Assessment

# The 4 Factors of Mind Wandering (4FMW) Questionnaire: content, construct, and clinical validity.



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# The *4 Factors of Mind Wandering* (4FMW) *Questionnaire*: content, construct, and clinical validity.


## Abstract

Despite great interest in Mind Wandering, a fully validated questionnaire has been lacking. The 4FMW Questionnaire, presented here, meets this demand. First, eighty items were judged for content validity by two panels of experts. Those items that survived this content validity assessment, were then tested using exploratory (EFA) and confirmatory factor (CFA) analyses on two independent samples of young adults. The sixteen resulting items were shown to cluster into four factors (i.e., Failure in social interaction, Failure in interaction with objects, Unawareness, and Inattention). The 4FMW questionnaire showed good reliability, robust structure, and acceptable goodness-of-fit indices, as well as good convergent validity with another Mind Wandering questionnaire. Importantly, the 4FMW questionnaire was able to discriminate between ADHD and OCD symptoms. The 4FMW Questionnaire is a reliable and valid instrument for assessing Mind Wandering in the young adult population.



## Keywords

Content Validity, Construct Validity, Clinical Validity, Mind Wandering, Psychometrics, ADHD, OCD


## Introduction

Mind-wandering (MW) is a familiar everyday experience in which attention becomes detached from the external environment (i.e., stimulus-independent; Antrobus, 1968; Teasdale et al., 1995; Teasdale, Proctor, Lloyd, & Baddeley, 1993; Stawarczyk et al., 2011) and untethered from current activities (i.e., task-unrelated; Giambra, 1989, 1995; Scerbo et al., 2005). Instead, in MW, the mind becomes focused on an internal train of thoughts (e.g., Schooler et al., 2014). MW can be unintentional (spontaneous) or intentional (deliberate). This distinction is related to the initiation of MW episodes rather than their maintenance (Smallwood, 2013) since the shift of attention from the external world to internal thoughts can be considered "uncontrolled" or "controlled" (Giambra, 1995): in the first case, a person is not meta-cognitively aware that they are mind-wandering; in contrast, the

second case involves a conscious moment of intention to initiate (or to continue) a mind-wandering episode (Seli, Risko, Smilek, and Schacter, 2016). Unintentional MW is broadly considered to be a failure in the executive control of attention instead of a controlled reorienting attention process (Villena-González & Cosmelli, 2020). It includes "crazy thoughts" that pop into the head, as in the evocative description in The Secret Life of Walter Mitty: "*The pounding of the cylinders increased: ta-pocketa-pocketa-pocketa-pocketa-pocketa*" (Thurber, 1939, p. 1). In contrast, intentional MW is not intrusive because attention has been voluntarily and inwardly reoriented. It does not interfere with task performance in the same way as intrusive thoughts. Indeed, it may contribute to creative thinking and incubation processes (Benedek & Jauk, 2018). According to Corballis (2012, p. 210) "*Walter Mitty exists in all of us, as our minds wander through landscapes often removed from the humdrum worlds that we actually inhabit*".

In the present study, we focus our attention on the phenomenon of unintentional or spontaneous MW, because this type of MW is associated with costly errors and accidents (e.g., Knowles & Tay, 2002), as well as difficulties in a variety of contexts, ranging from educational settings (Szpunar, Khan, & Schacter, 2013; Risko, Anderson, Sarwal, Engelhardt, & Kingstone, 2012) to the workplace (Knowles, & Tay, 2002). First, we examine the concept of MW and related constructs, and consider current approaches to measuring [unintentional] MW. Then, we propose a new tool to assess MW and test its reliability and validity. Our aim is to provide researchers with a sensitive and accurate instrument that enables them to identify salient aspects of the MW construct.

*Why does the mind wander – nearly half the time?*

Several researchers have tried to answer this question (e.g., Killingsworth & Gilbert, 2010; Shepherd, 2019) but the exact causes of MW have not yet been identified.

On the one hand, MW is considered to be a sort of "default" state of mind (e.g., Watkins's elaborated control theory, 2008; Klinger's concerns theory, 1971, 2009); on the other hand, following Smallwood & Schooler (2006), MW is deemed to be resource demanding. Commenting on these two

divergent points of view, McVay and Kane (2010), have suggested that MW draws on the same executive resources and mechanisms as executive control MW is not facilitated but rather controlled or stopped by using the executive-control system, such that MW episodes reflect failures of the control system (potentially due to the unavailability of executive resources for proper thought control). So, MW is avoided when control is proactively initiated and maintained in response to task demands or when control is reactively initiated to block or suppress task-unrelated thoughts as they are activated in response to cues.

Moreover, Smallwood (2013) outlined four hypotheses to explain the psychological basis of MW: the *current concerns* hypothesis ("*mental life is drawn to the most salient experiences, and so, whenever there is a dearth of salient external events, self-generated thought will form the focus of the mental experience of the individual*", p. 522); the *decoupling* hypothesis (during mind wandering, the brain's resources are shifted away from our surrounding environment and are redirected to our internal world in order to support our thoughts); the *executive failure* hypothesis (mind-wandering-associated mental content can be considered as a form of distraction, and so when the attention control system fails, task-irrelevant internally generated information arises); and the *meta-awareness* hypothesis ("*the absence of meta-awareness allow[s] attention to be decoupled from perception and so facilitate[s] self-generated thought",* p. 523).

Each of the aforementioned hypotheses has enjoyed support. None of them appears to have been more successful than any other, in terms of subsequent influence on the literature.

