

RELATIONSHIPS BETWEEN MEDITATION DEPTH, ABSORPTION, MEDITATION PRACTICE, AND MINDFULNESS: A LATENT VARIABLE APPROACH

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ABSTRACT: Meditation experiences evolve along a spectrum, ranging from an effortful struggle with the technique to deep transpersonal states where all dualities dissolve. The present study investigated to what extent the depth of meditation is influenced by the amount of meditation practice and the personality trait of absorption, and whether deep experiences influence the mindfulness of meditators in everyday life. A set of questionnaires (Meditation Depth Questionnaire, Tellegen Absorption Scale, and Freiburg Mindfulness Inventory) was distributed to meditators (N = 251) practicing different techniques. A structural equation modeling analysis revealed that absorption exerted a stronger influence on meditation depth (path coefficient: .48) than the amount of meditation practice (path coefficient: .21). Mindfulness was strongly influenced by meditation depth (path coefficient: .42) and moderately by absorption (path coefficient: .21). These complex relations between practice, personality, meditation experiences, and everyday behavior should be considered in future research on transpersonal states induced by meditation.

Insight into our true nature is an ultimate goal of all spiritual traditions. In many mystical traditions, meditation practice is one primary approach to reach transpersonal states of non-duality denoted with a variety of terms (*unio mystica*, *samadhi*, *nirvana*, *satori*, *transcendental consciousness*). During the deepest states of meditation, profound changes in the perception of reality and the self occur (Gifford-May & Thompson, 1994). Irrespective of the meditation technique, advanced practitioners report rather similar experiences, which can be arranged along a dimension of *meditation depth* (Piron, 2001). This dimension is conceived as a spectrum ranging from an effortful struggle with the requirements of the chosen technique to the realization of the fundamental ground of all being, where all dualities dissolve (Piron, 2001). In the current study on meditation experiences, the concept of meditation depth is used as the key component, because it takes into account the differences in experiences between individuals and can be assessed quantitatively. From the perspective of meditation research the question as to which factors determine the progress of meditation is intriguing. Traditional teachings emphasize the importance of regular practice, e.g. the yoga sutras of Patanjali (sutra I.14; Vivekananda, 2001). However, the amount of practice required to reach deep meditations also depends on the inclination and openness towards mystical states, i.e., it is a matter of personality. In this respect, the personality trait of *absorption* is highly relevant, because it includes the openness for mystical states (Tellegen & Atkinson,

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1974) and the meditative skill to focus on an object without being disturbed (Smith, 1987), which is a key requirement for successful meditation.

A further interesting question concerning deep meditation experiences is their significance for everyday life. While an extensive body of literature exists on meditation and its effects (Murphy & Donovan, 1997; Shapiro & Walsh, 2003), the impact of deep experiences on everyday life has been rarely investigated. What are the consequences of transpersonal experiences during deep meditation? Are they only passing events or do they lead to sustained alterations of the mindset? Empirical research on these questions is scarce but it can be assumed that such experiences should influence a person's behavior and perspective on life. Anecdotal reports describe a variety of effects such as heightened awareness and less automatic behavior during daily routines, acceptance and appreciation of one's life, as well as a detached observer position that reduces reactions to distressing events and suffering in general (Hetherington, 2003; Kapleau Roshi, 1989).

Mindfulness is a key concept that comprises all these aspects and is increasingly considered relevant for clinical treatment modalities (Baer, 2003; Germer, Siegel, & Fulton, 2005). A growing number of people practice meditation and it is successfully applied for prevention and therapy of different psychological disorders (Grossman, Niemann, Schmidt, & Walach, 2004), but basic research is still at its beginning. Although literature on meditation research comprises far more than a thousand publications (Murphy & Donovan, 1997), complex interactions between variables such as the personality of practitioners, the regularity of meditation practice, deep meditation experiences and their effects are not yet sufficiently understood.

Here, we present a model that proposes specific relationships between these variables. The model is tested with empirical data of participants with different extents of meditation practice. Questionnaires that measure these specific variables were administered to a large sample of meditators in yoga centers. As we intended to investigate the relationship between latent constructs, the statistical method that is most appropriate is structural equation modeling (SEM).

In the next section, the different components of the model (latent constructs)—namely meditation depth, absorption trait, meditation practice, and mindfulness—as well as the expected relations between them will be introduced. We will then introduce the structural model that specifies these relations and tests the fit of the empirical data with the postulated model. Furthermore, the postulated restricted model will be extended by allowing additional relations between the variables. Thus, the fit of two alternative models can be compared.

DIFFERENT COMPONENTS OF THE MODEL

Meditation Depth

Most spiritual traditions and masters of meditation agree that different stages of meditation depth exist (Piron, 2001). Different analogies and models can be found in the spiritual traditions that illustrate stages of meditation depth. The story of the ox

and the herdsman in Zen, the eight stages of Yoga by Patanjali, and the seven mansions by Teresa from Avila are examples for analogies and models that are used by the different traditions to illustrate the meditative development. Although these traditions differ in the conceptualization of the stages, they resemble each other in the structure of the depth of experiences. Piron's investigation showed that experts from different traditions agree in their understanding of the dimension of depth.

Piron (2001) developed an instrument, the Meditation Depth Questionnaire (MEDEQ), a self-report questionnaire measuring the depth of meditative experiences. According to his work, meditative experiences can be placed into five stages along a dimension of increasing depth. Piron labeled the first of the five stages "hindrances". It covers difficulties in meditation like boredom, impatience, and problems with motivation and concentration. The second stage, "relaxation", contains a comfortable feeling, inner peace, and calmness. "Concentration", the third stage, describes the experience of being detached from thoughts, having a deep understanding or insight and feeling centered. The fourth stage, "essential qualities" includes feelings such as love, devotion, thankfulness, and connectedness. The last of the five stages is labeled "non-duality" and comprises the disappearance of cognitive processes and the experience of the unity of everything.

Absorption

The experiences that meditators have in meditation can be considered altered states of consciousness (Vaitl, Birbaumer, Gruzelier et al., 2005). People differ in the ease with which they enter altered states. Hereby, personality plays a crucial role in determining whether a person will easily experience altered states of consciousness or not. The trait of absorption addressing the openness for self-altering experiences was introduced by Tellegen and Atkinson in 1974.

Tellegen and Atkinson (1974; S. 268) defined absorption as "a disposition for having episodes of 'total' attention that fully engage one's representational (i.e., perceptual, enactive, imaginative, and ideational) resources". The focus of attention is either narrowed or widened, so that the person enters an altered state of consciousness. Inherent correlates of the state-like manifestations of the trait of absorption are a heightened sense of the reality of the attentional object, an imperviousness to normally distracting events, and an altered sense of reality in general and of the self in particular (Tellegen & Atkinson, 1974). Absorption includes aspects such as the susceptibility for (esthetical) appealing stimuli, synesthetic associations, a disposition for thinking in images, self-forgetfulness, vivid memory, and mystical experiences. The instrument to measure absorption is the Tellegen Absorption Scale (TAS; Tellegen & Atkinson, 1974).

From a theoretical perspective, it seems most likely that people with a high absorption trait are able to enter states of deep meditation more easily. To our knowledge, no empirical studies on the influence of personality on meditation depth have been published so far, but we assume that the trait of absorption exerts an influence on the depth of meditative experiences.

