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FULL-LENGTH REPORT



# Different cultures, similar daydream addiction? An examination of the cross-cultural measurement equivalence of the Maladaptive Daydreaming Scale

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## ABSTRACT

*Background and aims:* Maladaptive Daydreaming (MD) is a proposed mental disorder, in which absorption in rich, narrative fantasy becomes addictive and compulsive, resulting in emotional, social, vocational, or academic dysfunction. Most studies on MD were carried out on aggregated international samples, using translated versions of the Maladaptive Daydreaming Scale (MDS-16). However, it is unknown whether the properties of MD are affected by culture. Thus, we investigated the cross-cultural measurement invariance of the MDS-16. *Methods:* We recruited both individuals self-identified as suffering from MD and non-clinical community participants from four countries: the USA, Italy, Turkey, and the UK ( $N = 1,081$ ). *Results:* Configural invariance was shown, suggesting that the hypothesized four-factor structure of the MDS-16 (including Yearning, Impairment, Kinesthesia, and Music) holds across cultures. Metric invariance was shown for Impairment, Kinesthesia, and Music, but not for Yearning, suggesting that the psychological meaning of the latter factor may be understood differently across cultures. Scalar invariance was not found, as MD levels were higher in the USA and UK, probably due to the over-representation of English-speaking members of MD communities, who volunteered for the study. *Discussion and conclusions:* We conclude that the urge to be absorbed in daydreaming and the fantasies' comforting and addictive properties may have different meanings across countries, but the interference of MD to one's daily life and its obstruction of long-term goals may be the central defining factor of MD.

## KEYWORDS

Daydreaming, Maladaptive Daydreaming, fantasy, measurement invariance, cross-cultural, mental disorder

## INTRODUCTION

Maladaptive Daydreaming (MD) is a recently proposed mental disorder, defined as a persistent and recurrent absorption in detailed fantastic imagery, to the point where it becomes a type of behavioral addiction, causing distress and impairing functioning in various life domains such as social relations or work (Pietkiewicz, Nęcki, Bańbura, & Tomalski, 2018; Schupak & Rosenthal, 2009; Somer, 2002). Diagnostic criteria include annoyance when being unable to daydream and repeated unsuccessful efforts to control, cut back, or stop

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daydreaming (Somer, Soffer-Dudek, Ross, & Halpern, 2017). Indeed, behavioral addictions involve elements of impulse-control symptoms alongside obsessive-compulsive symptoms (Demetrovics & Griffiths, 2012; Karim & Chaudhri, 2012; Robbins & Clark, 2015), and as such, involve both elements of risk aversion (negative reinforcement) and sensation-seeking (positive reinforcement) (Robbins & Clark, 2015), both of which are present in MD (Soffer-Dudek & Somer, 2018; Somer, 2002; Somer, 2018). It is yet unknown whether the properties of such abnormal daydreaming are universal, or affected by culture. To address this question, the current study set out to assess the cross-cultural measurement invariance of the factorial structure of the 16-item version of the Maladaptive Daydreaming Scale (MDS-16; Somer, Lehrfeld, Bigelsen, & Jopp, 2016; Somer, Soffer-Dudek, & Ross, 2017). Assessing the measurement invariance of the main tool used to measure MD may reveal the extent of cultural consistency in the relationships between items and between items and their factors, suggesting similarity versus divergence in the psychological meanings assigned to various properties of MD across countries.

### Daydreaming and related constructs

Daydreaming is a normal, widespread mental activity (Klinger, 1990; Singer, 1966). Almost half of our waking thoughts seem to be off-task and internally-generated, rather than focused on what we are doing at the present moment (Killingsworth & Gilbert, 2010). Off-task thinking, mind-wandering, or the decoupling of attention and perception (Baird, Smallwood, Lutz, & Schooler, 2014; Smallwood, 2013; Smallwood & Schooler, 2015) has a cognitive cost that comes with reduced attention to external events and a possible deterioration of mood (Killingsworth & Gilbert, 2010; Marchetti, Koster, Klinger, & Alloy, 2016), but it has also been hypothesized to play beneficial roles, such as future prospection, creativity, placing experiences in meaningful contexts, mental breaks, and adaptive functions that parallel those of nocturnal dreaming, including emotional regulation (Smallwood & Schooler, 2015). However, it is becoming clear that we need to better distinguish between different off-task mental states by examining, for example, the degree of control over one's off-task thoughts (Christoff, Irving, Fox, Spreng, & Andrews-Hanna, 2016). An intense attentional absorption and emotional involvement in a long, elaborate, narrative daydream may involve different mechanisms than experiencing a chain of unrelated distractions, although both would be considered "off-task" thinking to an outside observer, especially if there are neglected real-world task demands. Moreover, pinpointing such mechanisms most likely has implications for a fuller understanding of psychopathology. Indeed, it has been shown that a tendency for dissociative "absorption and imaginative involvement" is empirically distinct from other tendencies for off-task thought (mind-wandering and attention deficit symptoms) and has a strong and unique contribution over and above those constructs in explaining psychopathology (Soffer-Dudek, 2019).

In recent years it has become evident that similar to other normal human experiences, such as sadness or apprehension, absorption in daydreaming may also be so intense that it deserves specific clinical attention. MD describes the phenomenon of individuals capable of entering an absorbed mode of highly vivid and fanciful daydreaming for hours on end, with that special capability turning into a handicap as it spirals out of control, replacing human contact and interfering with life tasks (Bigelsen, Lehrfeld, Jopp, & Somer, 2016; Pietkiewicz et al., 2018). Individuals struggling with MD report that the daydreaming behavior is time-consuming, gratifying and thus performed for its own sake, and difficult to abstain from, despite adverse consequences; all of these characteristics are hallmarks of behavioral addictions (Perales et al., 2020; Robbins & Clark, 2015). Although there has been only little scientific research on this construct, many internet users have embraced it warmly, excited to learn that they are not the only ones compulsively engaged in this activity. Cyber-forums dedicated to MD include many thousands of members (for example, a "Reddit" peer support group dedicated to maladaptive daydreaming has over 45,600 members; Retrieved on September 30th, 2020, from: <https://www.reddit.com/r/MaladaptiveDreaming/>), and a Google search for the term MD produced about 478,000 results (Retrieved September 30th, 2020). Thus, it seems that it may be important to better understand the properties of MD and its reliability as a nosological entity.

