

The Estonian Mindful Attention Awareness Scale: Assessing Mindfulness Without a Distinct Linguistic Present Tense

Riin Seema · Jordan T. Quaglia · Kirk Warren Brown ·
Anna Sircova · Kenn Konstabel · Arno Baltin

Published online: 26 June 2014
© Springer Science+Business Media New York 2014

Abstract The paucity of mindfulness-based interventions and research in Estonia motivated the development of an Estonian Mindful Attention Awareness Scale (MAAS). Unlike most languages, the Estonian language lacks a distinctive present tense. This provides a potential challenge for assessing mindfulness, a psychological construct characterized by present-moment awareness. We outline the process of overcoming linguistic differences during translation. The Estonian MAAS showed a single-factor structure and strong internal consistency. A cross-cultural comparison showed factorial invariance between the Estonian and the original scale. In an Estonian adult student sample, MAAS scores were invariant across genders and education levels, positively related to subjective well-being and self-esteem and inversely related to public self-consciousness and social anxiety. Item response theory analyses (IRT) revealed seven items of the Estonian version carrying most of the information load. We discuss how translating the MAAS into a unique linguistic context could inform an understanding of mindfulness itself.

Keywords Mindfulness · Mindful Attention Awareness Scale · Estonian MAAS · Psychometrics · Item response theory

R. Seema (✉) · A. Baltin
Tallinn University, Narva mnt 25, Tallinn 10120, Estonia
e-mail: riin@smail.ee

J. T. Quaglia · K. W. Brown
Virginia Commonwealth University, Richmond, VA 23284, USA

A. Sircova
Umea University, Umea 901 87, Sweden

K. Konstabel
National Institute for Health Development, Hiiu 42, 11619 Tallinn,
Estonia

Introduction

The term *mindfulness* has been variously translated, though a majority of conceptualizations converge on the primacy of present-centered attention and awareness (see Quaglia et al. 2014 for review). Several researchers argue that mindfulness is an inherent human capacity or disposition, not just a product of practice (Brown and Ryan 2003; Kabat-Zinn 2003). From this perspective, the topic is suitable for study in the general population, and a variety of self-report measures of dispositional mindfulness have been developed for this purpose. Mindfulness is a highly nuanced concept not captured in its fullness by any of these self-report instruments. Arguably, however, any effective measure of basic mindfulness must assess the frequency with which attention and awareness are oriented to the present moment.

To date, assessment of mindfulness has been carried out in numerous languages, suggesting that the meaning of the construct can be mediated through a careful choice of words. For example, the Mindful Attention Awareness Scale (MAAS; Brown and Ryan 2003) has been previously translated into Chinese (Black et al. 2012; Deng et al. 2012), German (Michalak et al. 2008), Spanish (Soler et al. 2012), and Swedish (Hansen et al. 2009), among others. Mindfulness has been theorized to be pre- or para-conceptual in nature (Brown et al. 2007) and therefore should not depend on particular linguistic characterizations. Yet, the Estonian language presents interesting linguistic challenges for measuring mindfulness—challenges that relate to its very definition as present-oriented attention and awareness. Not only does Estonian have no term for “mindfulness,” the language also lacks a distinct tense for describing present-moment occurrences. More specifically, Estonian differs from English (and most other languages) in that it does not differentiate grammatical expressions of future tense (e.g., “I will do”) from the

present continuous tense (e.g., “I am doing”) or the present simple (e.g., “I do”).

While one other European language into which the MAAS has been translated (German) also lacks a distinctive present tense, Estonian and Finnish are the only European languages that lack *any* distinct grammatical marking for future events (Chen 2013). Such small differences in language are nontrivial. Linguistic relativity, popularly known as the Sapir–Whorf hypothesis, refers to the proposition that the particular structure of a given language exerts a causal influence on the way speakers perceive and conceptualize their world (Kay and Kempton 1984). Linguistic relativity differs from more general cultural relativity in that the former refers how differences in language structure per se, rather than other historically transmitted differences, may lead to distinct patterns of thought and behavior (Lucy 1997). A primary structural difference important to linguistic relativity concerns temporal representation (Lucy 1997). Research has demonstrated that differences in the temporal structure of language predict real-world, future-oriented behavior, such as saving money, smoking, and obesity (Chen 2013). Specific to the distinct characteristics of Estonian, lack of a distinct present tense (from future tense) tends to increase future-oriented behavior, since present and future are more psychologically associated (Chen 2013). In contrast to Estonian, the English language strongly dissociates present and future tenses.

Is it possible to assess mindfulness, as present-oriented attention and awareness, in a language without a distinct present tense? Even if correctly translated, would the construct hold the same meaning? Fortunately, by design, the MAAS does not rely heavily on terms describing mindfulness per se, but rather assesses mindfulness indirectly, through recognition of its absence (i.e., the frequency for which individuals’ attention and awareness is not oriented toward the present moment). In Estonia, people do have such ideas colloquially (e.g., being on “automatic pilot”), suggesting that the measurement approach of the MAAS may be well-suited for adaptation into the Estonian language. An Estonian translation of the MAAS would enable important cross-cultural research with this distinctive linguistic and cultural population.

