Short Research Report

Modification of Subjective Cognitive Outcomes in Older Persons Through Memory Training

Immediate Effect and 6-Month Follow-Up

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Abstract. Memory training is one way to achieve improvement in the quality of life and to prolong the independence of older people. Our contribution is a trial with one treatment group (N = 152) which concentrated on the effect of a basic memory training course available nationwide in the Czech Republic. The sample included nondemented, community-dwelling senior citizens. An important feature of the study is the inclusion of significant others who reported their observations. Results show that the training had a positive effect on the self-cognitions of the participants (rating of memory in general and ability to learn new things). The positive effect on memory and self-confidence in one's own abilities was also reported by the significant others.

Keywords: aging, memory training, subjective cognitive outcomes

The relationship between age and cognition has been richly documented since the earliest mental testing of adults (Salthouse, 1996). While no amount of mental activity is sufficient to guarantee against developing dementia or age-related cognitive decline (Valenzuela & Sachdev, 2009), mentally stimulating activities are often enjoyable and may contribute to a higher quality of life (Salthouse, 2006). Multimodal approaches to training that combine memory training with exercise enhancement, pharmacotherapy, lifestyle changes, and other modes of intervention may potentially produce additive, or even synergistic, benefits (Rebok, Carlson, & Langbaum, 2007). Projects focused on cognitive training measure objective and/or subjective outcomes. Objective outcomes mean better results in the trained tasks, near and far transfer tasks. The test reveals performance in certain cognitive abilities at the given point. Subjective outcomes mean data obtained from questionnaires, scales, or interviews relating to metamemory, cognitive self-efficacy. The responses on subjective measures do not necessarily correlate with objective memory performance (Herrmann, 1982; Salmaso, Lucoli, Viola, & Vittori, 1988; Verhaeghen, Marcoen, & Goossens, 1992). Results suggest that the improvement of subjective memory function is best accomplished by addressing both the improvement of skills (mnemonic training) and the development of (more adaptive) attitudes toward memory performance (expectance modification) (Floyd & Scogin, 1997). Subjective measures and the effectiveness of memory training on them have been studied in many projects. Meta-analyses thereof, however, showed overall small effects (Floyd & Scogin, 1997; Wilson, 2005). There is a tendency in normal seniors to underestimate their performance, while people with an initial cognitive impairment tend to overestimate their performance (Wong et al., 2006). Subjective memory measures often used in the studies of cognition are the Cognitive Failures Questionnaire (Broadbent, Cooper, FitzGerald, & Parkes, 1982), the Everyday Memory Questionnaire (Royle & Lincoln, 2008; Sunderland, Harris, & Baddeley, 1983), which include items describing cognitive lapses, or a three-dimensional Metamemory Questionnaire for Older Adults (Troyer & Rich, 2002). These methods were constructed to cover a wide range of cognitive lapses often seen in people with either aging-related or disease-related cognitive impairment (Royle & Lincoln, 2008). Subjective beliefs about one's own memory abilities, or metamemory (Zanardo, De Beni, et al., 1999),
& Moë, 2006), could be seen as a part of aging stereotypes because poor memory in old age is related to common negative stereotypes shared by both the old and the young (Hummer, Garstka, Shaner, & Strahm, 1994). These stereotypes are based on the ever-present observation and personal experience of many generations (Levy, 2003). Nevertheless, older people are able to alter their negative stereotypes (Horton, Baker, Pearce, & Deakin, 2010; Radavsky, Lynchard, & von Hippel, 2008). The findings suggest that self-perceptions of aging have an impact on survival that is greater than the impact of some other variables previously linked to survival, including sex, socio-economic status, functional health, and loneliness (Wurm, Tesch-Römer, & Tomasík, 2007). It is now known that age stereotypes are a significant predictor of health (Wurm et al., 2007). Levy, Hausdorff, Hencke, and Wei (2000) also found that positive aging stereotypes could be used in interventions to reduce cardiovascular stress, and that, on the contrary, negative age stereotypes can hinder self-efficacy. Aging stereotypes thus have become an important research topic (e.g., Bennett & Gaines, 2010; Horton et al., 2010; Hummer et al., 1994; Levy, 2003; Levy et al., 2000; Levy, Slade, Kunkel, & Kasl, 2002). Taylor, Lerner, Sherman, Sage, and McDowell (2003) suggested that self-enhancing cognitions (positive illusions) may enable people to develop and deploy psychological resources, and that they can foster health. Their study sample consisted only of young persons, so their suggestion may not be applicable to older persons. It was also found that subjective memory complaints, present in about one fourth of all healthy older persons (Tobiansky, Blizzard, Livingston, & Mann, 1995), influence coping behavior through memory-related anxiety and perceived seriousness of complaints, and that both memory complaints and coping influence well-being in older adults (Verhaeghen, Geraerts, & Marcoen, 2000).