Individuals suffering from MD spend on average about 4–5 h a day daydreaming (Soffer-Dudek & Somer, 2018) or in some cases up to 69% of their waking hours (Bigelsen et al., 2016). Often, the fantasies will include idealized versions of the daydreamer's self or will rely on the daydreamer's life in some way, but alternatively, many individuals will "watch" their daydreams from the side, viewing how their characters age, marry, have children and otherwise develop over time, similar to a soap-opera spanning several years (Bigelsen & Schupak, 2011; Somer, 2002; Somer, Somer, & Jopp, 2016). In addition to the experience of a constant craving to daydream, MD differs from normal daydreaming in several aspects such as content (Bigelsen et al., 2016), kinesthetic elements including stereotyped movements such as pacing, swinging, or shaking one's hands (Bigelsen & Schupak, 2011) and music involved in initiating and maintaining the mental activity (Somer, Somer, & Jopp, 2016). MD is strongly related to psychiatric symptoms (Somer, Soffer-Dudek, & Ross, 2017; Zsila, Urbán, McCutcheon, & Demetrovics, 2019) and functional impairment such as problematic internet use (Zsila, McCutcheon, & Demetrovics, 2018), and it has been suggested as an appropriate addition to the Diagnostic and Statistical Manual of Mental Disorders (DSM) (Somer, Soffer-Dudek, Ross, & Halpern, 2017). The most prevalent psychiatric comorbidities of MD are attention-deficit/hyperactivity disorder, anxiety disorders (and especially social anxiety disorder), depressive disorders, and obsessive-compulsive and related disorders (and especially skin-picking) (Somer, Soffer-Dudek, & Ross, 2017). It is yet to be determined whether MD is the underlying factor generating the emergence of additional symptoms. One daily study on individuals with MD

showed that a host of additional symptoms emerged on days of increased daydreaming, but only obsessive-compulsive and dissociative symptoms were also increased on the next day, and only obsessive-compulsive symptoms increased on the previous day (Soffer-Dudek & Somer, 2018). Further study is needed to shed light on the dynamics between different psychiatric symptoms and MD.

### A cross-cultural perspective on MD

To date, most MD studies have been conducted on diverse international samples and were typically conducted on self-diagnosed individuals active in cyber-forums on MD. Participants in these online communities usually join the forums following an Internet search for their condition and their conclusion that the concept of MD fits their situation best. They identify themselves as Maladaptive Daydreamers. Some studies have also involved additional non-clinical participants, but all have involved maladaptive daydreamers as at least part, if not all, of the study sample. Carried out online, most of these studies have crossed cultural and country boundaries. For example, Soffer-Dudek & Somer (2018) conducted a daily diary study on participants from 26 countries around the world, including many participants from English-speaking countries as well as from Europe, Asia, Latin America, Africa, and the Middle East. Similarly, another daily diary study followed 152 maladaptive daydreamers spanning 35 countries (Marcusson-Clavertz, West, Kjell, & Somer, 2019). On one hand, this represents a significant advantage as samples are large and heterogeneous. On the other hand, these studies usually do not formally assess culture or nationality as a possible intervening factor, raising the question of whether MD rests on the same underlying factors and entails similar psychological meanings across distinct groups.

To ascertain that people with MD from different countries refer to the same psychological construct when they address their MD, it is necessary to assess the measurement invariance of the main MD measure, the MDS-16 (Somer, Lehrfeld, et al., 2016; Somer, Soffer-Dudek, & Ross, 2017). Measurement invariance of a latent model may be assessed by employing confirmatory factor analysis (Baumgartner & Steenkamp, 1998; Steinmetz et al., 2009; Xu & Tracey, 2017). Three main steps are conventionally stipulated to fulfill this aim (e.g., Vandenberg & Lance, 2000; Xu & Tracey, 2017): First, *Configural Invariance* assessment to verify that the same latent structure (i.e., the same factorial model) holds across different groups; second, *Metric Invariance* evaluation to verify that the magnitudes of the associations between the latent constructs and their manifest observations (i.e., factor loadings) are equivalent across groups. This second procedure can indicate if the latent factors have the same psychological meanings across groups. The latent constructs representing analogous psychological meanings are a prerequisite for comparing their mean levels between groups; third, to the extent that such mean levels are also equivalent across groups, *Scalar Invariance* would lastly be called for. Each type of invariance is contingent upon the previous one.

The development of the first version of the MDS, spanning 14 items, was conducted on an English-speaking sample (Somer, Lehrfeld, et al., 2016). In that study, an exploratory factor analysis yielded three factors: (1) Yearning: items reflecting the addictive appeal of daydreaming, and the intense craving to engage in it; (2) Impairment: items reflecting the dysfunction, interference, and suffering associated with daydreaming; and (3) Kinesthesia: items reflecting the tendency to engage in physical motion during daydreaming or as a way to initiate daydreaming. A later study on a Hebrew-speaking sample validated the same structure using confirmatory factor analysis with the Hebrew translated version (Jopp, Dupuis, Somer, Hagani, & Herscu, 2018). Moreover, the Hebrew MDS showed configural, metric, and scalar invariance compared to the original English version. In later research, two items were added to the MDS (hence MDS-16), assessing music as another contributing factor to the initiation and maintenance of daydreaming (Somer, Soffer-Dudek, & Ross, 2017). A recent network analysis study (Green, West, & Somer, 2020) on an English-speaking sample confirmed the original factor structure, with music items joining kinesthesia to form a unified third factor. Indeed, many maladaptive daydreamers report that they combine repetitive motion (e.g., pacing) with listening to music during the daydreaming activity to maintain their intense absorption in it. Notably, however, exploratory factor analyses conducted on Arab-speaking and Italian-speaking samples yielded somewhat different results (presented in detail in the statistical analysis section below), suggesting that a cross-cultural exploration is in order.