The present study addresses the adaptation, development, and validation of an Estonian MAAS, while also highlighting the unique challenges of expressing the same meaning as the original scale items in the Estonian language. Our goal was to determine whether a basic expression of the mindfulness construct, as measured by the MAAS, can be adequately assessed in the Estonian language and whether the MAAS shows cross-cultural equivalence on factor structure and key indices of reliability and validity. Specifically, we first assessed the psychometric properties of the translated scale

in an Estonian adult sample and then tested the factorial invariance of the Estonian MAAS with the English-language MAAS by comparing item- and factor-level behavior in age- and sex-matched Estonian and American student and community samples. We also examined whether MAAS scores differed between educational groups and across genders. Higher MAAS scores in college student and community adult samples have been found to relate to a large number of mental health indicators, including higher self-esteem and psychological well-being, lower social anxiety, and lower public self-consciousness (Brown and Ryan 2003), and the present study provided an initial assessment of the validity of the Estonian translation using these criterion variables. Finally, we conducted an item response theory (IRT) analysis to disclose the most informative items on the scale and compared these results to those identified in an IRT analysis of the English-language MAAS (Van Dam et al. 2010).

Method

Participants

Participants were 703 students from different cities in Estonia of whom 376 (53.5 %) were acquiring baccalaureate-level higher education, 221 (31.4 %) professional higher education (e.g., legal assistant), and 95 (13.5 %) vocational education (e.g., secretary); 11 persons (1.6 %) did not report their educational level. Most of the participants (75 %) were female, and their ages ranged from 18 to 54 years ($M=24$ years, $SD=6.55$).

The majority ($n=652$) of participants completed the survey online via eformular.com, an Estonian online questionnaire interface that allows participant recruitment via email or websites and which stores participant responses anonymously in a secure, password-protected online database. University and professional school administrators were initially contacted about the survey, and those interested then sent links to students through official institutional email, which outlined the procedure and goals for the data collection through eformular.com. Contacted in a similar way, 51 additional participants completed paper-and-pencil measures. This study took place as a part of a larger project that included additional measures.

Procedure

Addressing Translation Challenges The MAAS was translated into Estonian by four philologists and two authors of the current article (R. S., A. B.). Two independent philologists then translated the Estonian version back to English. Two experts from this group (plus an additional, independent

scholar) met to compare the translations, back-translations, and the original MAAS to further adapt the scale. Finally, the Estonian version of the scale was reviewed by an independent Estonian philologist.

There is considerable variability in the linguistic structure of the items on the original MAAS. Therefore, different translation approaches were needed to convey the same meaning in Estonian, depending on the item. Because Estonian lacks a distinctive present tense, there was no possibility of word-for-word translation. Instead, translators used adverbs, word order, and related strategies to retain each item's original meaning, especially for those items which required reference to the present moment. To this end, several scale items (2, 4, 8, 11, 14, 15) were translated into Estonian using gerund, an infinitive form applied to the ends of words (e.g., *des*) to denote when two actions (verbs) are taking place simultaneously. In contrast, the negative equivalent of the *des*-form is the *mata* form which refers to the unperformed action (Erelt et al. 2006). For example, the item "I rush through activities without being really attentive to them" was translated as "*Ma teen asju kiirustades, pööramata tegevustele erilist tähelepanu.*" Here, one is both rushing and participating in activities (*des*), but not really being attentive during them (*mata*). Translated items and back-translations are presented in Table 1.

Pilot Studies Using field-testing and interviews, adapters are required to guarantee that the language used in the adapted tests is appropriate both linguistically and psychologically for the intended population (Hambleton 2004). For this reason, three sequential pilot studies were conducted featuring a sample of 117 adult students ($N_s=32, 42, \text{ and } 43$; 87.2 % female; $M\text{ age}=23.03, SD=5.2$). Two of these studies were conducted among professional higher education and vocational education students, while the third study was carried out with master-level psychology students. In addition to completing the scale, respondents provided written feedback on the comprehensibility of the items and their linguistic correctness. Group and individual interviews were also conducted to address these points, with a particular focus on items that linguists had translated in unique ways. Respondents' feedback informed modifications after every pilot study, based on both qualitative and quantitative data (including comparisons of factor analysis results).

Final Modifications Following Pilot Studies The original scaling (1 *almost always* to 6 *almost never*) was unfamiliar to respondents, so the scale of the adapted version was reversed (6 *almost always* to 1 *almost never*) such that higher numbers indicate more frequent behavior. Thus, all items were reverse scored before calculating the mean score to permit comparability to the original scale. Additionally, the expression "I drive places" from the original item 12 was replaced with the translation for "I go to places" because driving is not

common among Estonian students. A similar modification was made in the Swedish MAAS (Hansen et al. 2009). In the adapted MAAS, Estonian common phrases were used to reflect the meaning of each original item in a way that was familiar and meaningful to Estonian respondents.

