Multifactorial Memory Questionnaire

Professional Manual

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Acknowledgments

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Introduction

Construct of Metamemory

Metamemory is a multidimensional construct that includes what people believe about their own memory and how they control and monitor their memory processes (Dunlowsky & Thiede, 2013). It may include memory-related knowledge, perceptions, appraisals, emotions, and self-regulation.

The accurate measurement of metamemory is relevant for clinical assessment and intervention. Subjective memory impairment, for example, predicts future cognitive decline (Reid & MacLullich, 2006) and is one of the diagnostic criteria for mild cognitive impairment (Petersen, 2004). Also, the effectiveness of memory interventions may in part be determined by changes in memory knowledge, attitudes, self-efficacy, ability, and/or compensation. The availability of psychometrically sound, clinically relevant measurement tools can be useful for these purposes.

Description of the Questionnaire

The Multifactorial Memory Questionnaire (MMQ) consists of three scales measuring separate aspects of metamemory. Items are rated on a 5-point Likert scale based on the test taker's experiences over the previous two weeks.

The three MMQ scales and their respective metamemory domains include:

1. MMQ-Satisfaction (formerly called MMQ-Contentment). This scale measures satisfaction, concern, and overall appraisal of one's own memory. Each of 18 statements is rated based on degree of agreement. The score range is 0 to 72, with higher scores indicating a higher degree of satisfaction.

2. MMQ-Ability. This scale measures self-perception of everyday memory ability. Respondents rate how often they experienced each of 20 common memory mistakes over the previous two weeks. The score range is 0 to 80, with higher scores indicating better self-reported memory ability.

3. MMQ-Strategy. This scale measures the use of practical memory strategies and aids in day-to-day life. Respondents rate how often they used each of 19 memory strategies over the previous two weeks. The score range is 0 to 76, with higher scores indicating greater use of memory strategies.

Development of the MMQ

The MMQ was developed to assess multiple dimensions of metamemory that would be useful for clinical assessment and intervention. To increase clinical utility, we focused on memory abilities and strategies that are applicable to everyday life (e.g., remembering names, using repetition) rather than to laboratory situations (e.g., remembering word pairs, using the method of loci). To increase compliance, we created scales to be as short as possible while maintaining comprehensiveness of content and maximizing reliability. As a result, the entire MMQ can be completed in about 10 minutes or less for most test takers.

Questionnaire items were created based on a review of the literature, and adequate reliability and validity of the consequent MMQ scales have been demonstrated. Normative data provided in Troyer and Rich (2002) were developed based on a subset of the original sample: 115 healthy and cognitively normal middle-aged and older adults. In the time since the initial publication, the scales have been administered to additional samples of healthy adults, and the normative data presented here are based on a sample of 401 participants.

2
Administration and Scoring

Test Materials

The test materials for the MMQ include: (a) three separate forms for the test taker to complete (i.e., one for each of the Satisfaction, Ability, and Strategy scales); and (b) this Professional Manual, which contains information about the development, administration, scoring, interpretation, normative data, and technical information related to the MMQ. In addition to these materials, a pencil or pen is needed for the test taker to complete the MMQ.

Appropriate Populations

The MMQ was developed and validated for use in adults from age 39 to 91. To complete the written MMQ forms, test takers must have sufficient vision and reading ability to perceive and understand the instructions and questionnaire items, and sufficient motor skills to mark their responses.

Examiner Qualifications

The MMQ can be administered and scored by any person who has training and experience working with the target population and who has sufficient training and support to follow the established procedures outlined in this Professional Manual. Clinical interpretation of the scores can be done only by a professional with education, training, and supervised experience in psychological assessment.

Test Formats

The MMQ can be administered individually or in groups. Test takers may be supervised (e.g., in a clinic or laboratory) or unsupervised (e.g., in the test taker's home) while completing the questionnaire. One, two, or all three of the scales may be administered at any one time. When more than one

scale is used, the administration order is: Satisfaction, Ability, and then Strategy.

The MMQ has also been administered orally (e.g., Parikh, Troyer, Maione, & Murphy, 2016), although scores may be inflated when administered in this format. As such, normative data presented in this manual are applicable to written administration only.

Test Administration

Upon distributing the MMQ forms, the examiner should provide a brief summary of the instructions at the top of each form. The examiner should emphasize that test takers respond according to their experiences over the *past two weeks* and that they respond to *all items*, including those on the back of each form.

The following instructions may be used as a guide for introducing the MMQ:

> **These questionnaires will help us better understand your memory. Read the instructions at the top of each page, then read each item and think about your feelings or experiences over the past two weeks. Put a check in the box next to the response that best describes your feelings or experiences. It is important that you answer every question, so try not to skip any. Each questionnaire has a front and a back, so be sure to turn the paper over when you have finished the first side. Do you have any questions?**

These instructions may be paraphrased and/or repeated as often as needed.

The MMQ is a self-report questionnaire that should be completed without input from the test taker's family or friends, the examiner, or anyone else. If a test taker has a question about what is

meant by a specific item, however, clarification may be provided.

Upon completion of the MMQ, the administrator should review the forms to ensure that all items are answered and that only one response is given for each item. Any missing or double responses should be pointed out and corrected by the test taker. Some individuals may not be able to answer all items because they are not relevant. In this case, missing responses are acceptable. (See next section for scoring missing responses.)

For most test takers, administration time is about 10 minutes or less.

Scoring

Each of the three MMQ scales is scored and interpreted separately. Scores from the individual scales are not combined into a total score.

Before scoring the MMQ, each scale should be inspected for completeness. Any scale with 4 or more missing items is considered invalid and should not be scored or interpreted.

A scoring key is provided in Appendix A for each MMQ scale. The numbers next to each response in the scoring key indicate the numeric values for those responses. The three scales are scored differently, and scoring changes from item to item on the Satisfaction scale. The numeric value for each response can be written in the blank area to the right of the corresponding item. The total score for the scale is the sum of the values for each item.

If there are 1, 2, or 3 missing responses for a given scale, the score is calculated based on the items that were completed, and prorated using the following formula:

$$\text{Prorated Score} = \text{Number of possible items} \times \left(\frac{\text{Obtained score}}{\text{Number of completed items}} \right)$$

The number of possible items for the Satisfaction, Ability, and Strategy scales is 18, 20, and 19, respectively.