### The present study

In the present study, we used multi-group confirmatory factor analysis to test a 4-factor structure for the MDS-16, relying on the original three-factor structure of the MDS-14 and adding a factor for the two music items added to the MDS-16. Fig. 1 presents the hypothesized model we set out to confirm. We aimed to assess the invariance of this structure across different countries including both MD and non-MD volunteers. We assessed configural, metric, and scalar invariance across four countries using different translations of the MDS-16 (all available at “The International Consortium for Maladaptive Daydreaming Research” (ICMDR) Website: <https://daydreamresearch.wixsite.com/md-research>).

Showing that the structure of the MDS-16 is invariant across groups is important for methodological and theoretical reasons. From a methodological viewpoint, as mentioned, MD research is mostly based on diverse online international samples, aggregated into single samples. Finding that the factor structure of the assessment tool is comparable across groups will support the validity of these studies. From a theoretical viewpoint, showing that MD has similar properties across groups and cultures will be an important contribution to the establishment of its validity as a universal disorder, rooted in basic human traits. On the

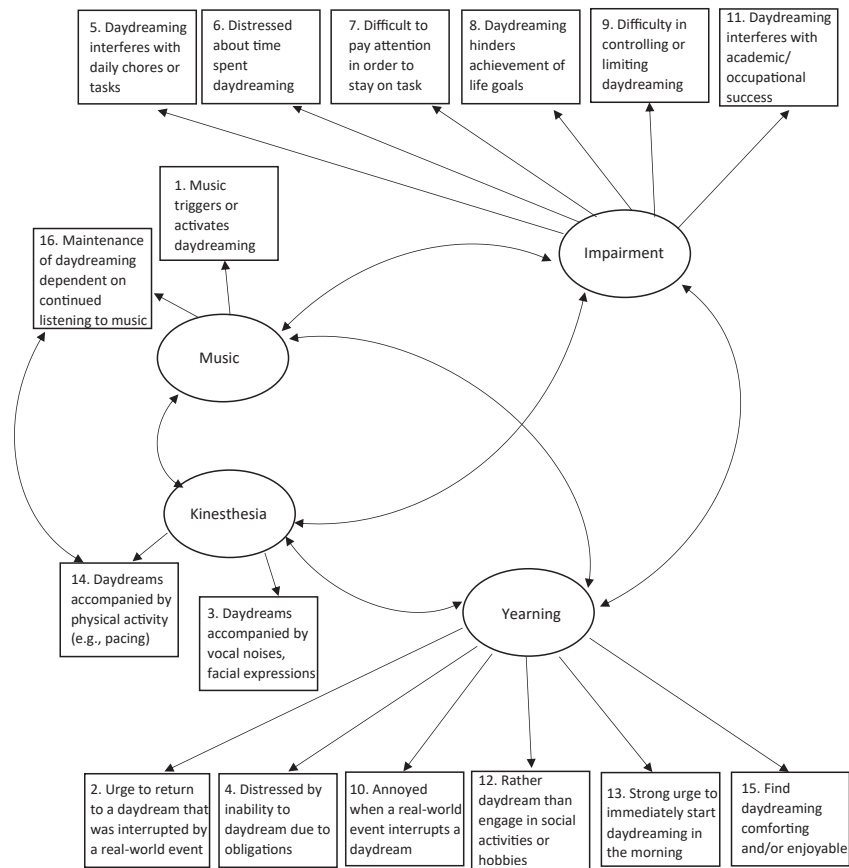


Fig. 1. Hypothesized latent structural model for the 16-item version of the Maladaptive Daydreaming Scale (MDS-16)

other hand, any variance found in this domain will help identify which elements of MD are universal and which elements should be treated as culture-specific. Predispositions toward mental illness are mostly similar across cultures, yet their specific manifestations are shaped by cultural variables (Lilienfeld, 2016). Shedding light on what is culture-specific may contribute both to our understanding of MD and our clinical sensitivities when treating culturally diverse people suffering from MD.

## METHODS

### Procedure

Data for this study were derived from a larger study (Sommer et al., in press) on MD in light of the COVID-19 pandemic, for which a call for participants was posted on various online English, Italian, and Turkish MD communities and was also spread on social media networks in these languages. Participants who were 18 years or older were included in the study. Interested respondents were provided with a link to an informed consent form in either English, Italian, or Turkish. After confirming their consent, participants proceeded to online electronic questionnaires that required between 15 and 20 min to complete. The survey was

available in the respective languages. Translation of the consent forms and the demographic questionnaires from the English source to Italian and Turkish was conducted and quality assured by native Italian and Turkish members of the research team.

### Participants

Respondents from 83 countries completed the questionnaire. After removing 10 underage participants, the sample size was  $N = 1,694$ . Some participants started filling out the MDS-16 but then stopped and skipped the rest of the items. At first, we removed participants who did not complete half (or more) of the items of the MDS-16, resulting in a sample of  $n = 1,653$ . But then, we observed that missingness was under 2%. Missingness under 5% is inconsequential, and any method of dealing with it will generate similar results (Tabachnick & Fidell, 2007). Thus, we focused on those participants with complete data ( $n = 1,623$ ). For the sake of the present investigation, which relies on multi-group (country) structural equation modeling, we analyzed only data from countries with at least 100 participants (Kline, 2005). Thus, our final sample comprised  $n = 1,081$  participants from the USA ( $n = 364$ ), Italy ( $n = 356$ ), Turkey ( $n = 259$ ), and the UK ( $n = 102$ ). Gender was mostly female (76.7% of the sample in general; 77.47% in the USA, 70.99%



Table 1. Demographic characteristics of the national samples in terms of education level, religion, and mental health diagnoses (top), and Maladaptive Daydreaming total score levels in each country (bottom)