*Mind wandering measurements*

Generally, measures of MW have been collected using a) "*experience sampling*", in which a person is asked to report on their experience, that is, whether they are paying attention or mind wandering at random intervals in a laboratory setting or in the real world; and b) neurophysiological techniques (Smallwood & Schooler, 2015). Collection of self-reports can be achieved by: a) probe-capture methods (participants are intermittently interrupted and probed regarding the contents of their

experience, in a random or quasi-random way) b) self-report methods (participants are asked to spontaneously report when MW occurs), c) retrospective methods (data on MW is collected at the end of a task via questionnaires), and d) open-ended methods (MW is collected by asking participants to describe in their own words what they experienced during a task). Objective indices of MW are recorded in terms of the frequency of occurrence and durations of behaviors (Carriere, Cheyne, & Smilek, 2008; Cheyne et al. 2006; McVay & Kane 2009), through observation of physical posture (Carriere et al. 2013, Seli et al. 2014); divergent eye movements (Foulsham. Farley, & Kingstone, 2013, Reichle. Reineberg, & Schooler, 2010) such as greater pupil dilation (Franklin et al. 2013a; Smallwood et al. 2011, 2012) or more frequent eye blinks (Smilek, Carriere, & Cheyne, 2010); changes in electroencephalography (EEG) readings (Baird, Smallwood, Lutz, & Schooler, 2014, Barron, Riby, Greer, & Smallwood 2011; Smallwood, McSpadden, & Schooler, 2008); and changes in the blood-oxygen-level dependent (BOLD) signal recorded during fMRI (Allen et al. 2013, Christoff et al. 2009, Stawarczyk et al., 2011).

With respect to retrospective methods, the most commonly used MW questionnaires include: the Mind Excessively Wandering Scale (MEWS) (Mowlem et al., 2016), a unidimensional structure that detects mind wandering in attention-deficit/hyperactivity disorder (ADHD), based on patient descriptions of MW in ADHD; the Mind-Wandering Questionnaire (MWQ) (Mrazek et al., 2013), a five-item scale (single construct) based on the interruption of task-focus by task-unrelated thought, which has been validated across college, high school, and middle school students, and adapted for other languages, including Spanish (Salavera, Urcola-Pardo, Usán, & Jarie, 2017; Trigueros et al., 2019), Chinese (Luo, Zhu, Ju, & You, 2016) and Croatian (Kovačević, Ćurković, Gorjanski, & Matić, 2020). In the Italian context, Borella and colleagues (2017) developed the Mind-Wandering Questionnaire, a five-item scale designed to analyse cognitive failure in adults and older people. The psychometric information it collects offers internal consistency ($\alpha$=.90) and predictive validity (r=.54, p<.001) with the Mindful Attention Awareness Scale (MAAS, Brown & Ryan, 2009).

*Manifestations of Mind Wandering*

As stated above, Mind Wandering appears to reflect the unintentional engagement of internally focused thoughts and can have consequences on currently unfolding actions. Hence, there seems to be a considerable amount of overlap between so-called MW and other signs indicating detachment from focused attention, such as intrusive thoughts, rumination, attention related cognitive errors or cognitive failures, and unmindful attention and unawareness (e.g., Seli, Risko, Purdon, & Smilek, 2017; Smallwood & Schooler, 2015; Lopez et al., 2021).

Intrusive thoughts are unwanted thoughts that repeatedly crop up without warning, in the form of images, sounds, or statements, (Salkovskis & Campbell, 1994). They may be disturbing, distressing, and upsetting (Freeston, Ladouceur, Provencher, & Blais, 1995). What distinguishes them from rumination is that intrusive thoughts are usually troubling, and the person often tries to resist them, while ruminations are passive repetitive thinking about symptoms of distress and its causes, meanings, and consequences (Kollarik et al., 2020). However, ruminations rarely tend to go anywhere or lead to new insights. Intrusive thoughts also tend to feel ego-dystonic or separate from the self. Ruminations usually feel more ego-syntonic, or like they are taking place in one's own mind (Nolen-Hoeksema, 1991). In addition, Nolen-Hoeksema and colleagues (2007) demonstrated that rumination can indicate risk for the onset of psychopathologies, such as depression, recurrent binge eating, substance abuse, and obsessive–compulsive disorder (OCD). It is important to underline how intrusive thoughts are associated with OCD in the sense of obsessive thoughts that often accompany OCD (Seli, Risko, Purdon, & Smilek, 2017), and attention-deficit/hyperactivity disorder symptomatology (ADHD, Seli, Smallwood, Cheyne, & Smilek, 2015; Shaw & Giambra, 1993; Bozhilova et al.2020; Figueiredo & Mattos, 2021).

Attention related cognitive errors or cognitive failures occur during the performance of a task that a person would normally execute successfully in everyday life and they are characterized by concentration problems, memory loss, and decreased perception (Broadbent, Cooper, Fitzgerald, &

Parkes, 1982). Errors in action execution can even occur in routine tasks that have been performed without error many times (Broadbent et al.,1982; Klumb, 1995). Moreover, cognitive failures in action regulation are associated with unmindful attention and unawareness (Elfering, Grebner, & Ebener, 2015), because one's complete attention is not focused on experiences occurring in the present moment (Kabat-Zinn, 1994; Gregório & Pinto-Gouveia, 2013). These kinds of symptoms involve not paying sustained and receptive attention to either internal or external experiences (Bishop et al., 2004; Segal, Teasdale, Williams, & Gemar, 2002) and they promote maladapted functioning (Brown, West, Loverich, & Biegel, 2011).

So far, MW has been described as an essentially individual experience. However, there is evidence that MW is also a phenomenon that has implications in the domain of social and emotional relationships. Some studies link mind wandering to unhappiness (Killingsworth & Gilbert, 2010); others suggest it facilitates recovery from negative emotional states (Poerio, Totterdell, Emerson, & Miles, 2016; Ruby, Smallwood, Engen, & Singer, 2013). Poor executive control has a well-documented association with mind wandering (McVay & Kane, 2009; Skoranski, Coatsworth, & Lunkenheimer, 2019; Kanske et al., 2016) and predicts variation in positive-habitual thoughts. Together, this evidence suggests that the experience of mind wandering should be linked to the social dimension of thoughts, both self-focused and other-oriented, involving relationships between the self and others or with the world (Linz, Reena, Smallwood, Engert, & 2019). Moreover, emerging evidence illustrates links between stress, ongoing thoughts, and MW (McVay, Kane, & Kwapil, 2009; Crosswell, Coccia, & Epel, 2020). In daily life, most stressful situations do not take place in isolation, but rather arise from social situations including both ourselves and others, and as suggested by Link and colleagues (2019) further data should substantiate and reinforce the link with social relationships.