Raw scores (including prorated scores, rounded to the nearest whole number) can be converted to T Scores using the normative data presented in Appendix B.

A sample of a completed and scored MMQ scale is provided in Figure 2.1.

Figure 2.1. Sample of a completed MMQ Satisfaction form.

Multifactorial Memory Questionnaire

How I Feel About My Memory

Name: _Mrs. Example_   Date: _Nov 30, 2014_

Below are statements about feelings that people may have about their memory. Read each statement and think about your feelings over the past *two weeks*. Then, check the box next to the response that best describes how much you agree or disagree.

1. I am generally pleased with my memory ability.

   ☐ Strongly Agree   ☑ Agree   ☐ Undecided   ☐ Disagree   ☐ Strongly Disagree   3

2. There is something seriously wrong with my memory.

   ☐ Strongly Agree   ☐ Agree   ☐ Undecided   ☑ Disagree   ☐ Strongly Disagree   3

3. If something is important, I will probably remember it.

   ☑ Strongly Agree   ☐ Agree   ☐ Undecided   ☐ Disagree   ☐ Strongly Disagree   4

4. When I forget something, I fear that I may have a serious memory problem, like Alzheimer's disease.

   ☑ Strongly Agree   ☐ Agree   ☐ Undecided   ☐ Disagree   ☐ Strongly Disagree   0

5. My memory is worse than most other people my age.

   ☐ Strongly Agree   ☐ Agree   ☑ Undecided   ☐ Disagree   ☐ Strongly Disagree   2

6. I have confidence in my ability to remember things.

   ☐ Strongly Agree   ☑ Agree   ☐ Undecided   ☐ Disagree   ☐ Strongly Disagree   3

7. I feel unhappy when I think about my memory ability.

   ☐ Strongly Agree   ☐ Agree   ☐ Undecided   ☑ Disagree   ☐ Strongly Disagree   3

8. I worry that others will notice that my memory is not very good.

   ☐ Strongly Agree   ☐ Agree   ☐ Undecided   ☑ Disagree   ☐ Strongly Disagree   3

9. When I have trouble remembering something, I'm not too hard on myself.

   ☑ Strongly Agree   ☐ Agree   ☐ Undecided   ☐ Disagree   ☐ Strongly Disagree   4

10. I am concerned about my memory.

   ☐ Strongly Agree   ☐ Agree   ☐ Undecided   ☑ Disagree   ☐ Strongly Disagree

3

11. My memory is really going downhill lately.

   ☐ Strongly Agree   ☐ Agree   ☐ Undecided   ☐ Disagree   ☑ Strongly Disagree

4

12. I am generally satisfied with my memory ability.

   ☐ Strongly Agree   ☑ Agree   ☐ Undecided   ☐ Disagree   ☐ Strongly Disagree

3

13. I don't get upset when I have trouble remembering something.

   ☐ Strongly Agree   ☐ Agree   ☐ Undecided   ☑ Disagree   ☐ Strongly Disagree

1

14. I worry that I will forget something important.

   ☐ Strongly Agree   ☐ Agree   ☐ Undecided   ☑ Disagree   ☐ Strongly Disagree

3

15. I am embarrassed about my memory ability.

   ☐ Strongly Agree   ☐ Agree   ☐ Undecided   ☑ Disagree   ☐ Strongly Disagree

3

16. I get annoyed or irritated with myself when I am forgetful.

   ☐ Strongly Agree   ☐ Agree   ☐ Undecided   ☐ Disagree   ☐ Strongly Disagree

?

17. My memory is good for my age.

   ☐ Strongly Agree   ☑ Agree   ☐ Undecided   ☐ Disagree   ☐ Strongly Disagree

3

18. I worry about my memory ability.

   ☐ Strongly Agree   ☐ Agree   ☐ Undecided   ☑ Disagree   ☐ Strongly Disagree

3

Prorated score:

$$18 \times (48/17) = 51$$

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3
Normative Information

Normative Sample

Participants comprising the normative sample were English-speaking healthy middle-aged and older adults recruited by advertisements or through research participant pools at Baycrest Health Sciences (Troyer, 2001; Troyer & Rich, 2002; Vandermorris, Au, Gardner, & Troyer, 2018; Wiegand, Troyer, Gojmerac, & Murphy, 2013) and York University (Shaikh, Tatham, Parikh, McCreath, Rich, & Troyer, 2018). Only participants who completed all three MMQ scales were included in the sample.

We excluded any test taker with less than 8 years of education. We also excluded those with low cognitive ability as measured by the modified Telephone Interview for Cognitive Status (i.e., score < 30; Welsh, Breitner, & Magruder-Habib, 1993) and those who endorsed significant mood symptoms on the 15-item version of the Geriatric Depression Scale (i.e., score > 4; Burke, Roccaforte, & Wengel, 1991).

The final sample consisted of 401 participants. Table 3.1 presents demographic characteristics of this group.

Table 3.1
Demographic Characteristics of the Normative Sample

	Mean	SD	Range	%
Age	71.4	8.9	39-91	
Education	15.0	2.7	8-21	
Sex				
Male				29%
Female				71%

Note. Sample size *(N)* = 401. SD = standard deviation.

All participants completed a written version of the MMQ, either on paper (*n* = 287) or electronically (*n* = 114). There were slight score differences between these two groups on the Satisfaction and Ability scales that favored the electronic format. Because these differences could plausibly be related to participant characteristics (i.e., older adults choosing to use technology for questionnaire completion may indeed have fewer memory concerns), we opted to combine the two groups for the purpose of calculating normative data.

Relation to Demographic Variables

Analysis of the normative sample revealed that MMQ scores were not correlated with age, *r*s = -.05 to .02, *p*s > .28. Similarly, there were no sex differences in any of the MMQ scores, *t*s = -1.42 to 1.49, *d*s = 0.15 to 0.17, *p*s > .13. Correlations between MMQ subscales and education were negligible to small in size, *r*s = -.02 to .13, and only the correlation with MMQ-Ability was statistically significant, *p* = .01.

Normative Data

Based on these findings, we provide normative data collapsed across age, education, and sex. Table 3.2 presents summary statistics for MMQ subscales based on our normative sample.

Table 3.2
Summary Statistics for MMQ Raw Scores

Scale	Mean	SD	SEM	Range
Satisfaction	43.9	13.7	0.7	7-72
Ability	48.8	11.2	0.6	0-80
Strategy	37.3	10.4	0.5	1-64

Note. Sample size *(N)* = 401. SD = standard deviation; SEM = standard error of the mean.