Meditation Practice

It has been shown that the depth of meditative experiences increases with the duration of meditation practice. That is, the more someone has practiced meditation, the deeper his or her meditative experiences will be. A study by Piron (2003) found a significant cross-sectional correlation between the amount of practice and the depth of meditation assessed with the MEDEQ. In addition, measurements were repeated in more than one hundred meditators after one year. Results showed that the increase of meditation depth was highly significant and yielded an effect size of 0.42.¹ Based on these results, we include the amount of meditation practice into the model as a further variable that influences the meditation depth. For the postulated model, we assume that absorption trait as well as the amount of meditation practice are the two relevant predictors for meditation depth.

In a cross-sectional study, Davidson, Goleman, and Schwartz (1976) found a difference in absorption scores (assessed with the TAS) between four groups of people with different amounts of meditation training, indicating an increase in TAS score from controls to long-term meditators. To test for the influence of meditation practice on the absorption trait, we included the path into the extended model, but not into the restricted model.

Mindfulness

Mindfulness is the core feature of the Buddhist insight meditation (Vipassana meditation). It has been described as a process of bringing a certain quality of attention to moment-to-moment experience (Kabat-Zinn, 1990; Buchheld, Grossman, & Walach, 2001). Following Bishop, Lau, Shapiro, et al. (2004), mindfulness comprises two components: self-regulation of attention and a specific orientation towards one's experiences. Attention is directed to immediate experiences, "thereby allowing for increased recognition of mental events in the present moment" (p. 232). The attitude towards the experiences is characterized by curiosity, openness, and acceptance.

In contemporary psychology, there has been substantial interest in the concept of mindfulness as an approach reducing cognitive vulnerability to emotional distress. Mindfulness has been adopted as an approach for increasing awareness and responding skillfully to mental processes that contribute to stress and maladaptive behavior. The mindfulness-based stress reduction program (Kabat-Zinn, 1982) that was initially developed for the management of chronic pain is now widely used to treat different emotional and behavioral disorders (Kabat-Zinn, 1998). In this training, mindfulness is first cultivated in formal meditation practice and then step by step transferred into everyday contexts.

Recently, Buchheld et al. (2001) developed an instrument to assess mindfulness in everyday life, the Freiburg Mindfulness Inventory (FMI). They conducted a pre-post design study and examined meditators' mindfulness scores with the FMI before and after insight meditation retreats. Scores after the course were significantly higher than before the retreat.

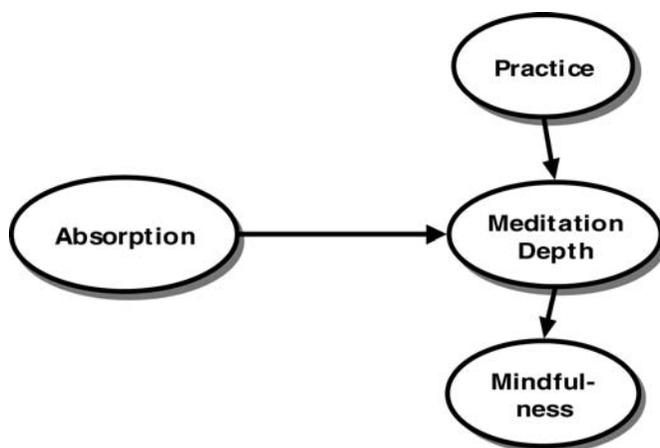


Figure 1. Structural (restricted) Model for the Experiences in Meditation (Meditation Depth), their Antecedents (Practice, Absorption) and Effect (Mindfulness).

The results reported by Buchheld et al. (2001) are specific for insight meditators. However, we assumed meditation to have a positive influence on mindfulness in everyday life also in our sample, because a mindful attitude, the nonjudgmental focus on the present moment, is also emphasized as a goal of meditation practice in yoga tradition (Sivananda Yoga Vedanta Center, 2000). The influence of meditation practice was expected to be mediated by meditation depth, because experiences of deep emotional significance and changed reality perception could result in heightened awareness and a “deautomatization” (Deikman, 1966) of routine behavior. In the extended model, the additional direct influence of absorption and the amount of meditation practice on mindfulness in everyday life was tested.

An Integrated Model of Meditation

Figure 1 gives an overview of the assumed causal structure between the variables in order to summarize the restricted model of meditation tested in the study.

The depth of meditation was assumed to be influenced by the personality trait absorption on one hand and by the amount of meditation practice on the other hand. Meditation depth was assumed to influence mindfulness in everyday life.

We first tested the model as depicted in Figure 1, since this structure appeals most, considering the relevant literature. As additional influences between the variables are conceivable, an extended model was specified allowing for all possible connections between the latent variables (c.f. Figure 2). Therefore, paths were included to model the direct influence of the variables practice and absorption trait on mindfulness not mediated by the meditation depth. Furthermore, the path from meditation practice to absorption trait was included to test the influence implicated by the results of Davidson et al. (1976). The possibility of a mutual influence of the variables will be addressed in the discussion.

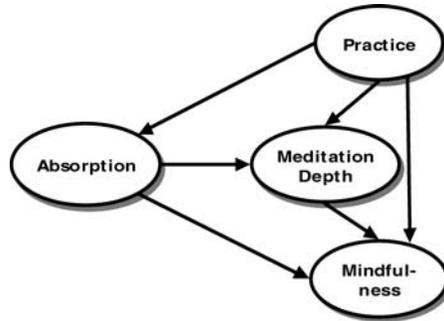


Figure 2. Extended Structural Model for the Experiences in Meditation (Meditation Depth), their Antecedents (Practice, Absorption) and Effect (Mindfulness).

METHOD

Sample

Participants were recruited among the yoga students of Yoga Vidya, a German yoga school in the tradition of Swami Sivananda, a well-known yoga master from Rishikesh/India, and his disciple, Swami Vishnu Devananda. All 15 urban yoga centers in Germany and Switzerland and two retreat centers were included. Questionnaires were sent to the centers and distributed to meditators. Urban centers received 50 questionnaires each, the two retreat centers 150 and 300 questionnaires, respectively (1400 questionnaires in total). Within three months, 251 completed sets of questionnaires were returned. The rather low return rate was due to the fact that only few questionnaires were actually handed out to meditators, because the number of serious and regular meditators was not very high among the yoga students, who were often primarily engaged in the body-oriented Hatha-yoga exercises. However, the exact number of distributed questionnaires is unknown.

The majority of participants were female (73%). The reason for the unequal distribution of sex was most likely due to the generally higher rate of female yoga practitioners. The age of participants ranged from 20.8 to 70.5 years (months transformed into decimal values of years) with a mean age of 40.7 years (standard deviation: 10.4 years).

Forty-three percent of the participants indicated that they belonged to no religious denomination. A similar percentage belonged to one of the two Christian churches that are predominant in Germany (24% protestant, 22% catholic). Seven percent marked that they belonged to more than one denomination; Buddhist and others reached 3%.

Meditation Experience of the Participants

The duration of meditation practice ranged from only some days to 50 years. The average meditation practice was 4.7 years. For 17 participants, the duration of meditation practice was unknown.