Significant others are usually involved in assessing patients with cognitive impairment, especially the activities of daily living (see Buurman, van Munster, Korevaar, de Haan, & de Rooij, 2011). Pol, Buurman, de Vos, and de Rooij (2011) showed that there are only insignificant differences in patient-proxy reports on the activities of daily living in patients without cognitive impairment. Foley (2007) found that cognitively impaired older adults tended to rate their memory as being significantly better than the ratings by proxies, which probably results from reduced insight. But her study involved only significant others (SOs) (N=17) of cognitively impaired participants, so that the results could not be controlled by comparing them to proxy-ratings of healthy older persons. Proxy-ratings can be biased by carer strain and depression (DeBettignies, Mahurin, & Pirozzolo, 1990). Nevertheless, proxy reports have been documented to be a reliable and consistent source of information on the cognitive status of dependents (Fischer, Visintainer, & Schulz, 1989; Koss, Patterson, Owby, Stuckey, & Whitehouse, 1993; O’Connor, Pollitt, Brook, & Reiss, 1989). Sitek, Soltan, Wieczorek, Robowski, and Slawek (2011) found that this may not be the case when the impairment is Parkinson’s disease: The patient-proxy consistency was high only for verbal recall assessment, and it was suggested that SOs may not be aware of the specificity of memory impairment.

The aim of our study was to determine a possible modification of subjective cognition evaluation as a part of the aging stereotypes in the elderly after a memory training (MT) course in a large group setting available through a network of certified memory trainers in the Czech Republic, part of a nationwide organization: the Czech Society for Memory Training and Brain Jogging (CSTPMJ). The MT program was not developed for research purposes and is offered publicly as one of the cognitively stimulating and generally activating programs. We were also interested in knowing whether the subjective evaluation correlates with objective outcomes, and whether MT would change the views of SOs.