Prior to computing *T* scores, the shape of the distribution for each scale was analyzed to determine if scores were skewed. All skewness values were well within the range of -1.0 to 1.0, which indicated that the distributions were normal. Consequently, linear *T* scores were generated as linear transformations of

the raw scores obtained from the normative sample without employing smoothing procedures.

As seen in Table 3.2, participants did not obtain scores at the highest and lowest ends of the possible score ranges on all scales. In addition, some raw scores were not obtained by any of the participants in the normative sample. When this occurred, interpolated *T*-score values were derived based on the means of adjacent scores.

The resulting *T* scores based on the normative sample have a mean of 50 and standard deviation of 10. A table for converting raw scores to *T* scores on each of the MMQ scales is provided in Appendix B.

4
Interpretation

This section presents guidelines for clinical interpretation of the MMQ. Results from this self-report measure provide information regarding three dimensions of metamemory. However, broader interpretive meaning can be derived when combined with results from a battery of clinical assessment measures, including objective measures of memory, personality and mood measures, and clinical history.

Principles of Interpretation

Interpretation of the MMQ begins with conceptual knowledge of the construct of metamemory. Considering that metamemory is a heterogeneous construct, total scores based on the three scales combined are meaningless and should not be interpreted. Scores from the individual scales are meaningful only with reference to normative data from an appropriate comparison group. For that purpose, raw scores are transformed to T scores based on our normative sample, described in Chapter 3. Guidelines for interpreting T scores are provided in Table 4.1.

Table 4.1
T-Score Interpretation

T-score range	Interpretation
Below 20	Very low
20-29	Low
30-39	Below average
40-60	Average
60-70	Above average
71-80	High
Above 80	Very high

Precautions should be taken when interpreting scores with special populations, such as those with clinical diagnoses or those using languages other than English. Examiners using the MMQ with special populations may wish to interpret scores in relation to mean scores reported for those populations in other published studies. Mean scores reported in individual journal articles have the advantage of being potentially more relevant for a given population than the norms included here. The disadvantage, however, is that the MMQ was developed and validated only with healthy middle-aged and older adults and in a small number of languages (see literature review in Chapter 6).

Interpreting Specific MMQ Scores

Each MMQ scale measures the extent to which the respondent endorses a particular dimension of metamemory. Higher scores indicate better ratings, or greater endorsement, for a given dimension, as indicated below for each scale.

Satisfaction scale. Individuals with high scores on this scale are generally quite satisfied with their memory abilities. The lower the score, the worse one feels about his or her memory. Clinicians should interpret low scores on this scale in the context of findings from more general measures of anxiety and depression. When dissatisfaction with one's memory is a manifestation of more generalized feelings of low self-worth or anxiety, scores on those measures will be low as well. When measures of depression and anxiety are in the normal range, low scores on the Satisfaction scale may be more confidently attributed to specific feelings about one's memory.

Ability scale. Individuals with high scores on this scale have a better subjective impression of their memory capabilities than do those with lower scores. Again, there are other possible interpretations of low scores on this scale, such as depression, which should be ruled out before concluding that the test taker has an isolated subjective memory impairment. In any case, scores on this scale should not be interpreted as

representing objective memory ability, as self-reported memory test performance tends not to correlate with objective memory performance (Crumley, Stetler, & Horhota, 2014).

Strategy scale. Higher scores on this scale indicate a greater reported frequency of use of memory aids and strategies relative to lower scores. Note that this scale indicates only the frequency of use and not the reason for using the aids. For example, individuals who use many strategies may do so to compensate for failing memory (see correlations to other MMQ scales in Chapter 5). Alternatively, habitual or frequent users of memory strategies could have very good memory performance and satisfaction precisely because they do use such strategies.

Change over time

MMQ scores may be useful for examining change in metamemory over time. Such changes could be related, for example, to deterioration in health or improvement following clinical intervention. In determining what would constitute a meaningful change in scores over time, it is useful to examine the standard error of measurement and reliable change index (Jacobson & Traux, 1991). These values were calculated from our normative sample of 401 healthy older adults and are presented in Table 4.2.

Table 4.2
Reliability of Change Scores

Scale	SEMeasurement	Reliable Change Index
Satisfaction	3.6	7.1
Ability	4.2	8.2
Strategy	3.6	7.1

Based on these data, changes in MMQ scale scores over time that exceed 7 or 8 points can be considered reliable, as they are unlikely to be attributable to measurement error.

5
Technical Information

Item Selection and Scale Construction

The initial development of the MMQ (Troyer & Rich, 2002) involved creating questionnaire items reflecting everyday aspects of memory satisfaction, ability, and strategy use. Sixty-one items were developed based in part on previous questionnaires (Berry, West, & Dennehey, 1989; Broadbent, Cooper, FitzGerald, & Parkes, 1982; Crook & Larrabee, 1992; Dixon, Hultsch, & Hertzog, 1988; Gilewski, Zelinski, & Schaie, 1990; Harris, 1980; Intons-Peterson & Fournier, 1986; Jennings & Hay, 1994; Lovelace & Twohig, 1990; Park, Smith, & Cavanaugh, 1990).

Twelve clinicians and researchers with expertise in memory functioning categorized the 61 items into three metamemory domains (i.e., emotions and perceptions of one's own memory, everyday memory mistakes or problems, and memory strategies or aids). Only items meeting a criterion of 70% agreement among the raters were retained.

The items were also subjected to a principle components analysis, described subsequently. Items that loaded most highly onto their respective components were retained.

Of the 61 initial items, 57 met both of these criteria and were included in the final questionnaire. The items were grouped into their respective scales to create an 18-item Satisfaction scale (originally called Contentment scale), a 20-item Ability scale, and a 19-item Strategy scale.

Our initial research with the MMQ (Troyer & Rich, 2002) and subsequent studies with clinical and nonclinical populations (Hohaus, 2007; Phillips & Stuifbergen, 2006; Riffo, Reyes, & Véliz de Vos, 2013; van der Werf & Vos, 2011) have shown that scores on the three MMQ scales tend to be correlated with each other. Across these different studies, correlations between Satisfaction and Ability tend to be positive and large in size, rs = .57 to .76. Strategy is negatively correlated with Satisfaction and Ability, rs

= -.15 to -.67, indicating that individuals with poor satisfaction and self-appraisal of memory tend to use more memory strategies.