The average length of a meditation session ranged from 5 up to 200 minutes, the mean being 30 minutes. The majority of the participants reported meditating once to twice daily (mean: 1.3 sessions per day), while some participants meditated up to five times a day. Not all of the participants meditated every day; responses ranged from daily practice to one session per week (mean: 5.3 sessions per week).

Most of the participants (45%) practiced a meditation technique based on the teachings of Swami Sivananda, Swami Vishnu Devananda, or a meditation practice taught by Yoga Vidya teachers. Forty-three percent of the participants made no specific response concerning the teacher and 17% of the meditators named other teachers, such as Maharishi or Goenka (multiple responses were possible).

The meditation techniques, which were practiced by the meditators, cover a wide range: 47% mantra meditation, 14% “silent” meditation, 10% concentration on the breath, 9% Vipassana- or mindfulness meditation, 5% meditation for expansion, 4% each, concentration on the chakras, energy meditation, and “meditation on the attributes” as well as 3% meditation on light. Thirty-four percent of the respondents named more than one technique; 6% made no response. However, an open answer format was given for the assessment of meditation techniques that had been practiced by the participants. Techniques were labeled in different ways and coding was sometimes ambiguous. We therefore refrained from analyzing differences between the subgroups of meditators practicing different techniques.

Meditation Techniques

A description of the most frequently named meditation techniques follows below. With the exception of mindfulness meditation, the techniques originate from the yogic tradition. For a more detailed description of meditation as taught by Swami Sivanada, see Swami Vishnu Devananda (1999).

Meditators typically sit in a comfortable cross-legged position with a straight back, keeping their eyes closed. For most of the techniques, the meditator is instructed not to change the breathing pattern, but solely to become aware of its natural pace and quality. Upcoming thoughts should be noticed, but not elaborated. When realizing that thoughts are coming up, the meditator should patiently redirect his attention to what he focuses on.

Mantra Meditation. A mantra is a word or phrase, a “mystical energy encased in a sound structure” (International Sivananda Yoga Vedanta Centers, 1989). It is stated that, when repeated in meditation, it will bring the individual to a higher state of consciousness (Sivananda Yoga Vedanta Center, 2000). For the yogic meditation practice, typically, a Sanskrit mantra is chosen. Common mantras are “om”, “soham”, and “om namah shivaya”. In the *Simple mantra meditation*, as taught by Yoga Vidya, the mantra is silently repeated with each inhalation and with each exhalation.

Meditation for Expansion. For the technique of expansion, the awareness is systematically directed to the different sides of the body. Beginning with the bottom side, the meditator feels those parts of the body that touch the ground. He then

imagines the parts to expand into the ground with every exhalation. He experiences the body to become wider and the body's energy to expand. This is done for all sides of the body. The breath is used to direct the awareness into the expansion.

Meditation on the Attributes. The aim of this technique is to strengthen a positive character trait. The meditator chooses a character trait that he wishes to cultivate and forms an affirmation, such as "I am brave" or "I am self-confident". He then silently repeats the affirmation. After some time, he starts contemplating about the character-trait. He, for example, thinks about the advantages and positive effects of braveness. Furthermore, he visualizes himself in situations where he makes use of the strong character trait and finally ends the meditation with the intention of realizing the trait in everyday life.

Light Meditation ("Tratak"). For light meditation, in Sanskrit "Tratak", a candle is placed about two to five meters in front of the meditator. The eyes are first kept open and the meditator gazes into the flame and "absorbs" the light. After watching the flame for some time, the meditator closes the eyes. He might then see the after-image of the flame, shades and lights or images. Without any expectation, he observes, what is there. Each session comprises times in which the eyes are kept open and times in which they are kept closed.

Energy Meditation. For energy meditation, the person sits with the spine erect and keeps the whole body very relaxed. He first imagines light and energy to flow into the body from the top of the head, the fontanel. Expanding the abdomen with each inhalation and contracting it with the exhalation, the meditator accumulates energy in the abdomen. He then guides the energy down to the lower end of the spine from where it is sent up through the spinal column into the head with the exhalation. A complete circle is created by sending the energy down to the lower end of the spine with each inhalation and up to the head with each exhalation.

Mindfulness Meditation. Mindfulness or insight meditation is a technique that stems from Buddhism. Its basic feature is a non-judging, non-manipulating observation of mental processes. The meditator is aware of whatever comes up in the mind – emotions or cognitions – but he refrains from analyzing or conceptualizing. The meditator first observes the breath (anapana-sati) and then systematically "scans" the body (vipassana meditation), to become more and more aware of feelings and sensations. The awareness is at first on a gross level of body sensations, and then, with growing experience, it is directed towards more and more subtle aspects of body sensations. A systematic approach of the technique was developed by S.N. Goenka (Hart, 1987).

Silent Meditation. The term "silent meditation" is, in the context of Yoga Vidya, used to refer to meditation sessions without direct guidance or instructions. Meditators sit with eyes closed and in silence and practice the technique which most appeals to them in that moment. It is therefore not possible to determine, which technique exactly was practiced, when participants reported to practice silent meditation.

Questionnaires

The set of questionnaires used in the study includes the *Meditation Depth Questionnaire* (Piron, 2001), the short version of the *Freiburg Mindfulness Inventory* (Walach, Buchheld, Buttenmüller, Kleinknecht, & Schmidt, 2006), and the German version of the *Tellegen Absorption Scale* (Tellegen & Atkinson, 1974) published by Ritz and Dahme (1995).

Meditation Depth Questionnaire (MEDEQ). The MEDEQ contains 30 items about experiences in meditation. The fit of these statements is rated referring to meditations of the last week, with the scale ranging from 0 (*not at all*) to 4 (*very much*). Responses are summed up to a total score for the dimension of meditation depth. Piron (2001) showed that the items of the questionnaire can best be interpreted in terms of a five-cluster solution:

1. Hindrances. Restlessness, busy mind, laziness, boredom (e.g. “I felt bored.”)²
2. Relaxation. Feeling well, smooth breathing, increasing patience and calmness (e.g. “I became more and more calm and patient.”)
3. Concentration. Being detached from thoughts, attentive control over the mind, feeling of centeredness, strong energy, insight, inner peace, and equanimity (e.g. “I experienced equanimity and inner peace.”)
4. Essential Qualities. Transcendence of method, form and time; clearness, wakefulness, love, devotion, connectedness, surrender, grace, thankfulness, unconditional self-acceptance, infinite bliss (e.g. “I experienced boundless joy.”)
5. Non-duality. Disappearance of cognitive processes such as thinking, comparing, discriminating, judgments and perceptions of emotions and sensations; unity of all; emptiness and infinity of consciousness; dissolution of the subject-object dichotomy (e.g. “I felt myself at one with everything.”)

Piron (2001) reported that a factor analysis revealed a one-dimensional structure of the MEDEQ, with all items except item no. 3 loading strongest on a single factor, which explains 69.5% of the total variance. Item no. 3 was therefore omitted for the generation of the total score. The internal consistency of the questionnaire is high: Cronbach’s $\alpha = 0.92$ and item discrimination indices range from $r_{it} = .72$ to $r_{it} = .93$.