### Methods

#### Participants

A convenient volunteer sample of 295 community-dwelling older persons was recruited through the media (TV programs for seniors, radio, newspapers) and the University of Free Time in Prague. They were pseudorandomized in experimental and comparison groups (waiting list). The pseudorandomization procedure consisted of two waves of recruitment with the same advertised objective — to recruit volunteers to a memory training research program, while it was not revealed which was an experimental group and what a control group. Only the time schedule was advertised so that volunteers knew beforehand whether their planned program would allow them to take part in the whole protocol (many older people have prescheduled medical examinations and procedures, travel plans, spa stays, or spend months away in their summer houses). For this reason, a regular randomization was not employed as a large dropout rate would have to be expected. Each participant gave written informed consent. The comparison group received the MT program after the follow-up assessment. We used a design of controlled before-and-after study. Of the senior citizens enrolled, 170 completed the entire program. Inclusion criteria were MMSE ≥ 27; performance in cognitive tests higher than 2 SD below the mean; maximum 1 absence in the memory training program (for the experimental group). Eighteen persons were excluded from the final statistical analysis for substandard objective results suggesting a cognitive impairment. Thus, the final statistics included 152 participants (experimental N = 76; comparison N = 76). Baseline data are shown in Table 1. The groups were nonequivalent in some objective measures; this fact was treated by the statistical methods. The groups did not differ in any parameter of subjective cognition scale (SCS, see Instruments).
The intervention program, commonly referred to as Memory Training, the usual term for this format of publically available training program, consisted of 20 45-min lessons in 9 blocks over 5 weeks' time (i.e., 15 h net), realized in a University of Free Time conference hall. We used a large group setting (145 persons finished the full training). Thus, we examined the impact of such a setting, with all participants receiving exactly the same training. The lecturer (DS) was a very experienced person in memory training lecturing who has developed the program since 1994; it was originally based on the ideas and approaches of Arlette Van Assel and of the German Bundesverband Gedächtnistraining e.V. Each session (Stepankova & Steinova, 2009a, 2009b) included mnemonics theory and practice (categorization, method of loci, pegwords, chunking, acrostics, acronyms); theoretical information on brain functioning, aging and neuroscientific findings (history of neuroscience, basic brain anatomy, cognitive processes, lateralization, etc.); various cognitive exercises (visual-spatial, speed of processing, verbal; semantic and episodic memory, reasoning, psychomotor exercises); healthy aging tips (e.g., regarding nutrition, mental effort, social activity, physical exercise, etc.). The participants were exposed to positive primes in relation to aging.

**Instruments**

Besides a structured interview, objective psychological tests (Mini-Mental State Examination; Rey-Auditory Verbal Learning Test; Trail-Making Test; Wechsler Memory Scale – Logical Memory Subtest) and several subjective measures were applied within 2 weeks before (T1) and within 2 weeks after the MT program (T2) and again 6 months later (T3).

We compiled a scale focusing on several subjective cognitive parameters (Subjective Cognition Scale – SCS) that were addressed by the intervention. The items of SCS were rationally derived from the interviews with 11 older participants (age M = 64, SD = 8.8; all women; education M = 14.0, SD = 2.95) of a pilot study as well as from the content of the memory training course. Content validity criterion was decided to be 75% among four memory-expert raters. All items incorporated in SCS reached the threshold (75% your theoretical knowledge of brain functioning; the other items 100%) except for your motivation toward activity in

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**Table 1. Baseline demographic data**

<table>
<thead>
<tr>
<th>Sample characteristic</th>
<th>Experimental group (N = 76)</th>
<th>Control group (N = 76)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Range</td>
</tr>
<tr>
<td>Age</td>
<td>68.6</td>
<td>7.9</td>
<td>54-87</td>
</tr>
<tr>
<td>Years of education</td>
<td>14.8</td>
<td>2.8</td>
<td>8-22</td>
</tr>
<tr>
<td>Under pension</td>
<td>9.6</td>
<td>7.7</td>
<td>0-29</td>
</tr>
<tr>
<td>Mini Mental State Examination</td>
<td>29.4</td>
<td>0.7</td>
<td>27-30</td>
</tr>
<tr>
<td>Sample characteristic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female sex</td>
<td>59</td>
<td>77.6</td>
<td>64</td>
</tr>
<tr>
<td>Married</td>
<td>36</td>
<td>47.4</td>
<td>42</td>
</tr>
<tr>
<td>Employed</td>
<td>20</td>
<td>26.3</td>
<td>21</td>
</tr>
</tbody>
</table>

*Notes:* Differences between groups tested with *t*-test and χ²-test respectively, significant differences marked with *p < .05, **p < .01, ***p < .001.
general, which was included after further discussion on the content of the intervention and its focus. For an assessment of test-retest reliability, young-old (65–75 years of age; mean age 68.8; 6 men; mean education 14.3 years; MMSE 27–30), respondents completed an identical retest questionnaire between 5 and 6 weeks after the original testing. The reliability coefficient was found to be $R = 0.75$ (Spearman rank order correlations), $p < .001$. Content validity of the method—the items clearly relate to the aspects of cognition addressed by the memory training and easily understandable to the respondents (see Table 3). Participants were to evaluate and grade their abilities on a 5-point scale (excellent, quite good, inbetween, quite bad, completely unsatisfactory).