Reliability

Internal consistency. In our original evaluation with a sample of 130 English-speaking middle-aged and older adults (Troyer & Rich, 2002), analyses using Cronbach's alpha indicated good internal consistency for the Satisfaction (α = .95), Ability (α = .93), and Strategy (α = .83) scales. Analysis of the present normative sample of 401 healthy adults provided similar results, with alpha coefficients of .95, .93, and .84, respectively. Subsequent research in clinical and nonclinical samples has shown similar alpha coefficients, as seen in Table 5.1.

Test-retest reliability. Four-week test-retest analysis in a subgroup of 24 participants from our original sample indicated highly reliable scores on the Satisfaction (r = .93), Ability (r = .86), and Strategy (r = .88) scales (Troyer & Rich, 2002). Test-retest reliability coefficients reported in other research studies are presented in Table 5.2.

Validity

Content validity. Classification of test items into their respective scales showed strong agreement among 12 memory experts (Troyer & Rich, 2002). Of the 61 original items, there was 100% agreement for 53 items, 92% agreement for 6 items, and 83% agreement for 1 item. Only one item failed to meet the criterion of 70% agreement, and it was not retained in the final version of the MMQ.

Factor structure. The original MMQ items were submitted to a principal components analysis with varimax rotation, forcing a three-component solution

(Troyer & Rich, 2002). Eigenvalues for the Satisfaction, Ability, and Strategy components were 15.3, 3.6, and 5.4, respectively. All but three items – which were subsequently eliminated from the MMQ – loaded most highly onto their expected components. The loadings for the 57 retained items are listed in Table 5.3.

Subsequent research with translations of the MMQ replicated the same three-component structure (Ide, Takahashi, & Mori, 2004) or suggested a four-component structure that included two Strategy components (Fort, Adoul, Holl, Kaddour, & Gana, 2004; Raimo et al., 2016; van der Werf & Vos, 2011). One study that examined only the Strategy scale also identified two components (Hutchens et al., 2012).

Convergent validity. The relationship between MMQ scores and a number of other measures of metamemory and mood have been examined, both in the original development of the MMQ (Troyer & Rich, 2002) and in psychometric evaluations of MMQ translations (Fort et al., 2004; Ide et al., 2004; Raimo et al., 2016; Simon, Ávila, Vieira, & Bottino, 2016; van der Werf & Vos, 2011). Comparison measures have included the Metamemory in Adulthood questionnaire (MIA; Dixon et al., 1988), the Memory Functioning Questionnaire (MFQ; Gilewski et al., 1990), the Prospective Retrospective Memory Questionnaire (PRMQ; Smith, Della Sala, Logie, & Maylor, 2000), the Symptom Checklist-90 (SCL-90; Derogatis, 1994), and the Geriatric Depression Scale (GDS; Yesavage et al., 1983).

As expected, the MMQ Satisfaction scale correlates with the MIA Change subscale, rs = .48 to .61, the MFQ Seriousness of Forgetting subscale, r = .45, the SCL-90 Insufficiency subscale, r = -.75, the SCL-90 Anxiety subscale, r = -.27, the MIA Anxiety subscale, rs = -.56 to -.63, and the GDS r = -.41. The MMQ Ability scale correlates with the MIA Capacity subscale, rs = .43 to .61, the MFQ General Frequency of Forgetting subscale, r = .70, and the PRMQ total score, r = -.89. The MMQ Strategy scale correlates with the MIA Strategy subscale, rs = .64 to .73, and the MFQ Mnemonics subscale, r = .66.

Self-reported memory on the Ability scale shows negligible to small correlations with objective memory tests, rs = .09 to .14 (Troyer & Rich, 2002).

Discriminant validity. MMQ scores are not related to objective measures of attention and processing speed, rs = -.02 to .07 (Troyer & Rich, 2002), or to tests of general cognition (Raimo et al., 2016; Simon et al., 2016).

Concurrent validity. In our original study (Troyer & Rich, 2002), we compared MMQ performance in a group of 12 participants with low objective memory scores (i.e., more than 2 standard deviations below the mean) to that of a group of demographically matched participants with normal objective memory. Scores on the Satisfaction and Ability scales were about 10 points lower in the low-objective-memory group, and these differences were statistically significant. Strategy scores did not differ between the two groups.

Subsequent research with a number of clinical groups has shown decreased MMQ Satisfaction and/or Ability scores relative to demographically matched control groups. These clinical groups include individuals with subjective memory complaint (Pike, Ong, Clare, & Kinsella, 2017; van der Werf et al., 2016), amnestic mild cognitive impairment (Chung & Man, 2009; Kinsella et al., 2015; Lenehan, Klekociuk, & Summers, 2012; Parikh et al., 2016), temporal-lobe epilepsy (Illman, Moulin, & Kemp, 2015), breast cancer treated with chemotherapy (Bruno, Hadi Hosseini, & Kesler, 2012; Kesler, Wefel, et al., 2013), insomnia (Fortier-Brochu & Morin, 2014), and severe pain (Bazargan, Yazdanshenas, Gordon, & Orum, 2016), as well as a mixed clinical sample recruited from an outpatient neurology clinic (van der Werf & Vos, 2011). There generally are no group differences in Strategy scores (Fortier-Brochu & Morin, 2014; Hutchens et al., 2012; Lenehan et al., 2012; Parikh et al., 2016), although a few studies have shown increased use of strategies in clinical groups (Illman et al., 2015; van der Werf et al., 2016; van der Werf & Vos, 2011). These findings are reviewed in more detail in Chapter 6.