Regarding the validity of the questionnaire, content validity was achieved by involving expert ratings in the process of item construction. Convergent validity exists with another questionnaire, which measures the depth of meditation experiences (Ott, 2001) and with the Meditation Development Index by Engel (1997). Discriminant validity was confirmed with a personality inventory, *Trierer Persönlichkeitsfragebogen* (TPF; Becker, 1989) and the *Symptom Check List* (SCL-90-R; Franke, 2002).

The levels of meditation depth are not specific to only certain meditation traditions, but seem to be universal: the depth of the expressed experiences was rated by 40 experts from different meditation schools with high concordance. Furthermore, meditators from different traditions did not differ in their mean scores.

Freiburg Mindfulness Inventory (FMI). The FMI (Walach et al., 2006) is an instrument measuring mindfulness in everyday life. The long version of the questionnaire consists of 30 items. It is very specific to mindfulness meditation (Vipassana) and the authors suggest employing it “among individuals who have had some prior exposure to the practice of mindfulness meditation” (Buchheld et al., 2001, p. 27). The short version, which comprises only 14 items, is less specific to mindfulness and the authors recommend using it for general populations without previous experience with mindfulness meditation (Walach et al., 2006). Items describe attributes of mindfulness, for example: “I am open to the experience of the present moment,” “I sense my body, whether eating, cooking, cleaning or talking,” and “I accept unpleasant experiences.” Items are rated on a 4-point Likert-type scale.

Item construction was based on German and English literature on mindfulness meditation. For the test development, expert ratings from well-experienced meditation teachers were obtained to check the item formulation. The long version of the questionnaire was employed in an investigation of meditation seminars. Significant increases in the scores after the course as well as the way of item construction denote a good validity of the questionnaire. The internal consistency of the scale is sufficient (Cronbach’s $\alpha = 0.86$).

Tellegen Absorption Scale (TAS). Within a series of factor-analytic investigations, Tellegen and Atkinson (1974) developed the TAS for the measurement of absorption. Tellegen (1992) reports a factor analysis based on a large sample ($n = 2000$) that yields a six factor structure of the questionnaire. Three factors, labeled “responsiveness to engaging stimuli” (e.g. “I can be deeply moved by a sunset.”), “synesthesia” (e.g. “I find that different odors have different colors.”) and “enhanced cognition” (e.g. “I often know what someone is going to say before he or she says it.”) each contain seven items. The factor “oblivious/dissociative involvement” contains six items (e.g. “When I listen to music I can get so caught up in it that I don’t notice anything else.”), “vivid reminiscence” three (e.g. “Sometimes I feel and experience things as I did when I was a child.”) and “enhanced awareness” four items (e.g. “I sometimes ‘step outside’ my usual self and experience an entirely different state of being.”). These six factors form one higher-order factor. However, the high correlations found between the factors (oblique rotation) point to a general absorption dimension and discourage the use of subscales (Tellegen, 1992).

A German version of the scale, which contains 34 items, was published by Ritz and Dahme (1995). Responses are marked on a 5-point rating-scale. Estimations for the reliability by split-half ($r_{tt} = 0.88$) and the internal consistency ($\alpha = 0.89$) are acceptable. Item discrimination indices are – with one exception (item 1: $r_{it} = .27$) – above $r_{it} = .30$.

Demographic Variables and Meditation Method. The set of questionnaires was supplemented by further questions concerning socio-demographic variables, such as age, sex, education, profession, marital status, and religious denomination. In addition, amount and style of meditation practice was assessed (years of practice, duration, frequency, method, and teacher) in an open answer format.

To obtain a measure for the amount of meditation practice, an estimation of the total hours of meditation (practice in weeks \times hours per week) appeared unreliable due to changing amounts of meditation practice over time. Instead, years of meditation practice was chosen to indicate *amount of practice*.

Method of Analysis: Structural Equation Modeling (SEM)

SEM is a multivariate method that permits the analysis of complex data. The method allows inspection of relationships between hypothetical constructs, which are non-observable, that is, latent factors (cf., Bollen, 1989; Maruyama, 1998). The hypothetical structure is tested for its fit with empirically gained data, using different goodness-of-fit statistics.

Goodness-of-fit Statistics. As the model fit cannot be determined by means of one single test, it is essential to simultaneously regard different goodness-of-fit statistics for the evaluation of the model (Bollen & Long, 1993; Mueller, 1996). The Chi-Square-Test (χ^2 -Test), Root Mean Square Error of Approximation (RMSEA), Goodness-of-Fit Index (GFI) and Adjusted Goodness-of-Fit Index (AGFI; Jöreskog & Sörbom, 1984), Non-Normed Fit Index (NNFI; Bentler & Bonett, 1980), and Comparative Fit Index (CFI; Bentler, 1990) were chosen for the evaluation of the structure in the study.

The χ^2 -test examines the congruence between the empirical covariance matrix and that generated for the postulated model. Because it is highly dependent on the sample size, the value has to be compared with the degrees of freedom of the model (Bollen, 1989). As there is no absolute standard, quotients of 2 or 3 are generally considered as *good* or as *acceptable* respectively.

The RMSEA regards the error of estimation in the population and it results from the minimum of the fit-function of the estimation of the model parameters, the sample size, and the degrees of freedom (Jöreskog & Sörbom, 1993). Following Browne and Cudeck (1993) an RMSEA of 0.05 can be considered a *good* fit and an RMSEA between 0.05 and 0.08 can be considered an *acceptable* fit. Taking the degrees of freedom into account, it satisfies the requirement for parsimonious models.

The GFI indicates how much of the total variance of the empirical matrix can be explained by the covariance specified by the model (Bollen, 1989) and thus equals the determination coefficient in a regression analysis. It should get close to “1” to indicate a good model. A value >0.95 is regarded sufficient. As the GFI favors complex models to parsimonious models, the AGFI, which takes the degrees of freedom into account, is used instead.

The NNFI expresses how much better the model fits in comparison to an independence model. Equally, the CFI refers to the discrepancy between the postulated and an independence model, which assumes the worst possible fit, but is standardized to a value between “0” and “1”. For both, NNFI and CFI, a *good* model fit lies above 0.95, an *acceptable* fit above 0.90.

A χ^2 -difference statistic was used for the comparison of the two models. χ^2 -

difference statistics measure the significance of the difference between two SEM models of the same data, in which one model is a nested subset of the other (cf. Bentler & Bonett, 1980), i.e., both models contain the same variables, but constraints are added for one of the models.

Specification of the Model in LISREL. The LISREL-model specified for the study included one confirmatory factor analysis for each of the three questionnaires. In order to reduce the number of parameters to be estimated, items were aggregated into parcels (for generation of item parcels cf. "Preprocessing of the data"). Factor loadings of the item parcels on the latent factors as well as the error variances were freely estimated by the program. The latent variable for meditation practice was directly accounted for by the years of practice. This means that the respective factor loading was fixed to 1 and the error variance to 0. In the structural model, which models the relationships between the latent variables, three coefficients were to be estimated by the program for the restricted model. Following the hypothetical assumptions, meditation depth was determined by absorption trait as well as by the amount of meditation practice. Accordingly, the path coefficients of the amount of practice and absorption trait on meditation depth were estimated. Furthermore, mindfulness in everyday life should directly be influenced by the depth of the meditation experiences. The corresponding coefficient was the third to be estimated in the structural model (cf. Figure 1). For the extended model, three more path coefficients were estimated, representing the influence of practice and absorption trait on mindfulness and the influence of practice on absorption (Figure 2).