Measures Validated self-report measures that have been translated into Estonian are comparatively few. Despite this limitation, we were able to select measures previously used to demonstrate discriminant and criterion (including concurrent) validity (Brown and Ryan 2003). Specifically, we selected measures that tap discrete, important domains of intrapersonal and interpersonal well-being, including self-esteem, subjective well-being, social anxiety, and both public and private self-consciousness. Parallel to findings for the original MAAS (Brown and Ryan 2003), we expected that the Estonian MAAS would be unrelated to private self-consciousness (discriminant validity) and relate to higher self-esteem and psychological well-being and lower social anxiety and public self-consciousness (concurrent validity).

Mindfulness. The adapted, 15-item MAAS trait mindfulness measure (see Table 1) assessed the absence of mindful attention in various circumstances (Brown and Ryan 2003; cf., Baer et al. 2004). The original internal consistencies across samples were >0.80 (Brown and Ryan 2003). Those authors argued that statements reflecting mindlessness are more accessible to people untrained in mindfulness, given that mindless states are much more common than mindful states (e.g., Varela et al. 1991). Brown and Ryan (2003) showed that the MAAS correlated highly with a directly worded version of the scale ($r=0.70$).

Self-esteem. The 10-item Estonian Rosenberg Self-Esteem Scale (ERSSES; Pullmann and Allik 2000) measured self-esteem (overall evaluation of one's worth or value; Rosenberg 1965; $\alpha=0.92$) on a 5-point scale ranging (*strongly disagree* to *strongly agree*). A sample item is "I take a positive attitude toward myself." The internal consistency was high in this sample, $\alpha=0.89$.

Psychological well-being. The WHO-Five Well-being Index (WHO-5; Sisask et al. 2008; $\alpha=0.93$) measured positive mood, vitality, and interest in activities with five statements on a six-point scale (*never* to *always*). Higher values indicate higher psychological well-being (sample $\alpha=0.82$). A sample item is "I have felt cheerful and in good spirits."

Self-consciousness. The 26-item Estonian Self-Consciousness Scale (ENTESK), adapted into Estonian from the original (Fenigstein et al. 1975; $\alpha=0.80$) by Realo and Allik (1998), includes three subscales, each using a five-point Likert scale (*wrong* to *right*). The private self-consciousness subscale (10 items) measured the tendency to reflect on and attend to one's inner thoughts, feelings, and motives (sample $\alpha=0.79$; example item, "I am always trying to figure myself out."). The public self-consciousness subscale (eight items) measured awareness of self as a social and public object

Table 1 Estonian MAAS, back-translation, means, standard deviations, and results from EFA, CFA, and IRT analysis

Items and back-translations	M	SD	F	ZF	I	TI %
1. <i>Võin olla haaratud mingist emotsioonist nii, et ma ei teadvusta seda kohe, vaid alles mõne aja pärast.</i> I could be caught up in some emotion and not be conscious of it until some time later.	4.4	1.2	0.54	0.47	3.3	4.90
2. <i>Lõhun või pillan asju hooletusest, tähelepanematuses või mõeldes millelegi muule.</i> I break or spill things because of carelessness, not paying attention, or thinking of something else.	4.7	1.1	0.47	0.45	2.5	3.63
3. <i>Mul on raske tähelepanelikult keskenduda käesoleval hetkel toimuvale sündmusele. It is difficult for me to stay focused on what's happening in the present.</i>	4.3	1.0	0.64	0.59	4.7	6.81
4. <i>Kõndides kiiresti sihtkoha poole, ei pööra ma tähelepanu sellele, mida minnes kogen.</i> I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	4.0	1.2	0.44	0.38	2.3	3.40
5. <i>Ma ei märka kehalisi pingeid ja ebamugavustunnet enne, kui need on muutunud tõesti tugevaks.</i> I do not notice feelings of physical tension or discomfort until they become really strong.	4.3	1.3	0.46	0.28	1.8	2.71
6. <i>Unustan inimese nime peaaegu samal hetkel, kui seda mulle esimest korda öeldakse.</i> I forget a person's name almost as soon as I've been told it for the first time.	4.0	1.5	0.35	0.41	1.8	2.63
7. <i>Tundub nagu tegutseksin automaatselt, oma tegevusest suurema teadlikkusega. It seems I am "running on automatic," without much awareness of what I'm doing.</i>	4.3	1.1	0.71	0.63	5.7	8.41
8. <i>Ma teen asju kiirustades, pööramata tegevustele erilist tähelepanu. I rush through activities without being really attentive to them.</i>	4.5	1.1	0.81	0.74	10.1	14.80
9. <i>Mõtlen eesmärgi saavutamisest sedavõrd, et ei keskendu sellele, mida eesmärgile jõudmiseks parasjagu teen. I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.</i>	4.6	1.0	0.65	0.64	5.6	8.21
10. <i>Teen oma töid ja tegevusi automaatselt, ilma et ma sel hetkel teadvustaksin, mida ma teen. I do jobs or tasks automatically, without being aware of what I'm doing.</i>	4.6	1.0	0.74	0.76	8.5	12.43
11. <i>Kuulates kedagi "poole kõrvaga", teen samal ajal ka midagi muud.</i> While listening to someone with one ear, I am doing something else at the same time.	3.6	1.1	0.47	0.36	2.6	3.80
12. <i>Ma liigun nagu autopiloodiga ja siis imestan, et miks ma olen teatud kohta välja jõudnud. I move places on "automatic pilot" and then wonder why I went there.</i>	4.7	1.2	0.71	0.66	5.7	8.35
13. <i>Ma vajun nii sügavalt mõttesse tuleviku või mineviku üle, et ei märka enda ümber toimuvat.</i> I get buried so deep in thought about the past or future, that I do not notice what is happening around me.	4.5	1.0	0.59	0.56	3.2	4.67
14. <i>Teen asju, neisse tähelepanelikult süvenemata. I do things without paying attention to them.</i>	4.6	1.0	0.72	0.65	6.8	9.98
15. <i>Toitu näksides ma ei märka, mida ma süüa või mis maitse sel on.</i> I snack without noticing what I am eating or how it tastes.	4.6	1.0	0.61	0.49	3.6	5.27