*The present study*

As stated by Wang and colleagues (2018, p.69) "*it is untenable to characterize mind wandering as a uniform experience"*. So, the present study stems from the analysis of a methodological problem:

the psychological tools that are available to measure MW deal with/investigate the dimensions of MW separately. It is important to go beyond this view: we need to develop a tool that gives the various manifestations of MW equal consideration.

This study aims to both develop and then test the psychometric properties of a new Mind Wandering Questionnaire, by examining its content, construct and clinical validity, and reliability in a sample of young adults. For this purpose, we collected an initial sample of 80 items, reflecting a broad range of MW experiences. We then asked two groups of experts (32 psychologists and psychotherapists, and 60 master students from a clinical psychology program trained in MW, respectively) to provide qualitative assessments. These groups confirmed that twenty-eight of the original 80 items had significant content validity. Subsequently, a group of 530 young adult participants were enrolled. We applied Exploratory factor analysis (EFA) to half, and Confirmatory Factor analysis (CFA) to the other half of the sample using a cross-validation approach (Knafl & Grey, 2007). The final version of the questionnaire, which we named the 4FMW Questionnaire (Four Factors Mind Wandering Questionnaire), was composed of 16 items. We next tested the questionnaire on a new sample of 70 young adults, to assess convergent validity with the MW Questionnaire of Borella and Colleagues (2017). Finally, we assessed the clinical validity of the tool by comparing the performance of a sample of 18 probable ADHD with 18 healthy participants, and the performance of 42 probable OCD and 42 healthy participants.



**Study I – Content Validity**

A pool of 100 test items was developed by the two Authors (X1, X2) to meet the need for a reliable and valid instrument for assessing unintentional or spontaneous Mind Wandering. Content validity refers to the degree to which the items of a test comprehensively represent a theoretical construct. To assure content validity, we first conducted an extensive review of the MW literature, which yielded a conceptual definition of the construct. We next developed a second cluster of items that provided a comprehensive and clinically meaningful description of MW, keeping the original 100 items in mind. After discussing the new items, the authors selected those that best represented

the construct and met the guidelines for item-writing (Martínez, Moreno, Martín, and Trigo, 2009; Bosco, 2003). This process led to the initial version of the questionnaire comprising 80 items.

## Method

We identified two panels of experts to conduct content evaluation of the questionnaire items: Panel 1 comprised 32 psychologists and psychotherapists (16 female, age M±SD: 47.25±8.13) who were implementing, among other methods, mindfulness-based cognitive therapy in their practice; Panel 2 included 60 master students from a clinical psychology program who had been trained in MW (56 female, age M±SD:23.83±3.01). The judgments made by these two panels were compared to check how they differed. The individual assessments were then pooled to compute overall ratings (see below). Finally, we assessed if the more highly rated items were representative of the target construct by determining the extent of overlap (or communality) between the MW domain and each item (Lawshe, 1975).

## Results

Each expert was asked to respond if the content of each item was "Essential", "Useful but not essential", or "Not necessary" for measuring MW. Responses from all panelists were then pooled and the total number indicating "essential" for each item was determined. Then, *"Performance on which item is perceived to be "essential" by more than half of the panelists"* (Lawshe, 1975, p. 567) was considered. Beginning from this assumption, the following formula for the *content validity ratio* (CVR) was employed:

$$CVR = \frac{(NE - \frac{N}{2})}{\frac{N}{2}}$$

in which *NE* is the number of panelists indicating "essential" and *N* is the total number of panelists. In the present case, for Panel 1 (32 members) a minimum CVR of 0.32 was required for a p= .05. Instead, a cautious value of 0.29 was adopted for Panel 2 (that is, the smallest value available in the table and suitable for a sample of 40 panelists for a p = 0.05).

Twenty-eight items surpassed the cut-off values across both the panels. Table 1 shows that CVR values ranged from 0.37 to 0.93 for Panel 1, and from 0.33 and 0.96 for Panel 2. As can be seen, both panels had broadly converging views. This was reflected in the mean CVRs across items, an indicator of overall test content validity, of 0.60 and 0.58, for Panels 1 and 2, respectively.

*Insert Table 1 here*

## Study II – construct validity

The purpose of Study II was to examine the psychometric properties of the pool of 28 items that had demonstrated high levels of content validity, by testing dimensionality and construct validity. Five hundred and thirty participants were randomly partitioned into two complementary subsets. We applied exploratory factor analysis (EFA) to one subset and then validated the analysis by applying confirmatory factor analysis (CFA) to the other subset. Each participant was assigned a uniform pseudorandom number generated by the Mersenne Twister algorithm (Matsumoto & Nishimura, 1998). These pseudorandom numbers were then ordered, thereby splitting the sample into two subsamples. An additional seventy young adults were recruited to run a convergent validity test, comparing the new scale with the MW Questionnaire of Borella and collaborators (2017).

*Exploratory Factor Analysis (EFA)*

### Method

*Participants*

Two hundred and sixty-five young adults (226 females, between 19 and 35 years of age; age M±SD: 23.22 ± 4.15) took part in the study. All participants were students at the University of Bari, were blind to the hypothesis of the study, and signed a consent form before participating. The participants were enrolled between November 2020 and February 2021. The local Ethical Committee of the Institution approved the study protocol. The mean level of education for the overall sample was 16.97 years (SD= 2.61 years).