Participants were also asked about their subjective opinion of the personal value/benefit of the MT. They answered on a 5-point scale (definitely no, definitely yes, I do not know, probably yes, definitely yes) to the question "Was the memory training an overall benefit to you?"

In a structured telephone interview, the SOs were asked about the participant's subjective memory complaints and about the value of the training to them: "Do you think his/her memory abilities were normal before the training?" (normal, better than usual at his/her age, worse than usual at his/her age), "Did he/she complain about his/her memory before the training?" (yes, often, sometimes, no, did not complain), "Was the training valuable to the participant?" (probably yes, I do not know, probably no, definitely no). The interviews were conducted after the training (12) and 6 months later (13). The same people were contacted during both the interviews.

### Statistical Analysis

To evaluate the effect of memory training at both a subjective and performance level, we used a mixed-effects model, similarly to that of Willis et al. (2006). The model included only the participants who passed all three test waves ($N = 152$, experimental and control sample). The participant's identity was used as a grouping factor in the model.

The dependent variables of the model were the subjective ratings in Time 1 to Time 3. The independent variables were Time (from 1 to 3) and Group (experimental x control). Their interaction (Time x Group) represented the training effect. The significant interaction effect means that the results of both groups in T2 or T3 differed from the predictions based on the between-group and between-time difference, i.e., we can attribute this difference to the intervention in the experimental group (memory training), which happened after the T1. The confidence intervals of model parameters were calculated using the Markov chain Monte Carlo method (MCMC) in the languageR package.

The relationship between objective performance changes and subjective changes was compared using Pearson correlation coefficient.

The ratings (subjective value, memory/self-confidence improvements) were recoded to numerical scale (-2 to +2) and analyzed using repeated measures ANOVA and t-tests. Changes in proportions were tested using z-test for proportions.

### Results

#### Subjective Cognition Scale

The intervention produced an immediate effect on subjective measures as shown in Table 2. None was retained across 6 months. Yet the effect after 6 months was close to significance in the parameter "Your ability to learn new things" ($p < .1$).

#### Objective Performance and Subjective Measures

The limited changes in cognitive performance after MT have been described elsewhere (Stepankova & Lukavsky, 2009). Table 4 offers a brief overview. The relationship between the changes in cognitive performance after MT (T2–T1 difference) and changes in SCS (T2–T1 difference) was investigated using correlation analysis. Pearson correlation coefficients ranged from −0.15 to +0.19, with only one statistically significant result (reported improvement of self-confidence and Wechsler Memory Scale – abbreviated Logical Memory 2 – delayed, $r = 0.193$, $p < .05$). Therefore we conclude that the bond between the individual cognitive improvements and the subjective perception of these changes is very weak if any.

#### Subjective Value of MT

The vast majority of the participants considered the memory training valuable (Figure 1). For the analysis we recoded the perceived value ratings with values from −2 to +2.

<table>
<thead>
<tr>
<th>Week</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10–27</th>
<th>28</th>
<th>29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td></td>
<td>Test 1</td>
<td></td>
<td>Ex: 5 week intervention (Co: no intervention)</td>
<td></td>
<td>Test 2</td>
<td></td>
<td></td>
<td></td>
<td>Interview 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Test 3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Study protocol - schedule of the assessments
Table 3. Results of subjective cognition evaluation. Interaction effect of training and time from baseline (T1) to posttraining (T2) and from baseline to 6-month follow-up (T3)