MAAS scale means (*M*), standard deviations (*SD*), EFA factor loadings (*F*), CFA standardized factor loadings (*ZF*), item information (*I*), and total information of trait estimates (*TI*%) from item response theory analysis. The seven items in bold represent two thirds of the total information of the scale as revealed by IRT

(sample $\alpha=0.82$; sample item, "I often think of the other's opinions about me."). The social anxiety subscale (eight items) reflected discomfort in the presence of others (sample $\alpha=0.85$; sample item, "I would rather avoid large groups.").

Data Analysis

Factorial Structure of the Estonian MAAS

Exploratory factor analysis (EFA) was first performed using SPSS, using the maximum-likelihood method, with half of the sample selected randomly ($n=349$). To determine the number of factors to extract, both the eigenvalues and scree plot were analyzed. Three eigenvalues above 1.0 were found, but showed a large gap between the first and the remaining factors. The scree plot indicated a clear "elbow" between factors 1 and 2, and thus a one-factor solution was applied (cf. Brown and Ryan 2003). The extracted factor accounted for 37.4 % of the total variance. All 15 items had factor loadings over 0.35, and factor loadings over 0.50 were found

for nine items (see Table 1). The Kaiser–Meyer–Olkin value was 0.89, which indicated the sample was adequate for factor analysis. Bartlett's test of sphericity was significant, $\chi^2(1,748)=105, p<.001$, again indicating that factor analysis was appropriate for this data.

Confirmatory factor analysis (CFA) was used to confirm the fit of the one-factor solution revealed by EFA. CFA was performed on the second half of the sample ($n=352$) using maximum likelihood estimation with robust standard errors. Five error covariances were added to the model, between items 1 and 15, items 1 and 5, items 10 and 13, items 2 and 13, and items 8 and 10. The content overlap in the items may have generated these error covariances. The model fit statistics showed Satorra–Bentler $\chi^2(85)=186.6$; $\chi^2/(df)=2.20$; CFI=.92; and root-mean-square error of approximation (RMSEA)=0.058. For comparative fit index (CFI) and RMSEA, Hu and Bentler (1999) have suggested that values close to 0.95 and 0.06, respectively, indicate good fit. Together, these results indicated a good-to-acceptable fit. The item-by-item standardized factor loadings (*ZF*) revealed by CFA are shown in Table 1.

Cross-Cultural Comparison of the Estonian and English MAAS

To test the factorial invariance of the Estonian MAAS with the original English language version, CFA with maximum likelihood estimation was performed in AMOS 18 (Arbuckle 2009) using the procedures described by Byrne (2001). For this analysis, a subsample of the Estonian sample, matched one-to-one on gender and age with an American student and community sample, was used ($n_s=228$; 85.1 % female; M age=23.79, $SD=8.00$).

Table 2, model 1 shows that a single factor, two-group model with no constraints provided a satisfactory fit to the data. Based on comparison with a model with constrained factor variance and loadings (model 2), no group differences in factor variance nor in factor loadings (with only one exception) were found across groups. The single difference in factor loading was on item 8; however, in both cultural groups, the standardized loading was high (0.76 and 0.63 in Estonian and US samples, respectively). In each sample, all items loaded on the latent MAAS variable ($p<0.001$). The analysis showed that the factor structures of the Estonian and English MAAS scales are similar.

Internal Consistency, Demographic Group Differences, and Test–Retest Reliability

For the total sample ($n=652$), the mean score of the MAAS in this sample was 4.0 ($SD=0.7$), with item skewness ($M=-0.38$; $SD=0.09$) and kurtosis ($M=0.38$; $SD=0.18$) values in acceptable ranges. In this sample, the full-scale internal consistency (Cronbach’s alpha) was 0.86. One-way ANOVAs showed no significant differences in mean MAAS scores according to education level or gender ($p>0.05$). The test–retest reliability of the Estonian MAAS was assessed with 40 students over a 2-week period. The Pearson correlation was 0.68, $p<0.01$.