*Materials and Procedure*

The twenty-eight items, based on a 5-point Likert-like scale from never (1) to always (5), were administered to the participants, together with a short general anamnesis requiring demographic information. The entire procedure was explained to the participants beforehand. Participants were assessed individually in a well-lit and quiet room without disturbances. Data were collected in a single session. The whole assessment lasted a maximum of ten minutes.

*Statistical Analysis*

The data were analysed using the R software packages *psych* (Revelle, 2017), MVN (Korkmaz, Goksuluk, & Zararsiz, 2016) and *lavaan* (Rosseel, 2011). The assumptions of normality, linearity, homogeneity, and homoscedasticity were checked to identify any violations. Measures of reliability and validity were obtained by measuring internal consistency (Cronbach's α) and performing exploratory factor analysis (EFA) according to Arifin's guidelines (2017). Following Hair and

colleagues (2010), an acceptable sample size for EFA, as well as for CFA, would include a number of observations equal to 5 times the number of observed variables, while a more acceptable ratio would be 10 times the number of observed variables. In the present study there were 265 observations for 28 observed variables.

**Results**

The data were not normally distributed at the multivariate level. The subsequent PAF extraction method was applied to deal with this non-normality. To check the suitability of the data for analysis, we applied the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (MSA) and found KMO was equal to 0.85, i.e., *meritorious* (Kaiser & Rice, 1974). Bartlett's test of sphericity was significant indicating significant correlations between the items ($\chi^2$= 2993.354; p< .001). Cronbach's alpha was used to examine the internal consistency of items. Any value above 0.7 is usually considered to indicate acceptable reliability value for any given scale (Kline, 1999). Here, the Cronbach's alpha of the total score of the scale, which comprised 28 items, was 0.87. To determine the number of factors, a parallel analysis was performed. A scree plot based on the data was compared to a scree plot based on randomly generated data (Brown, 2015). The best number of factors was the number of points above the intersection between the plots. The parallel-analysis scree plot suggested 7 factors.

*Insert Figure 1 here*

We next ran exploratory factor analysis (EFA). As stated above, the data were not normally distributed. For this reason, we chose principal axis factoring (PAF) as the extraction method, because it does not assume normality of data (Brown, 2015) and used the recommended rotation method, *oblimin* (Fabrigar & Wegener, 2012). The quality of items was then assessed; those that did not load adequately were not well-correlated with their factors. The starting point was to extract the number of factors equal to those suggested by the scree-plot (7). Six items did not load adequately, that is, above 0.30 (Hair et al., 2010). These items were: *3. Find your work interrupted by distracting thoughts*; *4. Cannot stop a train of thought*; *5. Find your mind wandering while you are working*; *6. Thoughts popping into your mind*; *13. Cannot concentrate because off-topic thoughts are on your mind*; *26. Find yourself easily distracted*. These six poorly performing items were removed before re-running the EFA analysis with 22 items. The number of factors was reduced to four in order to achieve the simple structure of the EFA, which requires at least three items to load on the same factor (Masha'al, Hayajneh, & Tawalbeh, 2021). Table 2 shows the higher factor loadings for each of the 4 components. In order to develop a slender tool, we chose the best four descriptors for each component

with adequate communalities, factor loadings, and low item complexity (Hardesty & Bearden, 2004; Bergkvist & Rossiter 2007; Drolet & Morrison 2001; Wanous, Reichers, & Hudy 1997).

*Insert Table 2 here*

The final version of the tool comprised 16 items and was called the 4FMW Questionnaire (Four Factors Mind Wandering Questionnaire). As seen in Table 3, the four factors were 1) *Failure in social interaction*, 2) *Failure in interaction with objects*, 3) *Unawareness,* and 4) *Inattention*. Next, we checked the internal consistency reliability of the factors extracted in the EFA with Cronbach's alpha. We ascertained the reliability of each factor separately by including the selected items per factor. The Cronbach alphas indicated very good internal consistency reliability (DeVellis, 2012, p. 95-96). The total scale reliability of the 4FMW Questionnaire was 0.82, which is considered very high. *Failure in social interaction and Failure in interaction with objects* seemed to share a certain remarkable amount of variance (r= 0.527), hence were correlated; *Failure in social interaction* and *Inattention* were also correlated (r= 0.456), albeit to a lesser extent.

*Insert Table 3 here*



*Confirmatory Factor Analysis (CFA)*

**Method**

*Participants*

Two hundred and sixty-five young adults, 227 females, between 19 and 35 years of age (age M±SD: 23.40 ± 4.97) took part in the study. The mean level of education for the overall sample was 16.74 years (SD= 2.51 years).

*Materials and Procedure*

Setting and materials were the same as in EFA.

*Statistical Analysis*

CFA was performed using maximum likelihood (ML) estimation to test the construct validity of the identified EFA structure and the fit of the 4FMW Questionnaire. The adequacy of fit was assessed using the relative chi-square ($\chi 2/df \leq 2$, Schreiber et al., 2006), Comparative Fit Index (CFI) $\geq 0.95$, Tucker-Lewis Index (TLI) $\geq 0.95$, Root Mean Square Error of Approximation (RMSEA) $\leq 0.05$, and standardized root mean square residual (SRMR) $\leq 0.08$.

## Results

CFA was used to test the construct validity of the identified four-domain factor structure of the 4FMW Questionnaire (see Figure 2). Since the standard chi-square test may not be a reliable indicator to model adequacy (Hu & Bentler, 1998), the relative chi-square fit index ($\chi 2$ /df) was also considered (values less than two have been suggested to represent "good" data-model fit, Ullman, 2001). The relative chi-square fit index for this model satisfied the recommended cut-off values, ($\chi 2$/df= 1.60). Accepted values were also found for four other "goodness of fit" indices: ($\chi 2$= 154.110; p≤ .001; CFI= 0.961; TLI= 0.952; RMSEA= 0.048; SRMR= 0.057), suggesting a good fit between the hypothesized model and the observed data (Hu and Bentler, 1999). The correlations between factors were also confirmed by CFA.