		USA	Italy	Turkey	UK
Education	Elementary, Junior, or High school	29.1%	38.2%	9.7%	39.2%
	Bachelor's degree/student	47.0%	24.7%	33.6%	32.4%
	Graduate degree/student	23.9%	37.1%	56.8%	28.4%
Religion	Christianity	29.7%	47.5%	1.5%	22.5%
	Islam	2.7%	0.3%	74.5%	3.9%
	Judaism	3.6%	0.0%	0.0%	0.0%
	Hinduism	1.1%	0.0%	0.0%	1.0%
	Buddhism	2.2%	0.8%	0.0%	1.0%
	I have no religion	31.6%	1.4%	14.3%	37.3%
	I am an atheist	15.1%	31.7%	5.0%	20.6%
	Other	14.0%	18.3%	4.2%	13.7%
Diagnosis <sup>a</sup>	Attention-deficit/hyperactivity disorder	23.6%	2.2%	8.1%	8.8%
	Social anxiety disorder	26.4%	4.5%	14.3%	26.5%
	Other anxiety disorders	33.8%	13.2%	8.9%	17.6%
	Obsessive-compulsive disorder	11.5%	4.2%	6.6%	9.8%
	Major depression	34.1%	7.6%	7.3%	21.6%
	Other diagnosis	25.3%	3.4%	12.7%	25.5%
	I do not know	11.8%	6.2%	48.6%	15.7%
	None	24.5%	71.9%	0.8%	28.4%
MDS-16 total average score level <sup>b</sup>	0–24.99	12.9%	28.7%	41.3%	9.8%
		<i>SR = -4.5</i>	<i>SR = 1.5</i>	<i>SR = 5.4</i>	<i>SR = -3.0</i>
	25–49.99	15.9%	26.4%	29.7%	11.8%
		<i>SR = -2.6</i>	<i>SR = 1.6</i>	<i>SR = 2.5</i>	<i>SR = -2.3</i>
	50–74.99	48.4%	27.5%	14.3%	45.1%
		<i>SR = 5.1</i>	<i>SR = -1.8</i>	<i>SR = -5.2</i>	<i>SR = 2.1</i>
	22.8%	17.4%	14.7%	33.3%	
	<i>SR = 1.2</i>	<i>SR = -1.1</i>	<i>SR = -1.9</i>	<i>SR = 3.0</i>	

#### Notes.

<sup>a</sup> For each country, percentages in either education, religion, or MDS-16 score level amount to 100%. In diagnoses they do not, as it was optional to mark more than one diagnosis per respondent.

<sup>b</sup> For MDS-16 score levels, below the percentages the standardized residual (SR) is given. SRs over 1.96 or under -1.96 are considered statistically significant and are thus italicized.

in Italy, 81.47% in Turkey, and 82.35% in the UK), with 19.4% males (13.19% in the USA, 28.73% in Italy, 18.53% in Turkey, and 11.76% in the UK), and 3.8% “other”, almost all of them from the English-speaking countries (9.34% in the USA, 0.28% in Italy, 0% in Turkey, and 5.88% in the UK). The minimum age in all countries was 18, and the maximum was 80 (USA), 69 (Italy), 61 (Turkey), and 75 (UK). Mean age in the general sample was 30.07 ( $SD = 12.59$ ), and  $M = 30.25, 30.71, 29.02, 29.87$ , with  $SD = 15.42, 11.15, 9.06$ , and 13.7, for the USA, Italy, Turkey, and the UK, respectively. Table 1 (top) presents additional sample demographics (education, religion, and psychiatric diagnoses).

## Measures

In addition to demographic variables (gender, age, country, education, religion, and existing mental health diagnoses), we assessed MD using the MDS-16 (Somer, Lehrfeld, et al., 2016; Somer, Soffer-Dudek, & Ross, 2017). As detailed above, this 16-item measure assesses four aspects of abnormal daydreaming: the extent to which one consistently feels drawn to daydreaming and has a strong, addictive urge to engage in daydreaming (yearning); the extent to which

one feels that engaging in daydreaming impairs their functioning in social, academic, or vocational domains and interferes both with wide-ranging life goals and with specific daily chores or tasks (impairment); the extent to which one finds oneself engaging in physical movement associated with daydreaming such as accompanying facial expressions, mouthing the words, rocking, or pacing (kinesthesia); and the extent to which one uses music to initiate or maintain the daydreaming experience (music). The scale is reliable (Schimmenti, Sideli, La Marca, Gori, & Terrone, 2019; Somer, Lehrfeld, et al., 2016; Somer, Soffer-Dudek, Ross, & Halpern, 2017) and is measured on an 11-point scale, ranging from 0% (e.g., never, no distress at all) to 100% (e.g., extremely frequent, extreme distress). In the present study, Cronbach's alpha for the 16 items on the final 4-country sample was 0.95, with 0.93, 0.96, 0.96, and 0.92 for the American, Italian, Turkish, and the British samples, respectively.

## Statistical analysis

First, we delineated the hypothesized structural model for which we aimed to assess measurement invariance (see



Fig. 1). As mentioned above, we designed it based on the original factor structure detailed in the introduction section (Somer, Lehrfeld, et al., 2016), and added a factor for the newer music items. Notably, exploratory factor analyses conducted on Arab-speaking and Italian-speaking samples both reported a 2-factor structure of the MDS-16 that mostly corresponded with Yearning and Impairment, with minor modifications (Abu-Rayya, Somer, & Meari-Amir, 2019; Schimmenti, Sideli, et al., 2019). Specifically, items which were originally labeled “impairment” consistently loaded upon a single factor in all studies (items 5, 6, 7, 8, 9, and 11 of the MDS-16); these newer studies labeled the factor “Distress and impairment” (Abu-Rayya et al., 2019) and “Interference with life” (Schimmenti, Sideli, et al., 2019). However, the “Yearning” construct (labeled in the new studies “Immerse daydreaming” and “Somato-sensory retreat”), was less consistent across studies. Specifically, In Abu-Rayya et al. (2019), item #10 (“Some people feel annoyed when a real-world event interrupts one of their daydreams. When the real-world interrupts one of your daydreams, on average how annoyed do you feel?”) loaded on the impairment factor, although theoretically, it represents yearning. Conversely, in Schimmenti, Sideli, et al. (2019), items #12 (“Some people would rather daydream than do most other things. To what extent would you rather daydream than engage with other people or participate in social activities or hobbies?”) and #13 (“When you first wake up in the morning, how strong has your urge been to immediately start daydreaming?”) loaded on the impairment factor. Whereas item #12 does address impairment of social relations, overall, these items address the urge to daydream or the addictive element of MD. Notably, item #12 was loaded with a similar effect size on the second factor as well, suggesting that in accordance with the theoretical expectation, it was not uniquely related to the impairment factor. To conclude, regarding Yearning, it becomes clear that whereas there was a consensus across studies that items #2, #4, and #15 represent yearning, items #10, #12, and #13 were less consistent. Kinesthesia (items #3 and #14) and music (items #1 and #16) loaded on the general yearning factor in these two studies, rather than forming a unique factor of their own or two additional factors.