Data were introduced in form of a covariance matrix and the estimation method chosen was the standard maximum-likelihood estimation (MLE) algorithm. MLE is considered a very robust estimation procedure, even when the prerequisite of multivariate normality is not strictly given (Bollen, 1989). According to Curran, West, and Finch (1996), skewness of ≥ 2 and kurtosis of ≥ 7 in the distribution of variables have to be considered problematic. For our data, only for the distribution of the amount of practice the assumption of normality was violated (skewness: 3.1; kurtosis: 14.6). However, Curran et al. (1996) showed that the MLE-based χ^2 -statistic tends to reject true models when the required normality is violated, rather than to accept misspecified models. According to Klein, Moosbrugger, and Schermelleh-Engel (2000), the application of a method that requires a multivariate normal distribution can in many cases be considered a methodical advantage even when requirements are not met, as it can more efficiently use statistical information contained in the data.

For statistical analysis, SPSS for Windows (Statistical Package for Social Sciences, Release 12.0.2., 2004. Chicago: SPSS Inc.) and LISREL (Linear Structural Relationships, Jöreskog & Sörbom, version 8.52, 1996) were used.

Preprocessing of the Data. Missing item responses were substituted by the mean value of the respective subscale within the questionnaire. For descriptive statistics and comparisons with previous studies, scale means and standard deviations were calculated for each questionnaire.

For the structural equation model, items were aggregated into parcels of several items for each questionnaire. This procedure served to reduce the number of parameters to be estimated. It would have been possible to estimate the model on the level of single items (and results show almost identical parameter estimations and fit), but as the sample size was too small, we decided to go for a solution with aggregated items.

For the TAS, items were grouped into six sub-scales, as identified by Tellegen (1992). The resulting classification is a solution with an inhomogeneous number of items per parcel. However, as these sub-scales resulted from factor analyses, we decided to maintain this approach.

For the FMI, items were grouped into four parcels according to their item reliability coefficient to obtain parcels that resembled each other with regard to their reliability.

For the MEDEQ, items differed substantially in their mean scores. We therefore decided to group them according to the parameter and assorted parcels in such a way that parcels maximally resembled in regard to the mean scores. Five parcels of six items each were aggregated. Item no. 3 was not excluded for the SEM analysis, since it loaded high on the general meditation depth factor in our data.

RESULTS

Descriptive Statistics

Meditation Depth. Item scores were summed up to the total score for meditation depth. The total score possibly ranges from zero to 116 points, because maximally 4 points can be gained per item (in order to assure comparableness to the study by Piron, 2001, item 3 was excluded). For the given sample, the mean total score of meditation depth was 66.24 points, with a standard deviation of 19.41. The mean score was close to that of the initial sample by Piron (2001). The mean score in Piron's sample was 62.56 (SD = 30.73) at the first measurement and 74.71 (SD = 26.88) after one year. In our study, skewness ($\gamma_2 = .055$; SE = .154) and kurtosis ($\gamma_2 = -.380$; SE = .306) showed that the distribution of MEDEQ scores was symmetrical, but rather platykurtic. The internal consistency of the scale was high (Cronbach's $\alpha = .94$). There were no sex differences ($t = -.94$; $df = 248$; $p = .35$) in total meditation depth scores, and no relevant correlation with age ($r = .042$; $p = .52$).

Absorption. Answers to the 34 items of the absorption scale were summed up to form the total score. The mean score of the total sample of meditators (76.49; SD = 21.24) was remarkably higher than that of the initial sample reported by Ritz and Dahme (1995), which had a mean score of 60.05 points (SD = 19.98). The gender difference they found (females = 66; males = 55) was not present in our sample of meditators (females = 76.2 (SD = 20.3); males = 77.1 (SD = 23.8); $t = 0.286$; $df = 103$; $p = .78$). Ritz and Dahme (1995) reported a negative correlation between age and TAS score, that was significant for the males only ($r = -.18$; $p < .05$). In our sample, equally, the correlation between age and absorption was only significant for males (males: $r = -.305$; $p = .013$; females: $r = -.145$; $p = .55$). Values of skewness

Table 1
Intercorrelations (r) Between Mindfulness Scores (FMI), Meditation Depth (MEDEQ), Years of Meditation Practice, and Absorption (TAS); the Diagonal Shows Reliability Coefficients of the Three Scales

	FMI	MEDEQ	Years of practice	TAS
FMI	.85	.510 (**)	.263 (**)	.354 (**)
MEDEQ		.94	.316 (**)	.410 (**)
Years of practice			—	.129 (*)
TAS				.92

(**) significance at the α -level of 0.01

(*) significance at the α -level of 0.05

($\gamma^2 = .114$; SE = .154) and kurtosis ($\gamma^2 = .229$; SE = .306) of the total absorption scores showed that the distribution of TAS scores did not significantly differ from a normal distribution. Internal consistency (Cronbach's $\alpha = .92$) was even slightly higher than reported by Ritz and Dahme (1995).

Mindfulness. Mindfulness in everyday life was assessed by the total score of the short version of the FMI. The inverted item (item no. 13) was accounted for accordingly. Responses were coded by numbers 1 to 4. Consequently, the total score could possibly range between 14 and 56 points. The sample's mean score was 41.49 (SD 5.57; smallest value: 23; highest value: 56) and thus, was relatively high, compared to the possible range. Values of skewness ($\gamma^2 = -.161$; SE = .154) and kurtosis ($\gamma^2 = .609$; SE = .306) revealed that the distribution of FMI scores was leptokurtic and slightly left-skewed. Mindfulness scores of males (N = 67; mean = 42.29; SD = 5.29) and females (N = 183; mean = 41.27; SD = 5.59) did not differ ($t = 1.30$; df = 248; $p = .19$). Scores were not correlated with the age of the participants ($r = .014$; $p = .83$).

Correlations Between the Scales. A correlation matrix is displayed in Table 1. All correlations between the four variables were positive and significant. The correlation between meditation depth and mindfulness ($r = .51$) was the highest; absorption and years of meditation practice correlated only moderately ($r = .13$).

LISREL-Model

The resulting LISREL-Model is illustrated in Figure 3. Inspection of the measurement models showed that the factor loadings of the six subscales on the latent absorption factor were quite similar and in the range of $\lambda = 0.68$ for the scale *vivid reminiscence* and $\lambda = 0.79$ for the scales *synesthesia* and *enhanced cognition*. Factor loadings for the mindfulness scale had a similar range of $\lambda = 0.70$ to $\lambda = 0.80$. Factor loadings for the MEDEQ were slightly higher and between $\lambda = 0.86$ and $\lambda = 0.90$. In summary, the factor loadings of the respective item parcels on the latent factors were high, as expected for parcels of aggregated items.