These results came from a post-hoc modification, using the modification indices. Actual model fit came from allowing the residual variances of Q18 and Q23, and Q21 and Q25 to be correlated. In our case, modifications were used sparingly (MacCallum, 1995), with the model improving after those coefficients were unconstrained. Theoretical justification for our choice was the similarity of items belonging to the same factor (Pan, Ip, & Dubé, 2017)

*Insert Figure 2 here*

Finally, convergent validity was tested in a sample of 70 young adults (age M±SD: 21.81 ± 1.05; education M±SD: 16.54 ± 1.33) to measure how closely the new scale approximated the MW Questionnaire of Borella and collaborators (2017). We found the two questionnaires were correlated (r= 0.73), demonstrating high association between the measures (recommended level: above 0.70, Carlson & Herdman, 2012).

## Study III – Clinical Validity

It is known that excessive spontaneous Mind Wandering is present in ADHD psychopathology (Mowlem et al., 2016). As shown by Shaw and Giambra (1993), the frequency of task-unrelated thoughts increases in young adults with a history of childhood ADHD diagnosis, compared to controls. Moreover, clinical observation suggests adults with ADHD have poorly controlled and excessive mind wandering (Asherson, 2005). Furthermore, reports of increased spontaneous mind wandering are associated with reports of increased OCD symptoms (Seli, Risko, Purdon, & Smilek, 2017). OCD symptoms and mind wandering both appear to reflect the unintentional engagement of internally focused thought; additionally, there seems to be considerable theoretical overlap between

these two constructs (e.g., Smallwood & Schooler, 2006). So, the aim of Study III was to test the clinical effectiveness of the 4FMW Questionnaire.

## Method

### *Participants*

A sample of 18 young adults with probable ADHD (P_ADHD,13 females, age M±SD: 21.89 ± 1.24; education M±SD: 16.33 ± 1.29) were enrolled in the study. They were compared to 18 controls (HC,13 females, age M±SD: 21.91 ± 1.24; education M±SD: 16.28 ± 1.48). The two groups did not significantly differ on mean age, t(34)= -0.24,p= .80, d= 0.00, or mean levels of education, t(34)= -0.11,p= .91, d= 0.00.

Furthermore, forty-two participants with probable OCD (P_OCD, 37 females, age M±SD: 21.29 ± 1.40; education M±SD: 15.79 ± 1.11) were compared with the same number of controls (HC, 37 females, age M±SD: 21.31 ± 1.42; education M±SD: 16.00 ± 1.34). In this case, too, samples were similar in terms of mean age, t(82)= 0.77,p= .93, d= 0.00, and mean levels of education, t(82) = 0.79,p= .43, d= 0.00.

All participants were students at the University of Bari, blind to the study hypothesis and were enrolled in the study in March 2021. They agreed to participate in more in-depth screening. They benefitted by obtaining a psychological report that gave them greater understanding of their cognitive behaviours and the way they approached issues at university, at work, and in their family and social lives.

### *Materials and Procedure*

The setting and most of the materials were the same as in the previous studies reported here. People were identified as probable ADHD according to their responses to the Ultra-short screening list for ADHD in adults (Kooij, 2013). Three or four questions were administered by a trainee: 1) Do you often feel restless? (for example: being nervous, having difficulty sitting still, fidgeting, doing a lot of exercise or being active); 2) Do you often act first and then think? (for example: blurting things out, spending too much money or being impatient); 3) Do you often have concentration problems? (for example: being easily distracted, not finishing things, being easily bored, forgetful, or chaotic). If the answer to questions 1 and/or 2 and/or 3 was yes, another question was posed: 4) Have you always been like this? (as long as you can remember, or for most of your life). If the answer to question 4 was yes, a further diagnostic assessment for ADHD was recommended to confirm the diagnosis (this further evaluation was not considered in the present study).

In order to identify probable OCD participants, the repetitive thoughts and behaviours domain of the DSM-5 Level 1 Cross-Cutting Symptom Measure–Adult (DSM XC, American Psychiatric Association, 2019) was first used. Respondents indicated how much (or how often) they had been bothered by each symptom in the prior two weeks using a five-point response scale (none, not at all to severe, nearly every day). If a score of 2 or higher was found for any symptom (Narrow et al., 2013), the DSM-5 Level 2—Repetitive Thoughts and Behavior—Adult measure, an adapted version of the 5-item Florida Obsessive-Compulsive Inventory (FOCI) Severity Scale (Part B), was also administered to assess the domain of repetitive thoughts and behaviours. Each item asked the individual (or informant) to rate the severity of the individual's repetitive thoughts and behaviours during the past 7 days. Each item on the measure was rated on a 5-point scale (i.e., 0 to 4) with different anchors for response categories depending on the item (i.e., how much time thoughts or behaviours occupied each day; how much distress these thoughts or behaviours caused; how hard it was to control them; and how much they interfered with life). The total score for the measure can range from 0 to 20, with higher scores indicating greater severity of repetitive thoughts and behaviours. The average total score reduced the overall score to a 5-point scale, rating the individual's repetitive thoughts and behaviour in terms of none (0), mild (1), moderate (2), severe (3), or extreme (4). The average total score was found to be reliable, easy to use, and clinically useful to the clinicians in the DSM-5 Field Trials. We considered participants with an average total score from moderate to extreme to have probable OCD.

**Results**

The Mann-Whitney U test was used to compare differences between two independent groups when the dependent variable was not normally distributed. In our case, we compared people with probable ADHD with healthy participants, and people with probable OCD with healthy participants in terms of their total scores and the single factors of the 4FMW Questionnaire.