Despite these results, we opted to create a separate music factor as would theoretically be expected, but added a specific correlation between the residual of Kinesthesia item #14 assessing accompanying physical activity such as pacing, swinging or shaking hands, and Music item #16 assessing the continued use of music for maintaining daydreaming. This was based on two reasons: the first was theoretical, in that phenomenologically, maladaptive daydreamers often combine repetitive motion and music when they try to maintain an ongoing special state of absorption in daydreaming (Somer, Somer, et al., 2016). The second reason was empirical; specifically, in previous studies, kinesthesia and music were never separate factors. They were either combined in a single larger factor (Abu-Rayya et al., 2019; Schimmenti, Sideli, et al., 2019) or loaded together on one 4-item factor (Green et al., 2020). The latter network analysis

study clearly shows that the strong relation of items #14 and #16 is at the root of the connection between the two domains (and as mentioned above, this makes sense theoretically). Thus, we decided to structure them as separate latent constructs with a specific correlation between residuals of items #14 and #16, suggesting that they have a unique strong correlation which does not go through the general association between Kinesthesia and Music.

Importantly, we chose to specify items 10, 12, and 13, as part of the yearning factor, because theoretically they represent yearning, and also because each of them loaded on the yearning factor in two out of three exploratory factor analysis studies (Abu-Rayya, Somer, & Meari-Amir, 2019; Schimmenti, Sideli, La Marca, Gori, & Terrone, 2019; Somer, Lehrfeld, Bigelsen, & Jopp, 2016).

Next, we inspected descriptive statistics of MDS-16 scores in different countries. Finally, all three types of measurement invariance tests were conducted using multi-group confirmatory factor analysis (CFAs) in AMOS (version 21). Configural invariance was examined by inspecting the fit indices of the multi-group model, i.e., a model relying on the full sample but specifying country as a grouping variable. A multi-group model will show acceptable fit indices if the hypothesized model does not significantly differ from each of the groups’ observed matrices. In other words, an acceptable fit means that the model fits the data from all groups well. Specifically, we looked at the chi-square statistic, the Non-Normed Fit Index (NNFI) also known as the Tucker-Lewis Index (TLI), the Comparative Fit Index (CFI, Bentler, 1990), the Root Mean Square Error of Approximation (RMSEA, Browne & Cudeck 1993), and the Standardized Root Mean Square Residual (SRMR, e.g., Jöreskog & Sorbom, 1988). The chi-square statistic is considered to represent acceptable fit if it is statistically non-significant, suggesting that the observed matrix does not significantly differ from the hypothesized matrix. Notably, however, we expected the chi-square to be statistically significant, because it is highly influenced by large sample sizes, such as ours, and thus it is unsuitable as an indicator of goodness-of-fit in this study. Dividing chi-square by its degrees of freedom lessens the influence of sample size and is thus more suitable. This statistic is labeled the normed chi-square (and denoted as  $\Delta\chi^2$ ). It is usually considered acceptable if it is under 3. Values over 0.90 for CFI and TLI, values below 0.06 for RMSEA, and values below 0.08 for SRMR also suggest good fit (Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999). Metric invariance was examined by comparing the factor loadings across groups, using a chi-square difference test for nested models, assuming the configural invariance model to be correct. Specifically, factor loadings (the relationships between latent factors and their indicators) were constrained to equality across groups, and this constrained model was compared to the previous model where they were freely estimated for each country. This enables the examination of whether constraining them to equality significantly impairs fit; if it does, this means that there are significant differences across countries in the magnitude of factor loadings. Scalar invariance was

Table 2. Standardized estimates of covariances (correlations) between the four factors for each country

	USA		Italy		Turkey		UK	
Impairment ↔ Yearning	0.76	$P < 0.001$	0.87	$P < 0.001$	0.92	$P < 0.001$	0.81	$P < 0.001$
Yearning ↔ Kinesthesia	0.72	$P < 0.001$	0.87	$P < 0.001$	0.87	$P < 0.001$	0.50	$P = 0.001$
Impairment ↔ Kinesthesia	0.63	$P < 0.001$	0.75	$P < 0.001$	0.79	$P < 0.001$	0.55	$P < 0.001$
Music ↔ Impairment	0.45	$P < 0.001$	0.44	$P < 0.001$	0.57	$P < 0.001$	0.48	$P < 0.001$
Music ↔ Yearning	0.62	$P < 0.001$	0.64	$P < 0.001$	0.69	$P < 0.001$	0.53	$P < 0.001$
Music ↔ Kinesthesia	0.58	$P < 0.001$	0.57	$P < 0.001$	0.58	$P < 0.001$	0.50	$P = 0.001$
#14 residual ↔ #16 residual	0.30	$P < 0.001$	0.31	$P < 0.001$	0.27	$P = 0.008$	0.15	ns

examined by constraining to equality the intercepts of all indicators, assuming the metric invariance model to be correct (Hong, Malik, & Lee, 2003). In other words, the fit of each model was compared to that of the previous step.

## ETHICS

The study procedures were carried out in accordance with the Declaration of Helsinki. The Human Research Ethics Committee of the University of Haifa approved the study. All subjects provided informed consent.

## RESULTS

First, we inspected the means across groups. As the sampling was based on both community samples and MD samples in each country, we wished to examine the characteristics of the study in terms of the level of MD. It has previously been reported that a mean score of 50 on the questionnaire is an appropriate cutoff score for identifying clinical-level MD (Sommer, Soffer-Dudek, Ross, & Halpern, 2017). The average of the sample as a whole, across the 4 countries, was  $M = 48.99$  ( $SD = 26.25$ ), suggesting that we had many participants well over and well under the clinical cutoff. Means for specific countries were  $M = 56.87$  ( $SD = 23.39$ ),  $M = 45.04$  ( $SD = 26.31$ ),  $M = 37.97$  ( $SD = 26.18$ ), and  $M = 62.68$  ( $SD = 20.98$ ), for the USA, Italy, Turkey, and the UK, respectively. An ANOVA model suggested that these were significant differences ( $F_{(3,1077)} = 42.45$ ,  $P < 0.001$ , partial  $\eta^2 = 0.11$ ). Table 1 (bottom) reports percentages of MDS-16 total scores when categorizing them into four levels (0–25, 25–50, 50–75, and 75–100). In hindsight, we understood that although the sampling was uniform, the English-speaking MD community is larger than the Italian and Turkish ones, and therefore people identifying themselves as suffering from MD were probably over-represented in the English-speaking countries compared to the other two countries.