Table 5.1
Internal Consistency of MMQ Subscales in Selected Research Studies

Study	Sample type	N	Cronbach's α		
			Satisfaction	Ability	Strategy
Fairchild & Scogin, 2010	Healthy older adults	53	.92	.90	.83
Fort et al., 2004	Healthy adults	294	.88	.88	.79
Ide et al., 2004	Healthy older adults	19	.88	.93	.82
	Healthy older adults	87	.86	.90	.84
Phillips & Stuifbergen, 2006	Persons with multiple sclerosis	482	.96	.96	.88
Raimo et al., 2016	Healthy adults	600	.91	.91	
Riffo et al., 2013	Healthy adults	740	.88	.91	.89
Rotenberg Shpigelman et al., 2017	Older adults with subjective memory complaints	91	.91	.91	.81
Rotenberg & Maeir, 2018	Older adults with subjective memory complaints	23	.94	.92	.71
Simon et al., 2016	Healthy older adults	30	.89	.87	.75
Troyer & Rich, 2002	Healthy adults	130	.95	.93	.83
van der Werf & Vos, 2011	Healthy adults	716	.95	.93	.88
	Neurological patients	299	.94	.93	.90

Table 5.2
Test-Retest Reliability of MMQ Subscales in Selected Research Studies

Study	Sample type	N	Test-retest interval	Pearson's r		
				Satisfaction	Ability	Strategy
Ide et al., 2004	Healthy older adults	26	10 days	.82	.84	.78
Raimo et al., 2016	Healthy adults	60	4 weeks	.95	.96	.97
Simon et al., 2016	Healthy older adults	30	3 months	.80	.74	.75
Troyer & Rich, 2002	Healthy adults	24	4 weeks	.93	.86	.88

Table 5.3
Component Loadings for the MMQ Items on Their Respective Scales

Item number	Component 1: Satisfaction	Component 2: Ability	Component 3: Strategy
Sa-1	**.79**	-.04	.15
Sa-2	**.68**	-.04	.36
Sa-3	**.58**	.05	.21
Sa-4	**.35**	-.24	.22
Sa-5	**.59**	-.02	.36
Sa-6	**.74**	.09	.20
Sa-7	**.70**	-.11	.20
Sa-8	**.59**	-.14	.34
Sa-9	**.52**	.12	.05
Sa-10	**.76**	-.08	.27
Sa-11	**.71**	-.06	.18
Sa-12	**.79**	.01	.14
Sa-13	**.58**	.07	.21
Sa-14	**.66**	-.02	.38
Sa-15	**.67**	-.16	.38
Sa-16	**.68**	-.17	.25
Sa-17	**.78**	.05	.20
Sa-18	**.78**	-.02	.22
Ab-1	.00	**.56**	-.12
Ab-2	.17	**.52**	-.07
Ab-3	.23	**.55**	.07
Ab-4	.29	**.54**	.54
Ab-5	.27	**.60**	-.15
Ab-6	.15	**.53**	.11
Ab-7	.15	**.67**	.00
Ab-8	.24	**.64**	.05
Ab-9	.28	**.67**	-.23
Ab-10	.29	**.65**	-.12
Ab-11	.07	**.54**	.07
Ab-12	.20	**.64**	.04
Ab-13	.08	**.63**	.07
Ab-14	.09	**.74**	-.10
Ab-15	.30	**.52**	.17
Ab-16	.40	**.56**	.08
Ab-17	.24	**.45**	-.03
Ab-18	.43	**.62**	-.11
Ab-19	.28	**.60**	-.12
Ab-20	.28	**.54**	-.04
St-1	-.16	-.19	**.27**
St-2	-.17	-.05	**.30**
St-3	.12	.23	**.45**
St-4	.26	.10	**.55**
St-5	-.06	.17	**.40**

(continued)

Table 5.1 (continued)
Component Loadings for the MMQ Items on Their Respective Scales

Item number	Component 1: Satisfaction	Component 2: Ability	Component 3: Strategy
St-6	.06	-.28	**.47**
St-7	.08	-.13	**.58**
St-8	-.11	-.06	**.64**
St-9	.04	-.12	**.38**
St-10	-.28	-.01	**.41**
St-11	.08	-.06	**.52**
St-12	-.12	-.07	**.53**
St-13	-.11	.04	**.70**
St-14	.15	.14	**.63**
St-15	-.02	.03	**.53**
St-16	-.03	.15	**.39**
St-17	-.05	-.01	**.70**
St-18	-.36	-.15	**.39**
St-19	-.08	-.24	**.64**
Eigenvalue	15.3	3.6	5.4

Note. Sample size *(N)* = 130. The highest component loading for each item is shown in bold. Data are taken from Troyer and Rich (2002).

6

A Review of the Literature

Since its original publication in 2002, the MMQ has been used in a wide variety of studies with clinical and nonclinical populations. Here, we review published research using the MMQ to evaluate program outcomes, to examine the relationship between metamemory and demographic variables, and to explore metamemory in different clinical populations, languages, and cultures.

Measuring Outcomes

MMQ scales have been used to evaluate outcomes in a number of memory intervention studies. These studies reflect a wide variety of methodological approaches (e.g., single case studies, case series designs, randomized controlled trials), participant groups (e.g., individuals with normal cognition, mild cognitive impairment, early dementia, amnesia, acquired brain injury), and clinical interventions (e.g., strategy training, cognitive rehabilitation, smartphone training).

The most consistent finding across studies is an increase in MMQ Strategy scores among individuals participating in some form of memory intervention (Belleville et al., 2017; Fairchild & Scogin, 2010; Hohaus, 2007; Jean et al., 2010; Kinsella et al., 2009; Kinsella et al., 2015; Laforest et al., 2017; Schmitter-Edgecombe, Howard, Pavawalla, Howell, & Rueda, 2012; Stuifbergen et al., 2012; Troyer, Murphy, Anderson, Moscovitch, & Craik, 2008; Unkenstein, Bei, & Bryant, 2017). Strategy scores also increase after participating in psychotherapy for psychogenic amnesia (Cassel & Humphreys, 2016) and intellectual programming (Biermann & Hartman-Stein, 2011). In one study, higher baseline Strategy scores were associated with greater benefit from a memory training protocol in patients with stroke (Stamenova et al., 2017).

The MMQ Satisfaction scale is used less frequently in evaluation studies. When it is used, it is most likely to show increased satisfaction with memory in middle-aged and older adults after participation in a memory program (Biermann & Hartman-Stein, 2011; Fairchild & Scogin, 2010; Hohaus, 2007; Kinsella et al., 2015; O'Connor et al., 2017; Troyer, 2001; Wiegand et al., 2013; Unkenstein et al., 2017).