*Insert Table 4 here*

As have in Table 4, the P_ADHD and P_OCD groups have the highest MW scores, overall; namely, they are the two groups with the highest mean rankings. The table shows the actual significance value of the U statistic for all comparisons and demonstrates that MW in the ADHD and OCD groups had significantly higher values than the control groups ($U= 23$, $p> .001$; $U= 71.50$, $p> .001$, respectively).

## General Discussion and Conclusion

The phenomenon of mind wandering occurs when attention is decoupled from an ongoing task and directed toward self-generated thoughts and feelings (e.g., Chin & Schooler, 2009; Smallwood & Schooler, 2006). It is associated with cognitive failures and sometimes accidents (Wagenaar, Hudson, & Reason, 1990). Indeed, as Luis Borges wryly noted, "*Blind to all fault, destiny can be ruthless at one's slightest distraction*" (1944, p.2).

The present study was prompted by the need to develop a new measure of unintentional or spontaneous Mind Wandering. Indeed, in the Italian context, the MW Questionnaire of Borella and collaborators (2017) mainly accounts for cognitive failures. Moreover, the instrument lacks factorial structure. The purpose of this study was to investigate the content, construct, and clinical validity of a new MW questionnaire, in a group of young adult participants.

The development of the 4FMW Questionnaire was based on current knowledge of MW and its sub-dimensions. When developing the new scale, we were careful to include items that described intrusive thoughts, rumination, attention-related cognitive errors or cognitive failures, unmindful attention, and unawareness. Two panels of experts – psychologists and psychotherapists, and trained master students – were employed to assess content validity. They found 28 items out of the initial pool of 80 to be appropriate and consistent with providing a comprehensive description of MW. Applying EFA to these 28 items, yielded a four-factor model with 16 items reflecting different dimensions of MW. The overall internal consistency of the 4FMW Questionnaire and that of each factor was good, ranging from 0.82 to 0.83. This model was confirmed by CFA and construct validity was also supported by the correlations between factors. Moreover, the 4FMW Questionnaire was correlated but not collinear with the MW Questionnaire of Borella and collaborators (2017), showing that it probably captures different content areas. Finally, a test of clinical validity suggests the tool has adequate diagnostic efficacy to discriminate probable ADHD and probable OCD participants from controls. Unfortunately, direct comparison between probable ADHD and probable OCD participants was not feasible due to the difference between the sample sizes. However, the tool generated consistent results, when comparing the two diagnostic subgroups with healthy controls.

The four factors of the 4FMW Questionnaire are *Failure in social interaction, Failure in interaction with objects, Unawareness,* and *Inattention*. *Failure in social interaction* and *Failure in interaction with objects* represent the outcomes of MW during interactions with other people and with objects such as personal belongings, respectively. To the best of our knowledge, this is the first time these two aspects of cognitive failure have been teased apart. Failure in social interaction reflects the social dimension of MW, which manifests as "*you talk to me and I don't listen to you*", or "*I talk to*

*you and I lose the train of thought*". *Unawareness* captures a lack of disposition to be aware of one's own feelings, thoughts, and proprioception (e.g., Carver, 2012). Finally, *Inattention* often manifests as a generally limited attention span, distractibility, or forgetfulness (e.g., Chervin et al., 2002). This lack of ability to focus on a given task, event, or situation interferes with individual cognitive functioning.

A limitation of the present findings is that the studies were conducted on a convenience sample mostly composed of females. Despite this limitation, several implications of our findings, including for future directions in research and clinical practice, should be highlighted. First, the results of this study provide evidence for the need to carefully investigate the theoretical structure of Mind Wandering. Moreover, this new questionnaire allows researchers to study *Failure in social interaction* and *Failure in interaction with objects*, separately. It could be well-adapted and useful for investigating special groups, in psychodiagnostic settings, including for testing people with neurodevelopmental and neurocognitive disorders, and in a variety of clinical and educational contexts. Indeed, it is likely that inattention/distraction, linked to relationships with people and objects, respectively, could be differentiated in certain disorders. Additionally, the questionnaire could be helpful for monitoring social failure within psychosocial interventions based on the creation of socially stimulating environments (Craig-Unkefer & Kaiser, 2002). Second, the model structure needs to be confirmed on an elderly sample. It could be useful for evaluating how Mind Wandering and associated distractions increase the risk of potentially dangerous behaviours in elderly people in daily life (e.g., Spano et al., 2019). From a therapeutic perspective, increased awareness of ongoing actions increases the potential to correct and redirect such actions and thereby prevent indoor and outdoor accidents.

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**Table 1**. Content validity ratio (CVR) for Panel 1 and Panel 2. Indicators of overall test content validity (Mean CVR) for each panel.

| Items | **Panel 1** | **Panel 2** |
|---|---|---|
| | *CVR* | *CVR* |
| Q1. Do not remember what you were just told because you were not attentive | 0.69 | 0.56 |
| Q2. Do not remember part of a conversation you were following, realizing that you were not paying attention (e.g., during a television program, or when with friends or relatives) | 0.81 | 0.70 |
| Q3. Find your work interrupted by distracting thoughts | 0.81 | 0.63 |
| Q4. Cannot stop a train of thought | 0.50 | 0.53 |
| Q5. Find your mind wandering while you are working | 0.93 | 0.86 |
| Q6. Thoughts popping into your mind | 0.38 | 0.46 |
| Q7. Have made a mistake because your mind is elsewhere | 0.75 | 0.83 |
| Q8. Lose the thread of the discourse because, while you were talking, you were thinking of something else | 0.88 | 0.90 |
| Q9. Are not aware of what you are doing because you have concerns/worries, you are distracted, or you are daydreaming | 0.53 | 0.73 |
| Q10. Think how hard it is to concentrate | 0.50 | 0.33 |
| Q11. Find your mind so crowded with thoughts that you can't finish your work | 0.50 | 0.43 |
| Q12. Find yourself wondering if you completed the action you just did (e.g., if you locked the car before going into a shop) | 0.38 | 0.40 |
| Q13. Cannot concentrate because off-topic thoughts are on your mind | 0.63 | 0.86 |
| Q14. Go past place you wanted to go to, while you were running errands, because you were thinking about something else (e.g., going past a certain shop, or passing a road you should have taken) | 0.50 | 0.53 |
| Q15. Taking something different from the thing you needed (e.g., to take wine instead of milk from the fridge) | 0.43 | 0.40 |
| Q16. Are not able to focus your attention on what you’re reading, and to have to read again | 0.75 | 0.96 |
| Q17. Put back an object in the wrong place (e.g., put the keys in the wardrobe) | 0.38 | 0.40 |