Thus, we suspected that we will not be able to show scalar invariance (i.e., similar intercepts across groups). Still, to see whether all or part of the constructs differ across groups, we decided to conduct a scalar exploration as planned, should configural and metric invariance be found.

Using a multi-group analysis CFA, we specified our hypothesized model and defined the four countries as four groups. Configural invariance was supported, as the fit

indices (except for the chi square, which is inappropriate, as mentioned above) of the latent structure indicated good fit ( $\chi^2 = 1093.09$ ,  $df = 388$ ,  $P < 0.001$ ,  $\Delta\chi^2 = 2.82$ , TLI = 0.94, CFI = 0.95, RMSEA = 0.04, SRMR = 0.04). Table 2 presents the standardized covariance estimates (correlations) between the latent factors of the configural model, and Table 3 (left) presents standardized loading estimates in each country.

Next, we examined metric invariance by constraining all factor loadings to equality across groups. Although the fit of the metric model was good ( $\chi^2 = 1193.15$ ,  $df = 424$ ,  $P < 0.001$ ,  $\Delta\chi^2 = 2.81$ , TLI = 0.94, CFI = 0.94, RMSEA = 0.04, SRMR = 0.05), the chi-square test comparing the metric model to the configural one indicated that the goodness-of-fit significantly decreased ( $\chi^2 = 100.06$ ,  $df = 36$ ,  $P < 0.001$ ,  $\Delta$ TLI = 0.000,  $\Delta$ CFI = 0.004,  $\Delta$ RMSEA = 0.000,  $\Delta$ SRMR =  $-0.009$ ).<sup>1</sup> Thus, we freed the individual loading constraints for each item separately, to identify which item loadings were variant across groups. Table 3 (right) shows the results of this analysis. As can be seen in the table, the metric variance stems specifically from the yearning factor, especially items 10, 12, 13, and 15. To better understand which groups are responsible for this metric variance, we ran post-hoc analyses in which, on these four items, only one country was constrained to equality to the USA (either Italy, Turkey, or the UK), whereas the loadings of the other two countries were allowed to be freely estimated. We chose to compare each country to the USA because: (1) statistically, it is the largest group; and (2) theoretically, it represents the largest MD community on which most previous research was done. We found that when comparing the UK to the USA goodness-of-fit did not significantly decrease, suggesting complete metric invariance between these two English-speaking countries ( $\chi^2 = 30.57$ ,  $df = 28$ ,  $P = 0.337$ ,  $\Delta$ TLI =  $-0.004$ ,  $\Delta$ CFI = 0.000,  $\Delta$ RMSEA = 0.001,  $\Delta$ SRMR =  $-0.003$ ). However, both Italy and Turkey significantly differed from the USA in the loadings of these four items ( $\chi^2 = 69.88$ ,  $df = 28$ ,  $P < 0.001$ ,  $\Delta$ TLI =  $-0.001$ ,  $\Delta$ CFI = 0.003,  $\Delta$ RMSEA = 0.000,  $\Delta$ SRMR =  $-0.007$ , for Italy; and  $\chi^2 = 49.83$ ,  $df = 28$ ,  $P = 0.007$ ,  $\Delta$ TLI =  $-0.003$ ,  $\Delta$ CFI = 0.001,  $\Delta$ RMSEA = 0.001,  $\Delta$ SRMR =  $-0.003$ , for Turkey). When running a model comparing Italy directly to Turkey, again a significant difference emerged ( $\chi^2 = 46.35$ ,  $df = 28$ ,  $P = 0.016$ ,  $\Delta$ TLI =  $-0.003$ ,  $\Delta$ CFI = 0.001,  $\Delta$ RMSEA = 0.001,

<sup>1</sup>Deltas represent the subtraction of the fit index of the metric model from that of the configural model.



Table 3. Standardized loading estimates of indicators of the four factors for each country and chi-square tests assessing metric invariance across the four countries

Factor	Item	USA	Italy	Turkey	UK	$\chi^2$	<i>df</i>	<i>P</i> -level
Impairment	5	0.84	0.90	0.89	0.83	3.85	3	>0.250
	6	0.80	0.87	0.87	0.73	1.50	3	>0.250
	7	0.77	0.86	0.86	0.74	0.78	3	>0.250
	8	0.87	0.95	0.94	0.87	4.08	3	>0.250
	9	0.85	0.89	0.93	0.80	3.44	3	>0.250
Yearning	11	0.85	0.91	0.95	0.90	3.85	3	>0.250
	2	0.84	0.74	0.62	0.79	7.36	3	0.061
	4	0.80	0.76	0.74	0.86	7.36	3	0.061
	10	0.83	0.85	0.75	0.77	9.72	3	0.021
	12	0.82	0.82	0.86	0.80	18.65	3	<0.001
Kinesthesia	13	0.73	0.82	0.89	0.67	20.78	3	<0.001
	15	0.65	0.80	0.62	0.54	49.68	3	<0.001
	3	0.77	0.79	0.72	0.70	2.95	3	>0.250
Music	14	0.78	0.87	0.92	0.72	2.95	3	>0.250
	1	0.81	0.84	0.89	0.90	1.62	3	>0.250
	16	0.62	0.67	0.61	0.66	1.62	3	>0.250

Note: Invariance tests that were statistically significant at the  $P < 0.05$  level are italicized.

$\Delta$ SRMR =  $-0.003$ ), suggesting Italy and Turkey are variant amongst themselves.