Improvements in MMQ Ability scores are exhibited most often in interventions utilizing training with smartphones as an external memory device (Ferguson, Friedland, & Woodberry, 2015; Savage & Svoboda, 2012; Svoboda & Richards, 2009; Svoboda, Richards, Leach, & Mertens, 2012). Strategy training programs can also result in increased Ability scores (Fairchild & Scogin, 2010; Kinsella et al., 2015; Konsztowicz, Anton, Crane, Moafmashhadi, & Koski, 2013; Troyer 2001; Unkenstein et al., 2017), although this is not a consistent finding (Hohaus, 2007; Kinsella et al., 2009; Laforest et al., 2017; O'Connor et al., 2017; Regan, Wells, Farrow, O'Halloran, & Workman, 2017; Schmitter-Edgecombe et al., 2008; Stamenova et al., 2014; Troyer et al., 2008; Wiegand et al., 2013).

In addition to these behavioural intervention studies, a neurophysiological intervention (i.e., transcranial direct current stimulation) was shown to produce increased MMQ Ability and Satisfaction scores in one study of patients with MCI (Yun, Song, & Chung, 2016).

Relation to Demographic Variables

In healthy groups, MMQ scores show negligible to small relationships with age, rs = -.23 to .09, education, rs = -.05 to .26, and sex, rs = -.13 to .13 (Fort et al., 2004; Raimo et al., 2016; van der Werf & Vos, 2011).

Ethnicity has been examined in a single study of individuals with diabetes recruited in Austin, Texas (Cuevas & Stuifbergen, 2017). No significant differences in MMQ scores were found between non-

Hispanic white, Hispanic, and African-American subgroups.

Performance in Clinical Populations

The MMQ has been administered to a variety of clinical populations, as summarized subsequently. For those studies reporting MMQ data for both clinical and control groups, we have calculated effect size *d* values, presented in Table 6.1.

Subjective memory complaints. As would be expected, individuals with subjective memory complaints (SMC) obtain lower scores on the Satisfaction and Ability subscales of the MMQ relative to control participants without SMC; they also obtain higher scores on the Strategy subscale, reflecting greater use of memory strategies (Pike et al., 2017; van der Werf, Geurts, & de Werd, 2016). Among individuals with SMC, those seeking medical help for their memory concerns obtained lower Satisfaction and Ability scores than those who did not seek medical help; there were no group differences in Strategy scores (Rotenberg Shpigelman et al., 2017).

Mild cognitive impairment. Individuals with amnestic mild cognitive impairment (MCI) tend to report more memory mistakes on the Ability scale than age-matched controls with normal memory function (Chung & Man, 2009; Kinsella et al., 2015; Lenehan et al., 2012; Parikh et al., 2016). Findings with the Satisfaction scale are mixed, with some studies showing lower scores in MCI relative to controls (Kinsella et al., 2015; Parikh et al., 2016) and others showing no group differences (Chung & Man, 2009; Lenehan et al., 2012). Generally, there are no differences between MCI and control participants in Strategy scores (Hutchens et al., 2012; Kinsella et al., 2015; Lenehan et al., 2012; Parikh et al., 2016).

Cancer treated with chemotherapy. Decreased MMQ Ability scores have been found in breast cancer survivors treated with chemotherapy relative to those not treated with chemotherapy and to healthy controls (Bruno et al., 2012; Kesler, Janelsins et al., 2013; Kesler, Watson et al., 2013; Kesler, Wefel et al., 2013). Ability scores were related to metabolic profile (Kesler, Watson et al., 2013) and default mode network connectivity (Kesler, Wefel et al., 2013) but

not to cytokine levels or hippocampal volumes (Kesler, Janelsins et al., 2013).

MMQ Satisfaction and Strategy scales have not been studied in this group.

Menopausal transition. In a study of 130 middle-aged participants, perimenopausal women obtained lower MMQ Satisfaction and Ability scores relative to pre- and postmenopausal women (Unkenstein, Bryant, Judd, Ong, & Kinsella, 2016). These scores were correlated with self-reported anxiety, depressive, vasomotor, and sleep symptoms, but generally not with objective neuropsychological test scores. There were no group differences in MMQ Strategy scores.

Pain. In a sample of 400 community-dwelling older adults, decreased MMQ Ability scores were found in individuals with severe pain relative to those with mild or moderate pain (Bazargan et al., 2016). MMQ Satisfaction and Strategy scales were not administered in this study.

Sleep disorders. In a sample of 25 adults with primary insomnia, MMQ Satisfaction scores but not Ability or Strategy scores were decreased relative to controls (Fortier-Brochu & Morin, 2014). In a correlational study of 205 adults without sleep disorders, lower MMQ Ability scores were associated with increased daytime sleepiness and poorer self-reported sleep quality (Mellor, Bucks, McGowan, & Waters, 2018).

Temporal lobe epilepsy. In a group of 82 individuals with temporal lobe epilepsy, scores on the MMQ Satisfaction and Ability scales were lower, and scores on the Strategy scale were higher relative to 82 healthy adults (Illman et al., 2015). MMQ scores were not related to subgroup differences such as hemispheric lateralisation, use of anti-epileptic medications, or seizure chronicity.

Diabetes. In a sample of 120 adults with diabetes (Cuevas & Stuifbergen, 2017), MMQ Satisfaction was negatively correlated with blood glucose levels. MMQ Ability was positively correlated with diabetes self-management activities (i.e., diet and exercise) and was a significant predictor of quality of life. MMQ Strategy was not related to any diabetes or quality of life variables.

Mixed clinical groups. In a large mixed clinical sample recruited from an outpatient neurology clinic, patients obtained lower Satisfaction and Ability scores and reported more use of memory strategies on the Strategy scale relative to a matched nonclinical sample (van der Werf & Vos, 2011).

The MMQ Across Languages and Cultures

The MMQ has been translated into a number of languages. Validation studies have been conducted on translations of the MMQ into French (Fort et al., 2004), Spanish (Riffo et al., 2013), Portuguese (Simon et al., 2016), Italian (Raimo et al., 2016), Dutch (van der Werf & Vos, 2011), and Japanese (Ide et al., 2004). In general, these studies have shown good internal reliability and convergent validity, and have replicated a factor structure similar to the original MMQ.

Additional research has used these and other versions of the MMQ in French (Desgagnés-Cyr et al., 2015; Fortier-Brochu & Morin, 2014; Imbeault et al., 2014; Jean et al., 2010; Laforest et al., 2017; Matteau et al., 2011), Dutch (van der Werf et al., 2016), Chinese (Chung & Man, 2009; Li et al., 2016; Man, Chung, & Lee, 2012), and Korean (Chin, Oh, Seo, & Na, 2014; Jeong et al., 2016) with different age and clinical groups. Although cross-cultural studies have not been conducted, an examination of raw data obtained in these studies shows considerable variations in MMQ scores. As such, there is a need for normative data that are specific to language and culture.