| | | |
|---|---|---|
| Q18. Daydream while you should be focusing on listening to someone | 0.69 | 0.86 |
| Q19. Skip an essential step in completing a task (e.g., to forget to switch the stove off after removing the pot or pan) | 0.69 | 0.40 |
| Q20. Have taken a wrong turn on a familiar road | 0.50 | 0.40 |
| Q1. Realize you were doing or did something without thinking about it | 0.63 | 0.60 |
| Q22. Are not aware of what is happening around you | 0.44 | 0.56 |
| Q23. Realize that you have read a few lines of a text without concentration and do not remember anything and so to have to read that part all over again | 0.75 | 0.83 |
| Q24. Start to talk to someone and realize you do not know remember your starting point and what you wanted to say exactly | 0.37 | 0.33 |
| Q25. Do jobs or tasks automatically, without being aware of what you are doing | 0.68 | 0.36 |
| Q26. Find yourself easily distracted | 0.44 | 0.90 |
| Q27. Are not aware of how you got home or what route you took home | 0.68 | 0.40 |
| Q28. Have walked into a room to look for something but can't remember what | 0.38 | 0.40 |
| *CONTENT VALIDITY INDEX (Mean CVR)* | *0.60* | *0.58* |

*Note: p = .05*

**Table 2**. Exploratory factor analysis, four-factor model, 22 items (N = 265) including factor loadings, communality, and item complexity.

| Items | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Communality | Item Complexity |
|---|---|---|---|---|---|---|
| Q1. Do not remember what you were just told because you were not attentive | **0.737** | 0.021 | -0.014 | 0.029 | 0.5787 | 1.01 |
| Q2. Do not remember part of a conversation you were following, realizing that you were not paying attention (during a television program, or when with friends or relatives) | **0.709** | -0.051 | 0.026 | 0.157 | 0.5924 | 1.11 |
| Q24. Start to talk to someone and realize you do not know remember your starting point and what you wanted to say exactly | **0.668** | -0.016 | -0.006 | 0.025 | 0.4502 | 1.00 |
| Q8. Lose the thread of the discourse because, while you were talking, you were thinking of something else | **0.624** | 0.073 | -0.009 | 0.069 | 0.4888 | 1.05 |
| Q28. Have walked into a room to look for something but can't remember what | 0.431 | 0.368 | 0.040 | -0.202 | 0.4160 | 2.43 |
| Q12. Find yourself wondering if you completed the action you just did (e.g., if you locked the car before going into a shop) | 0.401 | 0.256 | 0.002 | -0.042 | 0.3151 | 1.72 |
| Q7. Have made a mistake because your mind is elsewhere | 0.338 | 0.334 | 0.067 | 0.091 | 0.4121 | 2.22 |
| Q14. Go past place you wanted to go to, while you were running errands, because you were thinking about something else (going past a certain shop, or passing a road you should have taken) | -0.070 | **0.700** | 0.007 | 0.087 | 0.4825 | 1.05 |
| Q15. Taking something different from the thing you needed (e.g., taking wine instead of milk from the fridge) | 0.108 | **0.681** | 0.035 | -0.017 | 0.5514 | 1.06 |
| Q17. Put back an object in the wrong place (put the keys in the wardrobe) | -0.010 | **0.615** | -0.028 | -0.032 | 0.3583 | 1.01 |
| Q19. Skip an essential step in completing a task (to forget to switch the stove off after removing the pot or pan) | -0.010 | **0.601** | -0.017 | 0.104 | 0.3993 | 1.06 |
| Q20. Have taken a wrong turn on a familiar road | 0.043 | 0.493 | -0.037 | -0.070 | 0.2456 | 1.07 |
| Q21. Realize you were doing or did something without thinking about it | -0.077 | 0.026 | **0.795** | 0.109 | 0.6247 | 1.06 |
| Q9. Are not aware of what you are doing because you have concerns/worries, you are distracted, or you are daydreaming | 0.020 | 0.037 | **0.750** | -0.105 | 0.5895 | 1.05 |
| Q22. Are not aware of what is happening around you | 0.142 | -0.131 | **0.742** | -0.095 | 0.5798 | 1.17 |
| Q25. Do jobs or tasks automatically, without being aware of what you are doing | -0.096 | 0.094 | **0.643** | 0.085 | 0.4217 | 1.12 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Q16. Are not able to focus your attention on what you're reading, and to have to read again | 0.074 | -0.014 | -0.066 | **0.746** | 0.6129 | 1.04 |
| Q10. Think how hard it is to concentrate. | -0.004 | 0.026 | 0.082 | **0.654** | 0.4380 | 1.03 |
| Q18. Daydream while you should be focusing on listening to someone | 0.162 | 0.080 | -0.161 | **0.501** | 0.4207 | 1.49 |
| Q23. Realize that you have read a few lines of a text without concentration and do not remember anything and so to have to read that part all over again | 0.177 | 0.138 | 0.135 | **0.493** | 0.4581 | 1.60 |
| Q11. Find your mind so crowded with thoughts that you can't finish your work | 0.150 | 0.112 | 0.107 | 0.239 | 0.1731 | 2.64 |
| Q27. Are not aware of how you got home or what route you took home | -0.005 | 0.227 | 0.127 | 0.110 | 0.0981 | 2.08 |