As each type of invariance is a condition for the next one, we could not assess scalar invariance with the original model. Thus, we omitted the above-mentioned four items from the model, leaving only items 2 and 4 as indicators of yearning. The configural invariance of this modified model was again supported ( $\chi^2 = 472.27$ ,  $df = 188$ ,  $P < 0.001$ ,  $\Delta\chi^2 = 2.51$ , TLI = 0.96, CFI = 0.97, RMSEA = 0.04, SRMR = 0.04), but this time, the metric invariance was also supported ( $\chi^2 = 499.43$ ,  $df = 212$ ,  $P < 0.001$ ,  $\Delta\chi^2 = 2.36$ , TLI = 0.96, CFI = 0.97, RMSEA = 0.04, SRMR = 0.04). The chi-square test comparing between the configural and metric models indicated that they were both equally acceptable ( $\chi^2 = 27.15$ ,  $df = 24$ , ns), meaning that metric invariance was achieved for this modified model. Next, we examined scalar invariance by constraining item intercepts to equality across groups. Compared to the metric model, model fit significantly worsened ( $\chi^2 = 301.29$ ,  $df = 36$ ,  $P < 0.001$ ,  $\Delta$ TLI = 0.024,  $\Delta$ CFI = 0.027,  $\Delta$ RMSEA =  $-0.010$ ,  $\Delta$ SRMR =  $-0.004$ )<sup>2</sup> suggesting that scalar invariance was not achieved. Indeed, this was expected, in light of the results of the ANOVA reported above, which is also an assessment of the equality of the mean levels of MD across groups. When constraining individual intercepts to equality (to assess whether scalar invariance focused on some items and not on others), we found that the intercepts of all 12 items were significantly variant between groups, i.e., differed between the countries (see Table 4). We again conducted a post-hoc analysis whereby the USA was compared to each of the other individual countries, with equality constraints on all 12 item intercepts. The scalar model for each of the individual

countries had significantly worse fit than the metric model, with the most significant differences seen in the comparison with Turkey and the least significant with the UK ( $\chi^2 = 132.49$ ,  $df = 12$ ,  $P < 0.001$ ,  $\Delta$ TLI = 0.013,  $\Delta$ CFI = 0.012,  $\Delta$ RMSEA =  $-0.006$ ,  $\Delta$ SRMR =  $-0.004$ , for Italy;  $\chi^2 = 190.00$ ,  $df = 12$ ,  $P < 0.001$ ,  $\Delta$ TLI = 0.020,  $\Delta$ CFI = 0.018,  $\Delta$ RMSEA =  $-0.009$ ,  $\Delta$ SRMR = 0.000, for Turkey; and  $\chi^2 = 25.76$ ,  $df = 12$ ,  $P = 0.012$ ,  $\Delta$ TLI = 0.000,  $\Delta$ CFI = 0.001,  $\Delta$ RMSEA = 0.000,  $\Delta$ SRMR = 0.000, for the UK).

## DISCUSSION AND CONCLUSIONS

The present investigation demonstrated that the expected factor structure of the MDS-16 fit the data in all four (American, Italian, Turkish, and British) national samples. In other words, configural invariance was found, showing that in all four subsamples, the MDS-16 comprised Yearning, Impairment, Kinesthesia, and Music factors.

However, the samples differed in the loadings of the indicators on the “Yearning” factor, meaning that metric invariance was not achieved for the original model. Specifically, items 10, 12, 13, and 15 (all associated with Yearning) may be understood differently across English-speaking, Italian, and Turkish groups. Notably, the absolute differences in fit indices were very small, and the metric model had perfectly acceptable fit on its own, but formally, the chi-square comparison indicated that fit was poorer than that of the configural model, suggesting that the loadings of these items were not consistent across groups. This finding is in accordance with previous exploratory factor analysis studies (Abu-Rayya et al., 2019; Schimmenti, Sideli, et al., 2019) that showed less consistency of the loadings of items 10, 12, and 13 to this factor. In our study, item #15 (“Some people love to daydream. While you are daydreaming, to what extent do you find it comforting and/or enjoyable?”) seemed to be the

<sup>2</sup>Deltas represent the subtraction of the fit index of the scalar model from that of the metric model.



Table 4. Standardized estimates (based on the modified model) of intercepts of items for each country and chi-square tests assessing scalar invariance across the four countries

Factor	Item	USA	Italy	Turkey	UK	$\chi^2$	df	P-level
Impairment	5	47.93	38.81	28.18	55.94	77.24	3	<0.001
	6	43.43	35.30	28.62	50.86	48.44	3	<0.001
	7	60.00	44.07	32.70	66.47	128.26	3	<0.001
	8	53.71	38.12	30.54	63.92	108.21	3	<0.001
	9	58.82	39.02	30.15	66.57	149.41	3	<0.001
Yearning (modified)	11	50.50	38.79	29.07	61.96	92.82	3	<0.001
	2	62.67	56.12	55.06	71.96	33.87	3	<0.001
Kinesthesia	4	50.66	42.64	34.63	56.08	53.42	3	<0.001
	3	62.50	55.42	49.58	66.67	32.30	3	<0.001
Music	14	58.85	41.85	30.15	56.67	94.68	3	<0.001
	1	72.78	76.01	63.94	74.71	27.49	3	<0.001
	16	35.91	41.57	35.06	44.90	11.16	3	0.011

Note: Invariance tests that were statistically significant at the  $P < 0.05$  level are italicized.

least consistent, i.e., the most variant across cultures. Specifically, this item seemed to load strongly on a latent factor assessing addiction to daydreaming only in the Italian sample, whereas in other countries, most notably the British, addiction to daydreaming was not so strongly related to the enjoyment of daydreaming (i.e., one could enjoy daydreaming without being addicted to it, or vice versa – one could be addicted to the activity without finding it especially pleasurable). It seems that items assessing the extent to which daydreaming may be comforting and the urge to daydream may be understood differently in diverse groups. In other words, different cultures may diverge in their attitude towards absorption in fantastic imagery, and the wording of the items may be understood differently across translations regarding the tempting properties of this activity. Daydreaming is a natural and widespread phenomenon (Klinger, 1990), and both individuals and societies may differ in the degree to which they consider it shameful or a waste of time, or rather, a legitimate pastime. In other words, there may be more tolerance to daydreaming in some cultures compared to others. Indeed, some people have an ability for immersive daydreaming which is not necessarily maladaptive (West & Somer, 2020), and perhaps they may have different notions about their ability. Future studies could explore whether there are individual differences and culture-specific effects regarding the influence of one's urge to daydream on self-esteem, for example. Moreover, cultures may differ in the extent to which they are inclined to regard daydreaming as compulsive or addictive. Several domains of personality are related to the inclination for various behavioral addictions, such as internet addiction or exercise addiction (Andreassen et al., 2013). As scores on personality scales are also affected by cultural contexts (McCrae, 2001; Rolland, 2002), those cultural differences are also probably related to the inclination for certain behavioral addictions. For example, British samples tend to score very high on the "extroversion" trait (McCrae, 2002), which is positively correlated with Facebook addiction and compulsive buying (Andreassen et al., 2013). Also, British participants were higher than Italian participants in perceived dependence on