Discriminant and Concurrent Validity

The correlations between the MAAS with the WHO-Five Well-being Index, the Estonian Rosenberg Self-Esteem

Table 2 MAAS factorial invariance model results across Estonian and American samples

Model	χ^2	p	CFI	RMSEA	$\Delta\chi^2$
Unconstrained	265.17	<0.01	0.95	0.035	
Constrained factor variance and loadings ^a	289.88	<0.01	0.95	0.035	24.71, ns

$n_s=228$ per sample. $\Delta\chi^2$ is the difference between models 1 and 2, $df=17$

MAAS Mindful Attention Awareness Scale, CFI comparative fit index, RMSEA root-mean-square error of approximation

^aNo invariance constraint on MAAS item 8

Table 3 Pearson correlations between the MAAS and other scales

	MAAS	Private SC	Public SC	SA	WHO-5
ENTESK private SC	-0.07	–	–	–	–
ENTESK public SC	-0.21*	0.33*	–	–	–
ENTESK SA	-0.23*	0.12*	0.32*	–	–
WHO-5 well-being	0.27*	-0.00	-0.18*	-0.44*	–
RSES self-esteem	0.34*	-0.02	-0.25*	-0.49*	0.57*

$N=568$

MAAS Mindful Attention Awareness Scale, ENTESK Estonian Self-Consciousness Scale, Private SC private self-consciousness, Public SC public self-consciousness, SA social anxiety, WHO-5 WHO-Five Well-being Index, RSES Estonian Rosenberg Self-Esteem Scale

* $p<0.01$

Scale, and Estonian Self-Consciousness Scale are shown in Table 3. The Estonian MAAS was positively related to well-being (0.27, $p<0.01$) and self-esteem (0.34, $p<0.01$) and inversely related to public self-consciousness (-0.21, $p<0.01$) and social anxiety (-0.23, $p<0.01$). As expected, the adapted scale did not correlate with private self-consciousness (-0.07, $p>0.05$).

Item Response Theory Analyses

So far only one study has applied item response theory (IRT) analysis to the MAAS (Van Dam et al. 2010). The aims of the current analysis were to first identify the information value of the items (Embretson and Reise 2000; Ellis and Mead 2002) and, most importantly for this validation effort, to further

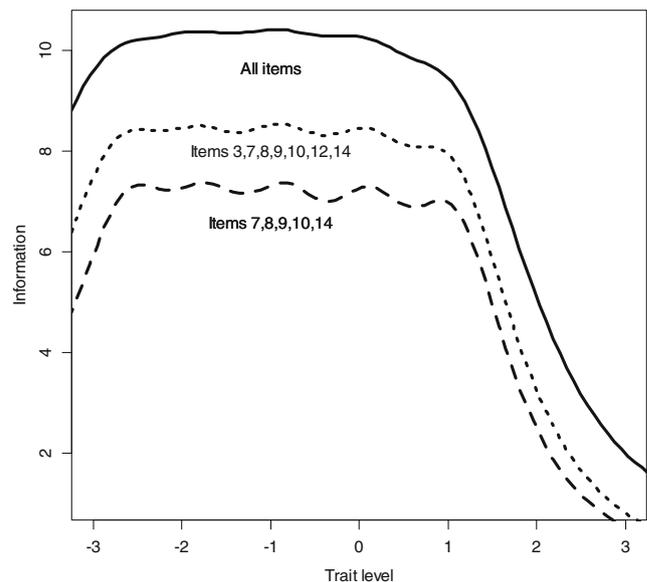


Fig. 1 Total information for the Estonian MAAS and item subsets (see text) across trait estimates as derived from item response theory analysis

determine if the MAAS scale is suitable for adult Estonians without mindfulness training.

For IRT analyses, R version 2.12.1 (R Development Core Team 2010) and the add-on package ltm (Rizopoulos 2006) were used. As suggested by Hambleton et al. (1991), we first computed trait estimates separately for odd and even items to estimate the assumption of trait invariance. The correlation between independent trait estimates was $r=0.79$, $p<0.001$, and is consistent with the assumption of trait invariance.

Results from the IRT analysis, including the amount of information of each item (I) and each item's relation to the total scale information (TI), are presented in Table 1. There is no recognized cutoff for acceptable total scale information, but it is worth comparing the item set comprising the 2/3 total scale information criterion used by Van Dam et al. (2010). In this sample, seven items of the scale (3, 7, 8, 9, 10, 12, 14) provided 2/3 of the total scale information, compared to Van Dam et al.'s (2010) five items. This comparison, as well as the total information for the full Estonian MAAS, is shown with item information curves in Fig. 1. At the high trait level, there is a sharp decline in information function approximately $\theta=1$ standard deviations above the mean. At the low trait level, the decline starts at -2.5 standard deviations below the mean, suggesting that the Estonian MAAS better captures variance in scale scores at the lower end of the six-point Likert scale.