The inspection of the structural model revealed that all path coefficients between the latent variables showed significant values. We had expected meditation practice to have an influence on meditation depth. Indeed, the relevant parameter ($\gamma = 0.23$) was

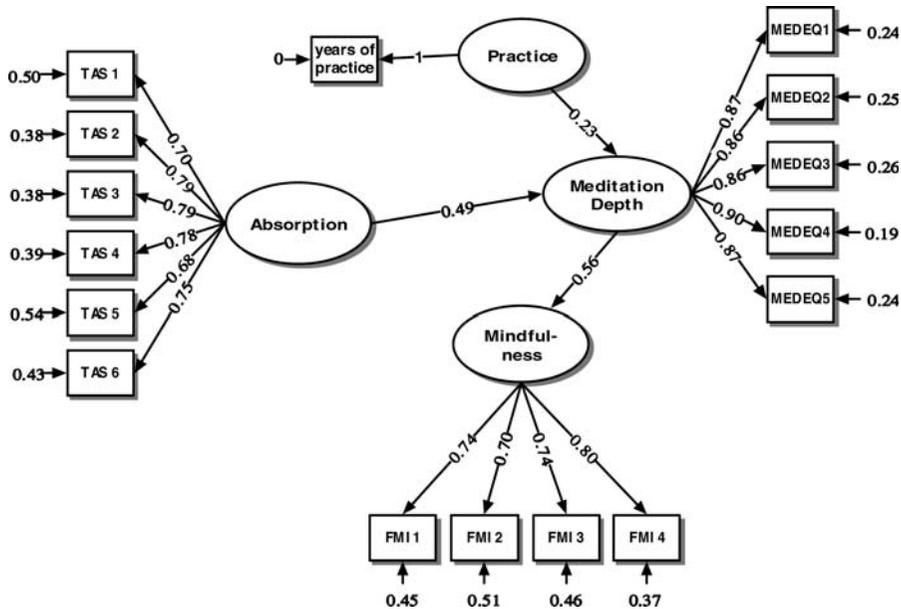


Figure 3. Meditation-LISREL-Model (restricted); the Structural Model includes four latent Variables (Absorption, Amount of Practice, Meditation Depth and Mindfulness); the Measurement Models specify the Relationships between the latent Factors and the respective Indicators.

positive and clearly significant ($t = 4.14$), but only moderate in size. Meditators with more practice experience deeper meditations than people with less practice.

The character trait absorption, though, had a much stronger, and also positive, influence on meditation depth ($\beta = 0.49$; $t = 7.56$). As expected, high absorptive people experience deeper meditations than less absorptive people.

Finally, we had postulated, that a meditator experiences more mindfulness in everyday life, the deeper he or she gets into the meditation. The expected relation was confirmed, as the path coefficient between meditation depth and mindfulness ($\beta = 0.56$; $t = 7.72$) revealed a strong, positive and significant effect.

Fit of the Model. An inspection of the fit indices manifests that the overall model fits the empirical data well. With a χ^2 -value of 211.55 and 102 degrees of freedom, the ratio χ^2 /degrees of freedom was 2.07, which can be considered a good value. NNFI and CFI both were close to 0.95 (NNFI = 0.94; CFI = 0.95) and RMSEA was 0.066, which can also be interpreted as a good and acceptable fit, respectively. Only GFI and AGFI did not indicate a good fit as clearly (GFI = 0.90; AGFI = 0.87). They were, however, still in a range that can be considered sufficient. Overall, the empirical data fitted the theoretically postulated model well enough.

Modification (Extension) of the Structural Model. Moreover, the model was extended and path coefficients between all latent variables were allowed (cf. Figure 4).

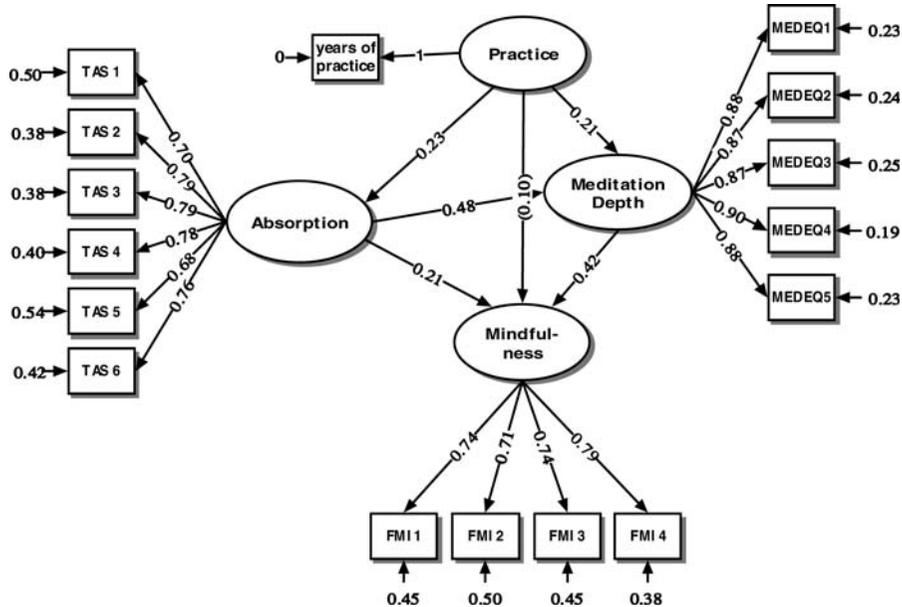


Figure 4. Extended LISREL-Model with additional Path Coefficients between the latent Variables.

The influence of the amount of meditation practice on the character trait absorption ($\gamma = 0.23$; $t = 3.50$) was small, but significant. People who had practiced meditation for a longer time were more absorptive (we will later discuss the possibility of a mutual influence of the two variables).

Furthermore, absorption also had a small and significant direct influence on mindfulness, with a path coefficient of $\beta = 0.21$ ($t = 2.70$). That is, a small part of the variance (0.04%) of mindfulness could be explained solely by the personality of a person, independent of the meditation practice.

The influence of meditation depth on mindfulness was slightly diminished by the modification ($\beta = 0.42$; $t = 5.24$).

Interestingly, the path coefficient between years of meditation practice and mindfulness was not significant. The amount of meditation practice had no direct influence on mindfulness in everyday life ($\beta = 0.10$; $t = 1.59$), and even the indirect effect, which was mediated by meditation depth ($0.21 * 0.42 = 0.09$) can be neglected.

The model fit of the extended structural equation model with additional parameters was slightly better than the introduced restricted model. The χ^2 -value was 194.74. With 99 degrees of freedom, the ratio χ^2 /degrees of freedom was 1.97, which is a good value. NNFI and CFI were both near 0.95 (NNFI = 0.95; CFI = 0.96) and RMSEA was 0.062. Again, only GFI and AGFI did not as clearly indicate a good fit (GFI = 0.91; AGFI = 0.88). However, they were in a range that can be considered sufficient. Overall, the modified model had a slightly better fit than the postulated model. The χ^2 -difference statistic yields a χ^2 -difference-value of 16.81. With the

difference of degrees of freedom being 3, the test is highly significant ($p < 0.001$). The parsimonious restricted model is thus to be rejected, and the extended model is favored.

DISCUSSION AND CONCLUSIONS

The present study was undertaken to shed light on factors which have an impact on deep experiences during meditation and on their consequences for everyday life. Our model proposed that the personality trait of absorption and meditation practice both influence meditation depth significantly, and that deep meditation experiences would lead to increased mindfulness. In the extended model, further influences between the variables were allowed, and both models were compared. Compared to the parsimonious restricted model, the extended full model turned out to be superior.