Table 6.1
Comparison of MMQ Scores in Clinical Versus Control Groups

Study	Subgroup	*N*	Age	Educ	Satisfaction			Ability			Strategy		
					M	SD	d*	M	SD	d*	M	SD	d*
Subjective memory complaints (SMC)													
Pike et al., 2017	SMC	68	73.8	14.5	40.9	11.3	**-1.07**				34.4	7.6	**0.30**
	Control	126	72.3	14.3	50.6	9.1					31.4	10.1	
van der Werf et al., 2016	SMC	65	51.9		31.8	13.1	**-1.89**	47.0	12.0	**-1.56**	30.2	12.9	**0.64**
	Control	41	52.6		51.8	10.6		59.0	7.7		24.5	8.9	
Mild cognitive impairment (MCI)													
Chung & Man, 2009	MCI	69	79.0		35.2	10.4	**-0.15**	48.1	14.8	**-0.54**	12.3	6.8	**-0.58**
	Control	86	76.8		36.6	9.5		55.0	12.7		17.9	9.6	
Kinsella et al., 2015	aMCI	106	76.1		32.5	11.0	**-1.12**	43.7	11.8	**-0.62**			
	Control	113	72.3		45.6	11.7		49.3	9.0				
Lenehan et al., 2012	aMCI	48	69.6	13.5	41.6	11.7	**-0.43**	45.8	10.4	**-0.58**	33.5	9.6	**0.32**
	naMCI	27	69.7	14.7	44.5	11.2	**-0.17**	48.8	10.3	**-0.28**	34.8	9.1	**0.45**
	Control	64	71.1	13.9	46.4	11.1		51.7	10.2		30.3	10.1	
Parikh et al., 2016	aMCI	14	79.0	15.6	34.3	11.9	**-2.37**	45.2	4.6	**-0.82**	37.5	7.2	**0.24**
	Control	23	72.5	15.3	51.6	7.3		51.1	7.2		35.7	7.4	
Breast cancer (BCA) with chemotherapy (C+)													
Bruno et al., 2012	BCA C+	34	55.2	16.8				44.3	11.3	**-2.13**			
	Control	27	55.1	16.8				59.2	7.0				
Kesler, Janelsins et al., 2013	BCA C+	42	54.6	16.3				42.2	11.2	**-2.31**			
	Control	35	55.5	17.0				59.3	7.4				
Kesler, Watson et al., 2013	BCA C+	19	55.1	17.0				40.8	11.2	**-2.32**			
	Control	17	55.9	16.0				58.2	7.5				
Kesler, Wefel et al., 2013	BCA C+	30	55	17				42	11	**-2.7**			
	BCA C-	27	58	17				58	8	**-0.4**			
	Control	24	56	17				61	7				
Other													
Fortier-Brochu & Morin, 2014	Sleep disorder	25	44.4	16.1	43.7	11.0	**-1.66**	50.3	12.6	**-0.70**	30.2	11.9	**-0.57**
	Control	16	42.8	17.0	54.3	6.4		56.1	8.3		36.9	11.8	
Illman et al., 2015 [a]	Temporal-lobe epilepsy	82	47.0	14.3	22.1	11.8	**-2.07**	34.6	11.0	**-1.29**	44.6	12.8	**1.31**
	Control	82	46.8	14.4	45.1	11.1		48.5	10.8		31.5	10.0	
van der Werf & Vos, 2011	Neurological patients	299	52.1		36.5	14.7	**-1.03**	50.7	14.7	**-0.82**	24.8	12.7	**0.35**
	Control	716	39.9		51.0	14.1		60.1	11.4		21.1	10.6	

Note. Educ = education; SMC = subjective memory complaints; MCI = mild cognitive impairment; aMCI = amnestic MCI; naMCI = nonamnestic MCI; BCA = breast cancer; C+ = chemotherapy; C- = no chemotherapy.

*d = $(M_1 - M_2)/SD_2$ where M_1 is the mean of the clinical sample and M_2 and SD_2 are the mean and standard deviation of the control sample. These scores were calculated from data in the respective publications, and are shown in bold in this table.

[a] Data for Strategy scales were re-calculated from the tables in this publication, where the scales were scored in reverse.

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Appendix A
Scoring Keys

Figure A1. MMQ-Satisfaction

Multifactorial Memory Questionnaire

How I Feel About My Memory

Name: _____ Date: _____

Below are statements about feelings that people may have about their memory. Read each statement and think about your feelings over the past *two weeks*. Then, check the box next to the response that best describes how much you agree or disagree.

1. I am generally pleased with my memory ability.

   4 Strongly Agree   **3** Agree   **2** Undecided   **1** Disagree   **0** Strongly Disagree

2. There is something seriously wrong with my memory.

   0 Strongly Agree   **1** Agree   **2** Undecided   **3** Disagree   **4** Strongly Disagree

3. If something is important, I will probably remember it.

   4 Strongly Agree   **3** Agree   **2** Undecided   **1** Disagree   **0** Strongly Disagree

4. When I forget something, I fear that I may have a serious memory problem, like Alzheimer's disease.

   0 Strongly Agree   **1** Agree   **2** Undecided   **3** Disagree   **4** Strongly Disagree

5. My memory is worse than most other people my age.

   0 Strongly Agree   **1** Agree   **2** Undecided   **3** Disagree   **4** Strongly Disagree

6. I have confidence in my ability to remember things.

   4 Strongly Agree   **3** Agree   **2** Undecided   **1** Disagree   **0** Strongly Disagree

7. I feel unhappy when I think about my memory ability.

   0 Strongly Agree   **1** Agree   **2** Undecided   **3** Disagree   **4** Strongly Disagree

8. I worry that others will notice that my memory is not very good.

   0 Strongly Agree   **1** Agree   **2** Undecided   **3** Disagree   **4** Strongly Disagree

9. When I have trouble remembering something, I'm not too hard on myself.

   4 Strongly Agree   **3** Agree   **2** Undecided   **1** Disagree   **0** Strongly Disagree

Please turn page over to complete the questionnaire.