Discussion

This article described the development of an Estonian language measure of basic mindfulness (MAAS) and provided initial evidence for its reliability and validity. The Estonian language lacks a distinct present tense, which presents challenges to translating a measure of mindfulness, a construct for which present-moment attention and awareness is fundamental. At the time of the study, the concept of mindfulness was unfamiliar in Estonia, and the Estonian language does not have a word for mindfulness. The MAAS items were translated by four philologists and two of the present authors. Various translation possibilities motivated multiple rounds of revision, including two independent back-translations into English for comparison. The final Estonian version of the scale was reviewed by an independent Estonian philologist. Multiple versions of the scale were thoroughly piloted to carefully adapt the scale. The factorial structure and item loadings were also subjected to a cross-cultural comparison and provided evidence that the adapted scale measures the same construct—the frequency of being present—as the original English version.

The specific linguistic challenges for translating the MAAS into Estonian concerned the lack of distinct grammatical marking for present events. Together with expert philologists,

this challenge was addressed by exploiting other devices from the Estonian language to convey each item's meaning. The nature of the MAAS, which intentionally assesses mindfulness through items about its absence, enabled adaptation of the scale into Estonian, since Estonians do colloquially possess ideas about the absence of present-oriented attention and awareness (e.g., doing tasks automatically).

Central to the present investigation were questions of whether the MAAS would retain its original meaning, as reflected in the factor structure, internal consistency, and relations to similar criteria across discrete domains of intra- and inter-personal well-being. We found that, as in the original English-speaking validation population, the Estonian MAAS showed a strong single-factor structure. The amount of variance explained by this factor (37.4 %) was similar to that found for both the French (Jermann et al. 2009) and Spanish (Soler et al. 2012) MAAS validation studies (33.3 and 42.8 %, respectively). The adapted MAAS showed strong internal consistency in the Estonian sample and a high level of factorial invariance with the English-language version of the scale, based on cross-cultural analyses.

Parallel to findings for the original MAAS (Brown and Ryan 2003) and other translations of the scale (Deng et al. 2012; Catak 2012; Jermann et al. 2009), no gender differences in scale scores were found. The present study also found no differences in scale scores among adult students at several levels of education, suggesting that the Estonian MAAS may be used among a variety of adult normative populations. Supporting the discriminant validity of the scale, the Estonian MAAS did not correlate with private self-consciousness. This result is consistent with the Brown and Ryan (2003) results, and Brown et al. (2007) suggest that while private self-consciousness concerns the application of attention to thinking about of the self, mindfulness involves observation of sensory and psychological aspects of personal experience broadly, rather than centrally concerning thoughts about the self.

Supporting the criterion validity of the scale, higher scores on the Estonian MAAS were related to several key indexes of psychological well-being, namely higher self-esteem and psychological well-being, lower social anxiety, and lower public self-consciousness. These subjective well-being indicators have similarly been used to assess the validity of the MAAS in other translations of the MAAS, such as the Turkish (Catak 2012) and Greek versions (Mantzios et al. 2013). The variables associated with mindfulness in the present study represent important domains of personal and interpersonal well-being. These results, though preliminary, support the application of self-reported mindfulness for basic and applied (e.g., clinical) research in Estonia. For example, a recent study found that the Estonian MAAS was related to a number of well-being indicators in a clinical sample (Seema and Sircova 2013).

Finally, an IRT analysis revealed that items capturing the most variability in the Estonian MAAS were somewhat comparable to those identified for the English-language MAAS (Van Dam et al. 2010). IRT analysis helps to specify a relation between ability and examinee's response, and in this study, as with Van Dam et al. (2010), the Estonian MAAS was better at distinguishing between lower levels of mindfulness than distinguishing between respondents scoring at the very high end of the scale. However, the test information function decline started at different points in the present study than in the Van Dam et al.'s (2010) study: +1 standard deviations in this study versus +1.5 in Van Dam et al.'s American sample and -2.5 SD in this study versus -2 in Van Dam et al.'s study. This means that in this Estonian sample, the MAAS best differentiated between respondents scoring between -2.5 and +1 standard deviations from the mean. Perhaps those higher in mindfulness are able to notice their mind wandering more often, resulting in greater measurement error for distinguishing those high (> +1 SD) in mindfulness. Our results also correspond with Van Dam et al.'s (2010) finding that items with general wordings seemed to measure trait mindfulness better than those involving specific situations. Nonetheless, the original MAAS was designed for respondents without training in mindfulness, and the present study in Estonian adult students without mindfulness meditation experience further demonstrated that the scale is suitable for measuring mindfulness in such a population.