**Table 3**. Summary table, including factor loadings, communalities, Cronbach's alpha, and factor correlations.

| Factor | | Item | Factor Loading | Communality | Cronbach's alpha |
|---|---|---|---|---|---|
| *Failure in social interaction* | fc1 | Q1 | **0.737** | 0.5787 | 0.820 |
| | fc2 | Q2 | **0.709** | 0.5924 | |
| | fc3 | Q24 | **0.668** | 0.4502 | |
| | fc4 | Q8 | **0.624** | 0.4888 | |
| *Failure in interaction with objects* | fa1 | Q14 | **0.700** | 0.4825 | 0.820 |
| | fa2 | Q15 | **0.681** | 0.5514 | |
| | fa3 | Q17 | **0.615** | 0.3583 | |
| | fa4 | Q19 | **0.601** | 0.3993 | |
| *Unawareness* | ua1 | Q21 | **0.795** | 0.6247 | 0.830 |
| | ua2 | Q9 | **0.750** | 0.5895 | |
| | ua3 | Q22 | **0.742** | 0.5798 | |
| | ua4 | Q25 | **0.643** | 0.4217 | |
| *Inattention* | in1 | Q16 | **0.746** | 0.6129 | 0.820 |
| | in2 | Q10 | **0.654** | 0.4380 | |
| | in3 | Q18 | **0.501** | 0.4207 | |
| | in4 | Q23 | **0.493** | 0.4581 | |

Factor correlations:

*Failure in social interaction* ↔ *Failure in interaction with objects* r = 0.527

*Failure in social interaction* ↔ *Unawareness* r = 0.107

*Failure in social interaction* ↔ *Inattention* r = 0.456

*Failure in interaction with objects* ↔ *Unawareness* r = 0.117

*Failure in interaction with objects* ↔ *Inattention* r = 0.292

*Unawareness* ↔ *Inattention* r = -0.052

**Table 4**. Group differences between probable ADHD (P_ADHD) and controls (HC); probable OCD (P_OCD) and controls (HC), (Mann-Whitney tests).

| 4FMW Questionnaire | Group Belonging | Sample proportion | Mean Rank | Sum of Rank | Mann-Whitney U test |
|---|---|---|---|---|---|
| Failure in social interaction | HC | 18 | 12.69 | 228.50 | 57.50 |
| | P_ADHD | 18 | 24.30 | 437.50 | p<0.001 |
| Failure in interaction with objects | HC | 18 | 12.19 | 219.50 | 48.50 |
| | P_ADHD | 18 | 24.80 | 446.50 | p<0.001 |
| Unawareness | HC | 18 | 10.94 | 197 | 26 |
| | P_ADHD | 18 | 26.05 | 469 | p<0.001 |
| Inattention | HC | 18 | 11.56 | 208 | 37 |
| | P_ADHD | 18 | 25.44 | 458 | p<0.001 |
| Total score | HC | 18 | 10.78 | 194 | 23 |
| | P_ADHD | 18 | 26.23 | 472 | p<0.001 |
| Failure in social interaction | HC | 42 | 24.88 | 1045 | 172 |
| | P_OCD | 42 | 60.12 | 2525 | p<0.001 |
| Failure in interaction with objects | HC | 42 | 30.83 | 1295 | 392 |
| | P_OCD | 42 | 54.16 | 2275 | p<0.001 |
| Unawareness | HC | 42 | 25 | 1050 | 147 |

| | | | | | |
|---|---|---|---|---|---|
| | P_OCD | 42 | 60 | 2520 | p<0.001 |
| Inattention | HC | 42 | 24.68 | 1036.50 | 133.50 |
| | P_OCD | 42 | 60.32 | 2533.50 | p<0.001 |
| Total score | HC | 42 | 23.20 | 974.50 | 71.50 |
| | P_OCD | 42 | 61.80 | 2595.50 | p<0.001 |

**Figure 1**. Parallel Analysis Scree Plot.

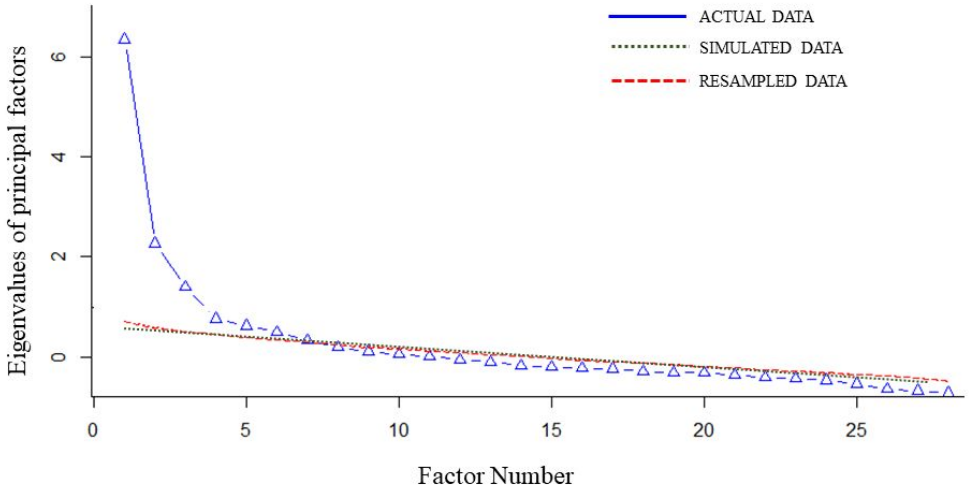

**Figure 2**. 4FMW Questionnaire: 4-domain confirmatory factor model, including factor correlations. FC = Failure in social interaction, FA = Failure in interaction with objects, UA = Unawareness, IN = Inattention.