<table>
<thead>
<tr>
<th></th>
<th>T1 x T2</th>
<th>95% CI</th>
<th>T1 x T3</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your memory in general</td>
<td>0.064</td>
<td>0.589 **</td>
<td>-0.428</td>
<td>0.149 ns</td>
</tr>
<tr>
<td>Your memory for numbers</td>
<td>-0.080</td>
<td>0.599 ns</td>
<td>-0.263</td>
<td>0.416 ns</td>
</tr>
<tr>
<td>Your memory for faces</td>
<td>-0.030</td>
<td>0.648 ns</td>
<td>-0.294</td>
<td>0.384 ns</td>
</tr>
<tr>
<td>Your memory for names</td>
<td>-0.123</td>
<td>0.523 ns</td>
<td>-0.589</td>
<td>0.055 ns</td>
</tr>
<tr>
<td>Your memory for events</td>
<td>-0.234</td>
<td>0.376 ns</td>
<td>-0.303</td>
<td>0.309 ns</td>
</tr>
<tr>
<td>Your ability to concentrate</td>
<td>-0.169</td>
<td>0.431 ns</td>
<td>-0.347</td>
<td>0.244 ns</td>
</tr>
<tr>
<td>Your theoretical knowledge of brain functioning</td>
<td>0.406</td>
<td>1.057 ***</td>
<td>-0.156</td>
<td>0.504 ns</td>
</tr>
<tr>
<td>Your ability to learn new things</td>
<td>0.185</td>
<td>0.785 **</td>
<td>0.019</td>
<td>0.612 ns</td>
</tr>
<tr>
<td>Your motivation toward activity in general</td>
<td>-0.021</td>
<td>0.549 ns</td>
<td>-0.125</td>
<td>0.451 ns</td>
</tr>
</tbody>
</table>

Note. Significant differences marked with *p < .05, **p < .01, ***p < .001.

Table 4. The training effect in T2 and T3

<table>
<thead>
<tr>
<th></th>
<th>Change in T2</th>
<th>95% CI</th>
<th>Change in T3</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVLT 1–5</td>
<td>-0.404</td>
<td>-0.786</td>
<td>-0.046</td>
<td>*</td>
</tr>
<tr>
<td>AVLT delayed</td>
<td>-0.382</td>
<td>-0.703</td>
<td>-0.031</td>
<td>*</td>
</tr>
<tr>
<td>TMT A</td>
<td>-0.160</td>
<td>-0.514</td>
<td>0.202</td>
<td>ns</td>
</tr>
<tr>
<td>TMT B</td>
<td>-0.302</td>
<td>-0.649</td>
<td>0.054</td>
<td>ns</td>
</tr>
<tr>
<td>WMS S1</td>
<td>0.076</td>
<td>-0.258</td>
<td>0.442</td>
<td>ns</td>
</tr>
<tr>
<td>WMS S2</td>
<td>0.103</td>
<td>-0.265</td>
<td>0.466</td>
<td>ns</td>
</tr>
<tr>
<td>Phone Numbers</td>
<td>-0.017</td>
<td>-0.369</td>
<td>0.350</td>
<td>ns</td>
</tr>
<tr>
<td>Shopping List</td>
<td>-0.092</td>
<td>-0.428</td>
<td>0.289</td>
<td>ns</td>
</tr>
</tbody>
</table>

Notes. The table shows parameter values for interaction effects Group x Wave. Parameter mean, confidence interval a p-value were calculated using MCMC. Significant differences marked with *p < .05, **p < .01, ***p < .001.

Figure 1. Perceived value of memory training by participants and significant others after the training (T2) and after 6 months (T3).

Figure 2. Significant others' reports on perceived MT effect on memory abilities and self-confidence regarding abilities.
The data were analyzed using repeated measures ANOVA (N = 57 for which we had complete data also from SOs) with perceived value as dependent variable and time and group as two independent factors. We found a significant effect of time (F(1, 56) = 5.03, p < .05), but neither group factor (F(1, 56) = 0.28, p = .60) nor the interaction (F(1, 56) = 1.34, p = .25) was significant.

For posthoc tests we used paired t-tests with Holm-Bonferroni correction (Holm, 1979) and found a small significant drop in the participant group between T1 and T3 (t(75) = 3.174, p = .009, Cohen’s d = 0.38). The results showed that initially participants and SOs rated the value of memory training similarly, but later on rated the value lower, while the SOs did not differ from their original ratings.