Toward Cross-Cultural Investigations of Mindfulness

As evident in the large number of adaptations of the MAAS, the scale has been readily translated into other languages since its introduction. We believe these translations also reflect, at least in part, the cross-cultural relevance of mindfulness. The present study corroborates this idea, demonstrating that mindfulness can be assessed in a language that lacks a word for mindfulness, has yet to adopt mindfulness-based interventions, and perhaps most interestingly, does not possess a distinctive tense for describing what is happening here and now. These findings are consistent with an understanding that mindfulness is pre- or para-conceptual (Brown et al. 2007) and not necessitating a particular linguistic characterization to be assessed psychometrically and associated with indicators of psychological well-being that are consistent with mindfulness theory. However, it is noteworthy that the test-retest of the Estonian MAAS over a two-week period was lower (0.68) than the original version (0.81 for original MAAS; Brown and Ryan 2003). One possible explanation for this is that only 40 participants were assessed across both time points in our study. Another explanation pertains to Estonia's unique grammar of time. The test-retest scores for languages similar to English have been high: 0.82 (Soler et al. 2012) and 0.90

(Cebolla et al. 2013) for the Spanish versions; 0.83 for the Turkish version by Catak (2012); and 0.97 (Mantzios et al. 2013) for the Greek version. However, test-retest scores for another language without a distinctive present tense, namely Chinese, were 0.54 (Deng et al. 2012) and between 0.35 and 0.52 (Black et al. 2012). Thus, although the test-retest scores could indeed reflect issues with the reliability of the translation, these test-retest scores may also represent a unique challenge for assessing mindfulness in languages with markedly different tenses.

As both Estonian and Chinese languages have unique grammar of time that does not differentiate present continuous tense (e.g., "I am doing"), from the future tense (e.g., "I will do") or the present simple (e.g., "I do"), low test-retest scores may reflect the tendency for Estonian and Chinese respondents to turn their attention more to their current state, while reading some of the scale items, than respondents in languages that more clearly distinguish between present and future tenses. More research is needed to compare the temporal stability of the scale across languages with and without distinct present tenses. As evident in the variety of theoretical issues explored in the present study, further adapting measures of mindfulness for use across a wide variety of cultures and languages might inform conceptualizations of mindfulness.

Limitations and Suggestions for Further Research

Our findings offer foundational support for using the Estonian MAAS in empirical research, but our initial assessment of the reliability, validity, and cross-cultural relevance of the MAAS had several limitations. The study was cross-sectional in design, and future research should test whether the Estonian MAAS predicts outcomes in longitudinal studies. Similarly, it is unknown whether the adapted scale predicts expected outcomes in clinical populations, and the present, initial study might inspire the deployment of mindfulness-based treatment interventions needed for further validation of the scale. It will also be important to assess the construct validity of the scale with a more diverse battery of measures. Such research should use the full, 15-item Estonian MAAS, as the IRT analysis reported here cannot be taken as a basis for a short MAAS scale, which would require an extensive validation effort. Finally, it may be useful to more directly assess relations between mindfulness and time perspective in Estonia (e.g., Seema and Sircova 2013) and in other cultures. For example, consistent with the linguistic relativity hypothesis (Lucy 1997), future research could explore whether differences in the temporal structure of language correspond to differences in the effects of mindfulness training on outcomes that can involve a tension between present- and future-oriented behavior (e.g., planning, procrastination).

Acknowledgments We thank translators Kristiina Alas and Külli Nõmme. We also thank consultant professor Mare Pork and Estonian philologist Kristina Kask.