the use of mobile phones in a study spanning ten European countries (Lopez-Fernandez et al., 2017), and much higher than both Italian and Turkish participants in percentages of problematic internet users in a study spanning nine European countries (Laconi et al., 2018). Further study on cultural influences on addictive behaviors is needed to fully comprehend the meaning of these differences across countries. Importantly, future studies attempting to investigate the prevalence rates of MD in representative populations of different countries should beware of direct comparisons concerning the Yearning factor.

In sharp contrast to the cross-cultural differences found for Yearning, the factors of Impairment, Kinesthesia, and Music were found to be invariant on a metric level, suggesting that these psychological constructs have the same meaning across cultures. Indeed, the use of music and movement to trigger and maintain daydreaming seems to be a unique feature of MD that distinguishes it from normal daydreaming or common mind-wandering. Importantly, all participants seemed to comprehend questions assessing whether daydreaming interferes with their life in the same manner. This suggests that the word "maladaptive" in MD is perhaps its defining feature: the daydreaming itself and the temptation to engage in it may mean different things to different people, but what eventually pinpoints it as psychopathology is the fact that it impairs functioning. Indeed, the DSM-5 (APA, 2013) includes a dysfunction criterion in every disorder. The concept of MD even fits a more stringent definition of a mental disorder, specifically, Wakefield's (1992, 1999) "Harmful Dysfunction" theory. According to this approach, a phenomenon should be considered a disorder only if it satisfies two conditions: (1) it is valued as causing substantial harm to the individual or others, similar to the dysfunction criterion of the DSM (e.g., the individual perceives MD to interfere with life goals); and (2) it has a biological-intrinsic property of reflecting a dysfunction or failure in an evolutionarily designed adaptation (e.g., instead of using the system of daydreaming for a beneficial evolutionary purpose, such as to prepare for a later social encounter, it is used to replace it, thus

promoting eventual social isolation). Future research could assess whether the Impairment items of the MDS-16 are more sensitive than the Yearning items to identify clinical levels of MD.

Finally, scalar invariance was not demonstrated. It seems that the English-speaking samples were higher on all items of the scale. In hindsight, there seemed to be an over-representation of MD in the English-speaking groups despite similar sampling methods, as the English-speaking MD community is by far the largest (spanning several dozen thousand members, as detailed in the introduction section, whereas Italian and Turkish forums have only about several hundred members each). Notably, looking at the mean levels of the items in the different countries, it is clear that all of the different items were variant in the same direction (consistent with the notion of over-representation of MD in the USA and UK). The finding that all of these items are higher in high-MD samples, rather than just some of them, supports the overall validity of the MDS-16. However, as we do not know the exact proportion of participants sampled from MD communities compared to general communities in each of the countries, the data from the present study cannot determine whether there are cross-cultural differences in the level of MD. Large-scale epidemiological studies on representative community samples in different countries are needed to estimate the prevalence of MD and its possible cross-cultural invariance.

The central limitation of the present study is that we were not in a position to demonstrate cross-cultural scalar invariance, as the test was probably affected by an uneven distribution of MD versus community respondents in the subsamples. Additional limitations of this study should be acknowledged. First, the study did not assess the cross-cultural convergent and concurrent validity of the MDS-16. Second, demographic variables such as age, gender, and education were not distributed equally among countries and thus pose confounds. Specifically, older participants tended to come from English-speaking countries. Research shows that many older Americans use the internet (McMillan, Avery, & Macias, 2008); perhaps older citizens are more internet-savvy in English-speaking countries, although this is speculative. Additionally, the sample was heavily skewed towards female participants, raising issues of generalization. However, this sex ratio seems to represent other samples of MD respondents (e.g., Soffer-Dudek & Somer, 2018). Also, The Turkish and to some extent the Italian samples seemed to be more likely to have graduate degrees, and there were also differences in the proportion of clinical diagnoses. This is probably again related to the difference in the proportion of MD versus community respondents in the samples, as previous literature showed that MD have low functioning levels (high levels of unemployment, associations with problematic internet use) and high rates of psychiatric comorbidity (Somer, Soffer-Dudek, & Ross, 2017; Zsila et al., 2018, 2019). However, some of these differences may also reflect cross-cultural diversity; for example, whereas the majority (71.9%) of the Italian sample marked that they have no diagnosis, about 50% of the Turkish tended to mark that

they did not know whether they had one or not. This may reflect differences in cultural attitudes towards mental health rather than differences between samples in the prevalence of psychopathology. Similarly, gender-fluid participants were mostly from the USA, probably reflecting cultural differences that influenced the demographic composition of the sample, specifically, the social desirability of gender fluidity in English-speaking countries compared to Turkey.

Nevertheless, the study demonstrates several strengths: we sampled a large and international sample, including both self-proclaimed maladaptive daydreamers and community participants in all countries, that answered the same questionnaire, translated into the respective national languages. This procedure enabled the assessment of the latent factorial structure across cultures. On one hand, the study suggests that more research is needed to understand the similarities versus differences of maladaptive daydreamers' yearning and urges to daydream across different cultures, as it seems that there is variance across cultures in the compulsive/addictive component of yearning. On the other hand, the results of this study show that a similar latent structure holds across four different countries and that the psychological meaning of daydreaming turning maladaptive and interfering with life and the use of music and movement to enhance or maintain daydreaming are similar across national groups. It has recently been suggested that high-quality research in the field of behavioral addictions other than gaming and gambling is very much needed, to identify which behaviors with addictive potential may develop into a disorder (Rumpf et al., 2019). Our findings support the need for formal international recognition of this disorder in diagnostic manuals, and for the development of useful interventions to help those suffering from it.

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