**Evaluation by Significant Others**

We analyzed the reports of SOs about participants’ memory improvement and self-confidence improvement after the training and 6 months later. Four reports were excluded for negative evaluation of their validity by the trained interviewers. The ratings were recoded to -2 to +2 values and analyzed with paired t-tests (Figure 2). Both memory and self-confidence improvements were rated better than the neutral point of the scale (one sample t-test, t(70) = 3.781, p < .001 for memory; t(70) = 8.475, p < .001 for self-confidence). The memory improvement ratings after 6 months were lower, though the difference was not significant (paired t-test, t(60) = 1.308, p = .196). In self-confidence improvement a significant decrease with time was observed (paired t-test, t(60) = 2.191, p < .05). The results suggest that SOs reported a positive effect of training on memory and self-confidence, and they also reported a decrease of this effect with time at least in self-confidence, which may reflect that the initial self-confidence boost provided with the training decreased in the course of time.

Even with this decrease the self-confidence improvement rating after 6 months was still rated above the neutral point of the scale (one-sample t-test, t(64) = 5.755, p < .001). The memory improvement rating after 6 months was also rated significantly above the neutral point, although the effect was small and could respond a reflection bias (one sample t-test, t(64) = 5.755, p < .05).

SOs rated the overall participants’ memory performance at 6 months before the training mostly as within the norm (65%), 24% rated their performance as better and 11% as worse. Then, 6 months after the training the overall memory performance ratings were similar, with a slight shift toward better ratings (62% within the norm, 32% better, 6% worse), which did not reach significance ($\chi^2$ test; $\chi^2 = 1.912; df = 2; p = .38$).

According to SOs observations, 25% participants reported SMCs before the training and only 6% after the training. Similarly, number of participants with no reported SMCs increased from 34% to 58%. The changes in reported SMCs were significant ($\chi^2 = 12.522; df = 2; p < .01$).

**Discussion**

This study wanted to find about an effect of the publicly available memory training course for older persons, specifically about its effect on subjective self-evaluation and its relationship to objective performance in tests and its effect perceived by SOs.

We found statistically significant changes in the evaluation of several subjective cognitive measures after the memory training. These changes did not correlate with the changes in objective memory performance, which improved only in one of the tests for episodic memory (RAVLT). Both the participants and the SOs perceived the training as valuable. Nevertheless, the SOs were conservative in reporting memory improvements after MT, although they did report more improvements in self-confidence and observed less SMCs.

The important feature of this study was the incorporation of the SOs in the evaluation of the intervention. Despite our effort to find a similar study focused on healthy older people which included also SOs, we did not succeed, which makes us believe our data are unique in that sense.

The answers from both the participants and the SOs reflected an effect on self-confidence expressed either directly or via other subjective measures (self-evaluation of memory, ability to learn new things, motivation). This was particularly clear directly after the training (T2, T2). Later the subjective effect in SCS disappeared, but it remained in the opinion of the SOs. We suggest this is due mainly to the return to stereotypes of the elders as well as to the short-term MT.

Results show that the participants recognized the value of all the theoretical information they received during the training, so that it is useful to provide the information as a part of the MT. We greatly appreciated the positive change in the evaluation of ability to learn new things. It proves that the training positively changes seniors’ attitude toward learning even though their opinion on memory function is not so much improved. It was surprising to see that the detailed parameters of memory ability addressed by the training program and special techniques were not subjectively improved. We suspect this could be due to the size of the group and the lack of the individual work of the lecturer and the students. More promising, however, is the positive effect on memory in the general evaluation.

We are aware of several limitations of our study: The group size and short duration of the MT, participants’ high education level and the question of validity of the SOs reports. We discuss the limitations in more detail below.