References

- Arbuckle, J. L. (2009). *AMOS 18 [computer software]*. Crawfordville: AMOS Development Corp.
- Baer, R. A., Smith, G. T., & Allen, K. B. (2004). Assessment of mindfulness by self-report: the Kentucky Inventory of Mindfulness Skills. *Assessment, 11*(3), 191–206.
- Black, D. S., Sussman, S., Johnson, C. A., & Milam, J. (2012). Psychometric assessment of the Mindful Attention Awareness Scale (MAAS) among Chinese adolescents. *Assessment, 19*(1), 42–52.
- Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84*, 822–848.
- Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: theoretical foundations and evidence for its salutary effects. *Psychological Inquiry, 18*, 211–237.
- Byrne, B. M. (2001). *Structural equation modeling with AMOS: Basic concepts, applications, and programming*. Mahwah: Lawrence Erlbaum.
- Catak, P. D. (2012). The Turkish version of Mindful Attention Awareness Scale: preliminary findings. *Mindfulness, 3*, 1–9.
- Cebolla, A., Luciano, J., DeMarzo, M., Navarro-Gil, M., & Campayo, J. (2013). Psychometric properties of the Spanish version of the Mindful Attention Awareness Scale (MAAS) in patients with fibromyalgia. *Health and Quality of Life Outcomes, 11*(6), 1–7.
- Chen, K. (2013). The effect of language on economic behavior: evidence from savings rates, health behaviors, and retirement assets. *American Economic Review, 103*(2), 690–731.
- Deng, Y. Q., Li, S., Tang, Y. Y., Zhu, L. H., Ryan, R., & Brown, K. (2012). Psychometric properties of the Chinese translation of the Mindful Attention Awareness Scale (MAAS). *Mindfulness, 3*(1), 10–14.
- Erelt, T., Leemets, T., Mäearu, S., & Raadik, M. (2006). *Eesti õigekeelsus sõnaraamat*. Tallinn: Eesti Keele Sihtasutus.
- Ellis, B. B., & Mead, A. D. (2002). Item analysis: Theory and practice using classical and modern test theory. In S. G. Rogelberg (Ed.), *Handbook of research methods in industrial and organizational psychology* (pp. 324–344). Malden: Blackwell.
- Embretson, S. E., & Reise, S. P. (2000). *Item response theory for psychologists*. Mahwah: Lawrence Erlbaum.
- Fenigstein, A., Scheier, M. F., & Buss, A. H. (1975). Public and private self-consciousness: assessment and theory. *Journal of Consulting and Clinical Psychology, 43*, 522–527.
- Hambleton, R. K., Sawinathan, H., & Rogers, H. J. (1991). *Fundamentals of item response theory: Measurement methods for the social science*. Newbury Park: Sage.
- Hambleton, R. K. (2004). Issues, design, and technical guidelines for adapting tests into multiple languages. In R. K. Hambleton, P. F. Merenda, & D. Spielperger (Eds.), *Adapting educational and psychological tests for cross-cultural assessment* (pp. 3–38). Mahwah: Lawrence Erlbaum.
- Hansen, E., Lundh, L. G., Hommans, A., & Wångby-Lundh, M. (2009). Measuring mindfulness: pilot studies with the Swedish versions of the Mindful Attention Awareness Scale and the Kentucky Inventory of Mindfulness Skills. *Cognitive Behavior Therapy, 38*, 2–15.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1–55.
- Jermann, F., Laroï, F., Bondolfi, G., Billieux, J., d'Argembeau, A., Zermatten, A., et al. (2009). Mindful Attention Awareness Scale (MAAS): psychometric properties of the French translation and exploration of its relation with emotional regulation strategies. *Psychological Assessment, 21*(4), 506–514.
- Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: past, present, and future. *Clinical Psychology: Science and Practice, 10*(2), 144–156.
- Kay, P., & Kempton, W. (1984). What is the Sapir-Whorf hypothesis? *American Anthropologist, 86*(1), 65–79.
- Lucy, J. A. (1997). Linguistic relativity. *Annual Review of Anthropology, 26*, 291–312.
- Mantzios, M., Wilson, J.C., & Giannou, K. (2013). Psychometric properties of the Greek versions of the Self-Compassion and Mindful Attention Awareness Scales. *Mindfulness*. doi:10.1007/s12671-013-0237-3.
- Michalak, J., Heidenreich, T., Ströhle, G., & Nachtigall, C. (2008). Die deutsche version der Mindful Attention and Awareness Scale (MAAS). Psychometrische Befunde zu einem Achtsamkeitsfragebogen. *Zeitschrift für Klinische Psychologie und Psychotherapie, 37*(3), 200–208.
- Pullmann, H., & Allik, J. (2000). The Rosenberg Self-Esteem Scale: its dimensionality, stability, and personality correlates in Estonian. *Personality and Individual Differences, 28*, 701–715.
- Quaglia, J. T., Brown, K. W., Lindsay, E. K., Creswell, J. D., & Goodman, R. J. (2014). From conceptualization to operationalization of mindfulness. In K. W. Brown, J. D. Creswell, & R. M. Ryan (Eds.), *Handbook of mindfulness: Theory, research, and practice*. New York: Guilford.
- R Development Core Team. (2010). *R: A language and environment for statistical computing*. Vienna: R Foundation for Statistical Computing. Retrieved March 01, 2011, from <http://www.R-project.org>.
- Realo, A., & Allik, J. (1998). The Estonian Self-Consciousness Scale and its relation to the five-factor model of personality. *Journal of Personality Assessment, 70*(1), 109–124.
- Rizopoulos, D. (2006). ltm: an R package for latent variable modelling and item response theory analyses. *Journal of Statistical Software, 17*, 1–25. Retrieved from <http://www.jstatsoft.org/v17/i05/>.
- Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton: Princeton University Press.
- Seema, R., & Sircova, A. (2013). Mindfulness—a time perspective? Estonian study. *Baltic Journal of Psychology, 14*, 1–2.
- Sisask, M., Värik, A., Kõlves, K., Konstabel, K., & Wasserman, D. (2008). Subjective psychological well-being (WHO-5) in assessment of the severity of suicide attempt. *Nordic Journal of Psychiatry, 62*, 431–435.
- Soler, J., Tejedor, R., Feliu-Soler, A., Pascual, J. C., Cebolla, A., Soriano, J., et al. (2012). Psychometric properties of Spanish version of Mindful Attention Awareness Scale (MAAS). *Actas Españolas de Psiquiatría, 40*(1), 19.
- Van Dam, N. T., Earleywine, M., & Borders, A. (2010). Measuring mindfulness? An item response theory analysis of the Mindful Attention Awareness Scale. *Personality and Individual Differences, 49*(7), 805–810.
- Varela, F. J., Thompson, E., & Rosch, E. (1991). *The embodied mind: Cognitive science and human experience*. Cambridge: MIT Press.