7	14.0	13.1	14.1	14.0	14.0	14.0	14.1	13.1	14.0	13.8	14.1	14.6
	80	12.0	12.0	11.4	12.0	11.9	11.9	11.9	12.0	11.4	12.1	12.0	12.4	12.8
	50	8.2	7.9	7.7	7.5	7.4	7.4	7.4	7.5	7.7	7.9	8.2	8.6	9.0
	20	5.0	4.4	4.6	3.7	3.6	3.6	3.6	3.7	4.6	4.4	5.1	5.4	5.9
	10	3.4	2.6	3.0	1.7	1.7	1.6	1.7	1.8	3.1	2.7	3.5	3.8	4.2
	5	2.3	1.4	1.9	0.4	0.3	0.3	0.3	0.4	1.9	1.4	2.3	2.7	3.1
	1	0.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.5	0.8	1.3

Table 14

Normative Data for the Change General Scale Stratified by Gender and Age. The raw scores that correspond to the percentiles 1, 5, 10, 20, 50, 80, 90, 95 and 99 are presented.

		Females													Males													
		Age in years													Age in years													
percentile		20	25	30	35	40	45	50	55	60	65	70	75	80	20	25	30	35	40	45	50	55	60	65	70	75	80	
99		17.2	15.3	15.6	15.9	17.5	17.7	17.9	18.1	18.2	18.2	18.2	18.1	17.8	16.5	16.9	17.3	15.2	15.4	15.6	15.8	17.3	17.3	17.4	17.4	17.3	15.9	15.7
95		14.6	13.6	13.9	14.2	15.3	15.4	15.6	15.8	15.9	15.9	15.9	15.8	15.6	13.9	14.3	14.6	13.5	13.7	13.9	14.1	15.0	15.1	15.1	15.1	15.1	14.2	14.0
90		13.6	12.9	13.2	13.5	14.4	14.6	14.7	14.9	15.0	15.0	15.0	14.9	14.7	12.9	13.2	13.6	12.8	13.1	13.3	13.4	14.1	14.2	14.2	14.2	13.5	13.4	
80		12.4	12.2	12.5	12.8	13.4	13.6	13.8	13.9	14.0	14.0	14.0	13.9	13.7	11.7	12.1	12.4	12.1	12.3	12.5	12.7	13.2	13.2	13.3	13.2	12.8	12.7	
Scale Change	50	10.5	11.0	11.3	11.6	11.8	12.0	12.2	12.3	12.3	12.3	12.3	12.3	12.1	9.8	10.2	10.6	10.9	11.1	11.3	11.5	11.6	11.6	11.7	11.6	11.6	11.5	
	20	9.0	10.0	10.3	10.6	10.5	10.7	10.8	10.9	11.0	11.0	10.9	10.9	10.8	8.3	8.7	9.0	9.9	10.1	10.3	10.5	10.2	10.3	10.3	10.3	10.6	10.5	
	10	8.0	9.4	9.7	10.0	9.7	9.9	10.0	10.1	10.1	10.1	10.1	10.0	10.0	7.3	7.7	8.0	9.3	9.5	9.7	9.9	9.4	9.5	9.5	9.5	10.0	9.9	
	5	7.3	8.9	9.2	9.5	9.0	9.2	9.4	9.4	9.5	9.5	9.5	9.4	9.4	6.6	7.0	7.3	8.8	9.1	9.3	9.4	8.8	8.9	8.9	8.8	9.5	9.4	
	1	4.2	6.9	7.3	7.6	6.4	6.6	6.8	6.8	6.8	6.8	6.8	6.7	6.7	3.5	3.9	4.2	6.9	7.1	7.3	7.5	6.2	6.2	6.3	6.2	7.5	7.4	