The positive influence of absorption trait and meditation practice on meditation depth was confirmed. Absorption exerted a higher influence on meditation depth, than the amount of meditation practice. That is, the depth of meditative experiences appears to be more determined by personality than by the amount of training. Since absorption trait and meditation depth were assessed with reliable questionnaires while practice was quantified by the rather inexact measure of years, a methodological artifact could possibly account for this result. In addition, a part of the variance shared by the questionnaire measures could have derived from response tendencies, e.g. acquiescence.

Furthermore, deep meditation experiences had a remarkable influence on the mindfulness of meditators. People with deeper meditation experiences reported to be more mindful in everyday life. There was no additional direct influence of meditation practice on mindfulness. The influence of meditation practice was mediated solely by meditation depth. As indicated by the extended model, the character trait absorptions also exerted an influence on mindfulness in everyday life, independent of meditation depth.

It should be kept in mind that the direction of causality implied within the structure of our model is not mandatory. Influences in the opposite direction are equally conceivable. For instance absorption was entered into the restricted model as an exogenic variable, which only serves as an independent variable. However, it appears plausible that the absorption capacity facilitates meditation practice and is also enhanced by it (Ott, 2003). Although conceptualized as character trait, absorption might be modified by experiences and training. Given that approximately 40% of this trait are genetically determined (Ott, in press), the actual phenotype depends to a large extent on environmental factors. Inspection of the full model revealed that a relationship exists between absorption and meditation practice, as proposed by the results of Davidson et al. (1976). Nonetheless, from the data of this cross sectional study, the causal direction of influence between the variables cannot be determined. Similarly, the relationship between meditation practice and meditation depth is not necessarily unidirectional. Deep experiences could also represent a source of motivation to maintain meditation practice for a long time. From this perspective, meditation experience accounts as cause for a short or a long meditation practice and the amount of meditation practice could be considered the result of a so called "self selection". This alternative view also

applies to absorption, which could be the cause as well as the result of a deep meditation experience. Furthermore, mindfulness in everyday life could lead to a special sensitivity and openness for experiences in meditation.

On the basis of the covariance matrix between the variables, it is not possible to define the causal interrelation between the variables. Only a longitudinal study could provide definitive answers to those questions. For the analysis of the exact causal relationships between personality traits, amount of training, meditation experiences, and everyday life experiences, a repeated measures design on a longitudinal basis is indispensable. The present study showed that strong relationships indeed exist between these variables; this encourages further investigations. This study could thus serve as the basis for elaborating hypotheses to be tested in longitudinal research projects. A restriction for the generalization of results derives from the rather self-selected sample, which might not be representative for the population of meditators. Ideally, a replication of the given study should be performed with a large representative sample.

Future research should also try to delineate differences between meditation techniques. A wide variety of meditation techniques was practiced by the participants of the given study. The differential impact of the diverse meditation techniques could not be considered in the study at hand, as the sample size impeded the performance of separate analyses for each meditation method. However, it is likely that different meditation techniques are done for different motives. And, they will have differential impact on mental functioning. Future studies should take these differences into account and investigate research questions deriving from the characteristics of the specific meditation technique. For instance, would mindfulness meditation be more effective to increase mindfulness in everyday life and less dependent on the absorption trait to increase meditation depth compared to concentrative forms of meditation?

Finally, it has to be noted that several problems are inherent in the use of self-report as a means of assessing variables. Aside from problems that every questionnaire based study has to face (e.g. Jackson & Messick, 1967; Paulhus, 1984; Webster, 1958; Wilde, 1977), the topic of response bias might be especially relevant in the given context, arising from what Chögyam Trungpa (1973) called spiritual materialism. Given that the three questionnaires might in a similar way be prone to certain response biases, e.g., acquiescence or social desirability, a part of the shared variance could be due to that bias and could have led to an overestimation of the effects of one variable on another. In future research, these constraints can be avoided by the inclusion of objective behavioral data. Multitrait-multimethod approaches (Campbell & Fiske, 1959) can be used to control the effects of equal methods.

In conclusion, the results of the present study indicate that several factors influence the state and trait effects of meditation. A variety of meditation techniques have been developed over the past millennia and their potential as powerful tools for the exploration and expansion of consciousness into the transpersonal realms has been proven. While many seekers around the globe apply these techniques, modern science has only now begun to realize and appreciate the value of these mental training techniques for approaching the riddle of consciousness. Our findings show that non-ordinary, egoless states of pure presence are possible for predisposed persons with longstanding

meditation training. These states are natural phenomena and scientific accounts of consciousness which ignore them remain incomplete (James, 1902). Meditation, conceptualized as a method of systematic self-regulation, offers a promising avenue for the empirical study of the transpersonal realms of human existence.

ACKNOWLEDGMENTS

This study was a research project of the Society for Meditation and Meditation Research (<http://www.smmr.de>). We thank Theo Fehr and Harald Piron for their help in preparing this study and Sukadev Volker Bretz, chairman of the Yoga Vidya society, for his support in distributing the questionnaires.

NOTES

¹ The effect size was not reported by Piron, but was calculated by the authors of this paper on the basis of data given by Piron (2003).

² English translations according to Piron (2001).

REFERENCES

- BAER, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical Psychology: Science and Practice*, *10*, 125–143.
- BECKER, P. (1989). *Der Trierer Persönlichkeitsfragebogen (TPF). Testmappe mit Handanweisungen. [The Trier Personality Questionnaire. Test folder and manual.]* Göttingen: Hogrefe.
- BENTLER, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, *107*, 238–246.
- BENTLER, P. M., & BONETT, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, *88*, 588–606.
- BISHOP, S. R., LAU, M., SHAPIRO, S., CARLSON, L., ANDERSON, N. D., CARMODY, J., SEGAL, Z. V., ABBEY, S., SPECA, M., VELTING, D., & DEVINS, G. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice*, *11*(3), 320–241.
- BOLLEN, K. A. (1989). *Structural equations with latent variables*. New York: Wiley.
- BOLLEN, K. A., & LONG, J. S. (1993). Introduction. In K.A. Bollen & J.S. Long (Eds.), *Testing structural equation models* (pp. 1–9). Newbury Park: Sage Publications.
- BROWNE, M. W., & CUDECK, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park, CA: Sage.
- BUCHHELD, N., GROSSMAN, P., & WALACH, H. (2001). Measuring mindfulness in insight meditation (Vipassana) and Meditation-Based Psychotherapy: The Development of the Freiburg Mindfulness Inventory (FMI). *Journal for Meditation and Meditation Research*, *1*, 11–34.
- CAMPBELL, D. T., & FISKE, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod method matrix. *Psychological Bulletin*, *56*, 81–105.
- CHOGYAM TRUNGPA (1973). *Cutting through spiritual materialism*. Boston: Shambhala Publications.
- CURRAN, P. J., WEST, S. G., & FINCH, J. F. (1996). The robustness of test statistics to non-normality and specification error in confirmatory factor analysis. *Psychological Methods*, *1*, 16–29.
- DAVIDSON, R. J., GOLEMAN, D., & SCHWARTZ, G. E. (1976). Attentional and affective concomitants of meditation: A cross-sectional study. *Journal of Abnormal Psychology*, *85*(2), 235–238.