10. I am concerned about my memory.

0 Strongly Agree   **1** Agree   **2** Undecided   **3** Disagree   **4** Strongly Disagree

11. My memory is really going downhill lately.

0 Strongly Agree   **1** Agree   **2** Undecided   **3** Disagree   **4** Strongly Disagree

12. I am generally satisfied with my memory ability.

4 Strongly Agree   **3** Agree   **2** Undecided   **1** Disagree   **0** Strongly Disagree

13. I don't get upset when I have trouble remembering something.

4 Strongly Agree   **3** Agree   **2** Undecided   **1** Disagree   **0** Strongly Disagree

14. I worry that I will forget something important.

0 Strongly Agree   **1** Agree   **2** Undecided   **3** Disagree   **4** Strongly Disagree

15. I am embarrassed about my memory ability.

0 Strongly Agree   **1** Agree   **2** Undecided   **3** Disagree   **4** Strongly Disagree

16. I get annoyed or irritated with myself when I am forgetful.

0 Strongly Agree   **1** Agree   **2** Undecided   **3** Disagree   **4** Strongly Disagree

17. My memory is good for my age.

4 Strongly Agree   **3** Agree   **2** Undecided   **1** Disagree   **0** Strongly Disagree

18. I worry about my memory ability.

0 Strongly Agree   **1** Agree   **2** Undecided   **3** Disagree   **4** Strongly Disagree

Figure A2. MMQ-Ability

Multifactorial Memory Questionnaire

Memory Mistakes

Name: _____ Date: _____

Below is a list of common memory mistakes that people make. Decide how often you have done each one in the *last two weeks*. Then, check the box next to the appropriate response.

1. Forget to pay a bill on time.

    0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

2. Misplace something you use daily, like your keys or glasses.

    0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

3. Have trouble remembering a telephone number you just looked up.

    0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

4. Not recall the name of someone you just met.

    0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

5. Leave something behind when you meant to bring it with you.

    0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

6. Forget an appointment.

    0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

7. Forget what you were just about to do; for example, walk into a room and forget what you went there to do.

    0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

8. Forget to run an errand.

    0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

9. In conversation, have difficulty coming up with a specific word that you want.

    0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

Please turn page over to complete the questionnaire.

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10. Have trouble remembering details from a newspaper or magazine article you read earlier that day.

        0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

11. Forget to take medication.

        0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

12. Not recall the name of someone you have known for some time.

        0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

13. Forget to pass on a message.

        0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

14. Forget what you were going to say in conversation.

        0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

15. Forget a birthday or anniversary that you used to know well.

        0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

16. Forget a telephone number you use frequently.

        0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

17. Retell a story or joke to the same person because you forgot you already told him or her.

        0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

18. Misplace something that you put away a few days ago.

        0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

19. Forget to buy something you intended to buy.

        0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

20. Forget details about a recent conversation.

        0 All the Time   **1** Often   **2** Sometimes   **3** Rarely   **4** Never

Figure A3. MMQ-Strategy

Multifactorial Memory Questionnaire

Use of Memory Strategies

Name: _____ Date: _____

People often use different tricks or strategies to help them remember things. Several strategies are listed below. Decide how often you used each one in the *last two weeks*. Then, check the box next to the appropriate response.

1. Use a timer or alarm to remind you when to do something.

       4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

2. Ask someone to help you remember something or to remind you to do something.

       4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

3. Create a rhyme out of what you want to remember.

       4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

4. In your mind, create an image of something you want to remember, like a name and face.

       4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

5. Write things on a calendar, such as appointments or things you need to do.

       4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

6. Go through the alphabet one letter at a time to see if it sparks a memory for a name or word.

       4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

7. Organize information you want to remember; for example, organize your grocery list according to food groups.

       4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

8. Say something out loud in order to remember it, such as a phone number you just looked up.

       4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

9. Use a routine to remember important things, like checking that you have your wallet and keys when you leave home.

       4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

Please turn page over to complete the questionnaire.

10. Make a list, such as a grocery list or a list of things to do.

    4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

11. Mentally elaborate on something you want to remember; for example, focus on a lot of the details.

    4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

12. Put something in a prominent place to remind you to do something, like putting your umbrella by the front door so you will remember to take it with you.

    4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

13. Repeat something to yourself at increasingly longer and longer intervals so you will remember it.

    4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

14. Create a story to link together information you want to remember.

    4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

15. Write down in a notebook things that you want to remember.

    4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

16. Create an acronym out of the first letters in a list of things to remember, such as carrots, apples, and bread (cab).

    4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

17. Intentionally concentrate hard on something so that you will remember it.

    4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

18. Write a note or reminder for yourself (other than on a calendar or in a notebook).

    4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

19. Mentally retrace your steps in order to remember something, such as the location of a misplaced item.

    4 All the Time   **3** Often   **2** Sometimes   **1** Rarely   **0** Never

Appendix B
Normative Data

Table B. MMQ Raw Score to *T*-Score Conversion

Raw Score	*T* scores Satisfaction	*T* scores Ability	*T* scores Strategy	Raw Score	*T* scores Satisfaction	*T* scores Ability	*T* scores Strategy
80		78		40	47	42	53
79		77		39	46	41	52
78		76		38	46	40	51
77		75		37	45	39	50
76		74		36	44	39	49
75		73		35	44	38	48
74		72		34	43	37	47
73		72		33	42	36	46
72	70	71		32	41	35	45
71	70	70		31	41	34	44
70	71	69		30	40	33	43
69	69	68		29	39	32	42
68	68	67		28	39	31	41
67	67	66		27	38	31	40
66	66	65		26	37	30	39
65	65	64	>76	25	36	29	38
64	65	64	76	24	35	28	37
63	64	63	74	23	35	27	36
62	63	62	74	22	34	26	35
61	62	61	73	21	33	25	34
60	62	60	72	20	33	24	33
59	61	59	71	19	32	23	32
58	60	58	70	18	31	23	31
57	60	57	69	17	30	22	31
56	59	56	68	16	30	21	30
55	58	56	67	15	29	20	29
54	57	55	66	14	28	<20	28
53	57	54	65	13	28		27
52	56	53	64	12	27		26
51	55	52	63	11	26		25
50	54	51	62	10	25		24
49	54	50	61	9	25		23
48	53	49	60	8	24		22
47	52	48	59	7	23		21
46	52	48	58	6	<23		20
45	51	47	57	5			<20
44	50	46	56	4			
43	49	45	55	3			
42	48	44	55	2			
41	48	43	54	1			
				0			