The size of the group was a limitation (absence of an individualized approach), but at the same time we see it as a future possibility when considering a large-group setting. Our results suggest that even such a format of training can lead to benefits for the participants. Our program corresponded roughly to a program of introductory MT, after which it is possible to attend various advanced courses.
People who attend a basic memory training course usually do proceed to other courses and attend them for years; such is the experience of the CSTPMJ. In our study we asked participants not to proceed to the other courses in the following 6-month period in order to assess the duration of the effect. Thus, our results are in accord with the findings of Bottiroli, Cavallini, and Vecchi (2008), who concluded that a short-term memory training may not be sufficient as the performance seems to go back to the original level without additional practice.

We suppose that the level of education in our sample could affect the results as well, especially in the pretest and posttest stagnation of the objective measures, where a ceiling effect could play a role. It is our experience from other research projects that mainly highly educated people of all ages are interested in participation regardless of financial or other remuneration, which seems to be a usual phenomenon (e.g., Lezak, Howieson, & Loring, 2004, p. 296; Trant & Koutstaal, 2008). Other studies involving persons on lower education levels should follow to better reflect the real situation regarding the education levels ratio in senior generations. Nevertheless, memory trainers unofficially report to us that their experience in publicly available courses is similar to ours: People of higher education are interested in improving their knowledge and actively try to prevent cognitive decline through participation in the courses. In our opinion this is a point where physicians, geriatricians, psychologists, and other professionals working with senior citizens can play a very important role — by motivating the elders of all education levels to stay active through such training.

In general, the answers of the experimental group and the SOs' reports could be affected by their mere participation in the study. The first was treated by comparing the results of the experimental group with a control group. The SOs' reports may be considered valid for two reasons: They reported slight or no improvements in memory performance, which was in accord with the results of objective measures. Similarly, they reported an increase in self-confidence in abilities, while the most significant subjective effect in participants was observed in the ability to learn new things. Validity of the reports was also assessed by the trained interviewers, who marked any negative personal comments about participants or hesitation in the answers of the SOs; such data were excluded as nonvalid. Moreover, it was shown above that proxy-ratings correlate more than self-ratings with test results (Broadbent et al., 1982). We suggest that including SOs in the studies of memory promoting interventions also with healthy adults may offer researchers the ability to "gain multiple perspectives on the assessed constructs" (Snow, Cook, Lin, Morgan, & Magaziner, 2005), but it may also serve intergenerational solidarity by drawing the attention of the younger generations to those issues and to their elders.

We believe that such interventions are beneficial not only for the participants as the positive effect is mediated to their friends and family members who note the positive change. Our hypothesis is that it may influence their own aging stereotypes in a positive way. These MT participants then may be "the best antidote to negative stereotypes" (Horton et al., 2010, p. 369), affecting others across generations.

If we agree with Floyd and Scogin (1997) that the effects on the subjective aspects of memory are just as important indications of success as objective memory performance change (and are arguably more important), then the public memory training program may be considered effective. We also believe that the subjective positive impact of MT would last if participants were to continue with booster training programs.

Conclusions

Successful and active aging is one of the goals of modern society. One of the topics related to this is prevention of cognitive disorders, along with promotion of health and aspects of active aging. Preventive strategies include various types of cognitively stimulating programs such as memory training. These programs are aimed at building cognitive reserves, new cognitive strategies, and metacognition; they also present an opportunity for social contact and stimulation. Despite limited real objective results (measured by neuropsychological tests), the most valuable effects are the subjective outcomes. Memory training combined with a motivational element can positively influence self-evaluation of one's abilities and memory function and might favorably shift self-stereotypes of aging. This positive effect can be observed by others and might lead to a shift in their attitudes toward the person. Such positive changes may have a positive impact on the health of the senior population. Similar cognitive training should be accessible to the elderly for an overall activating effect. Another potential benefit that needs to be studied is a positive shift in aging stereotypes and motivation to cognitive training in younger close persons due to the observed positive change in aging autostereotypes of the senior participants. We conclude that the publicly available MT in the Czech Republic is beneficial to senior participants as it positively modifies their self-cognitions, is clearly observable by their SOs — and this effect is present even in a cost-effective large-group setting.

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Declaration of Conflicts of Interest

The authors declare that no conflicts of interest exist.

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