- DEIKMAN, A. J. (1966). Deautomatization and the mystic experience. *Psychiatry*, 29, 324–38.
- ENGEL, K. (1997). *Meditation (vol. 2): Empirical research and theory*. Frankfurt: Peter Lang.
- FRANKE, G. H. (2002). *Symptom-Checkliste von L.R. Derogatis: SCL-90-R [German Version; 2. Edition]*. Göttingen: Beltz Test.
- GERMER, C. K., SIEGEL, R. D., & FULTON, P. R. (2005). *Mindfulness and psychotherapy*. New York: Guilford Press.
- GIFFORD-MAY, D., & THOMPSON, N. (1994). “Deep states” of meditation: Phenomenological reports of experience. *The Journal of Transpersonal Psychology*, 26, 117–138.
- GROSSMAN, P., NIEMANN, L., SCHMIDT, S., & WALACH, H. (2004). Mindfulness-based stress reduction and health benefits: A meta-analysis. *Journal of Psychosomatic Research*, 57, 35–43.
- HART, W. (1987). *The art of living: Vipassana Meditation as taught by S. N. Goenka*. San Francisco: Harper.
- HETHERINGTON, I. (2003). *Realizing change: Vipassana Meditation in action*. Seattle, WA: Pariyatti Press.
- INTERNATIONAL SIVANANDA YOGA VEDANTA CENTERS (1989). *Yoga teachers’ training manual*. Quebec: Sivananda Ashram Yoga Camp.
- JACKSON, D. N., & MESSICK, S. (1967). *Problems in human assessment*. New York: McGraw Hill.
- JAMES, W. (1902). *The varieties of religious experience. A Study in Human Nature*. New York: Longmans, Green.
- JÖRESKOG, K. G., & SÖRBOM, D. (1984). *LISREL VI users guide (3rd ed.)*. Moorsville, IN: Scientific Software.
- JÖRESKOG, K. G., & SÖRBOM, D. (1993). *LISREL 8: Structural Equation Modeling with the Simplis Command Language*. Chicago, IL: Scientific Software International.
- JÖRESKOG, K. G., & SÖRBOM, D. (1996). *LISREL 8: User’s reference guide*. Chicago, IL: Scientific Software International.
- KABAT-ZINN, J. (1982). An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry*, 4, 33–47.
- KABAT-ZINN, J. (1990). *Full catastrophe living: Using the wisdom of your mind to face stress, pain and illness*. New York: Dell.
- KABAT-ZINN, J. (1998). Meditation. In J.C. Holland (Ed.), *Psycho-oncology* (pp. 767–779). New York: Oxford University Press.
- KAPLEAU ROSHI, P. (1989). *The three pillars of Zen*. New York: Anchor Books.
- KLEIN, A., MOOSBRUGGER, H., & SCHERMELLEH-ENGEL, K. (2000). Die Robustheit der LMS-Methode bei Verletzung der Verteilungsannahmen. [The robustness of the LMS-method against a violation of distribution assumptions.] *Reports of the Institute of Psychology, Goethe-University, Issue 09/00*. Frankfurt am Main: Institute of Psychology.
- MARUYAMA, G. M. (1998). *Basics of structural equation modeling*. Thousand Oaks, London, New Delhi: Sage Publications.
- MUELLER, R. O. (1996). *Basic principles of structural equation modeling: an introduction to LISREL and EQS*. New York: Springer.
- MURPHY, M., & DONOVAN, S. (1997). *The physical and psychological effects of meditation: A review of contemporary meditation research 1931–1996*. Sausalito, CA: The Institute of Noetic Science.
- OTT, U. (2001). The EEG and the depth of meditation. *Journal for Meditation and Meditation Research*, 1, 55–68.
- OTT, U. (2003). The role of absorption for the study of yoga. *Journal for Meditation and Meditation Research*, 3, 21–26.

- OTT, U. (in press). States of absorption: In search of neurobiological foundations. In G. Jamieson (Ed.), *Hypnosis and consciousness states: The cognitive-neuroscience perspective*. New York: Oxford University Press.
- PAULHUS, D. L. (1984). Two-component models of socially desirable responding. *Journal of Personality and Social Psychology*, 46(3), 598–609.
- PIRON, H. (2001). The Meditation Depth Index (MEDI) and the Meditation Depth Questionnaire (MEDEQ). *Journal for Meditation and Meditation Research*, 1, 69–92.
- PIRON, H. (2003). Meditation depth, mental health, and personal development. *Journal for Meditation and Meditation Research*, 3, 45–58.
- RITZ, T., & DAHME, B. (1995). Die Absorption-Skala: Konzeptuelle Aspekte, psychometrische Kennwerte und Dimensionalität einer deutschsprachigen Adaptation. [The Absorption Scale: Conceptual aspects, psychometric properties, and dimensionality of a German adaptation]. *Diagnostica*, 41, 53–61.
- SHAPIRO, S. L., & WALSH, R. (2003). An analysis of recent meditation research and suggestions for future directions. *The Humanistic Psychologist*, 31(2–3), 86–113.
- SIVANANDA YOGA VEDANTA CENTER (2000). *The new book of Yoga*. London: Ebury Press.
- SMITH, J. C. (1987). Meditation as psychotherapy: a new look at the evidence. In M. A. West (Ed.), *The psychology of meditation* (136–149). New York: Oxford University Press.
- TELLEGEN, A. (1992). *Note on the structure and meaning of the MPQ Absorption scale*. Unpublished manuscript, University of Minnesota, Minneapolis.
- TELLEGEN, A., & ATKINSON, G. (1974). Openness to absorbing and self-altering experiences (“absorption”), a trait related to hypnotic susceptibility. *Journal of Abnormal Psychology*, 83(3), 268–277.
- VAILL, D., BIRBAUMER, N., GRUZELIER, J., JAMIESON, G., KOTCHOUBEY, B., KÜBLER, A., LEHMANN, D., MILTNER, W. H. R., OTT, U., PÜTZ, P., SAMMER, G., STRAUCH, I., STREHL, U., WACKERMANN, J., & WEISS, T. (2005). Psychobiology of altered states of consciousness. *Psychological Bulletin*, 131, 98–127.
- VISHNU DEVANANDA, S. (1999). *Meditation and mantras*. Delhi: Motilal Banarsidass Publishers.
- VIVEKANANDA, S. (2001). *Raja yoga*. Calcutta: Advaita Ashram.
- WALACH, H., BUCHHELD, N., BUTTENMÜLLER, V., KLEINKNECHT, N., & SCHMIDT, S. (2006). Measuring mindfulness – The Freiburg Mindfulness Inventory (FMI). *Personality and Individual Differences*, 40(8), 1543–1555.
- WEBSTER, H. (1958). Correcting personality scales for response sets or suppression effects. *Psychological Bulletin*, 55, 62–64.
- WILDE, G. J. S. (1977). Trait description and measurement by personality questionnaires. In R. B. Cattell & R. M. Dreger (Eds.), *Handbook of modern personality theory* (pp. 69–103). Washington: Hemisphere.

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