Implicit measure for yoga research: Yoga implicit association test

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ABSTRACT

Context: The implicit association test (IAT), a new tool for yoga research is presented. Implicit measures could be used in those situations where (1) The construct is difficult to self-report, (2) there is a threat of social desirability. Clinically, we can assess cognitive dissonance by evaluating incongruence between implicit and explicit measures. Explicit preferences are self-reported. Implicit preferences are what we inherently believe, often without our conscious awareness.

Aims: The primary objective of this study is to provide a bird's eye view of the field, implicit cognition, with emphasis on the IAT and the secondary objective is to illustrate through an example of our study to develop an implicit tool to assess implicit preference toward yoga.

Settings and Design: A total of 5 independent samples of total 69 students undergoing short and long-term yoga courses in a Yoga University were assessed for their implicit and explicit preferences towards yoga.

Materials and Methods: The yoga-IAT (Y-IAT), explicit self-rating scale was administered through computers using the Inquisit program by Millisecond Software. Experimental and scoring materials are provided.

Statistical Analysis Used: Data were extracted using recommended scoring algorithm and descriptive statistics highlighting basic psychometric properties of Y-IAT are presented along with its congruence with explicit self-measure.

Results: A moderate preference toward yoga was detected, with a lower implicit-explicit congruence, reflecting possible confound of social desirability in the self-report of preference toward yoga.

Conclusions: Implicit measures may be used in the yoga field to assess constructs, which are difficult to self-report or may have social desirability threat. Y-IAT may be used to evaluate implicit preference toward yoga.

Key words: Implicit association test; implicit explicit congruence; misattribution; yoga.

INTRODUCTION

Yoga research is indeed a multidisciplinary venture and has adopted tools from various disciplines such as biology, medicine, psychology, psychiatry, sociology, etc. The strength of any field lies in the strength of its methods and measurement tools used. Effects of yoga can be studied at various levels using the various methods. Tools of medicine and psychology are majorly used in yoga research. For self-report of subjective feelings and thoughts questionnaires are chiefly used. However, there are many constructs,

which are difficult to self-report and might have influence of social desirability (a voluntary or an involuntary mode of response to project socially desirable). Do I say what I actually think? Am I influenced by my conditioning, unaware of myself? Often people tend to deliberately distort their responses to questionnaires or give the wrong response quite unknowingly. To address such questions, implicit measures were successfully utilized.[1] In this article, we present a tool, extensively used in the west, especially in psychology since last 15 years and which has attained a status of state-of-the-art tool in the field. We propose to review this tool and highlight its utility in the field of yoga, with an example of a study conducted by us. The objective of this paper is not to present a detailed review of the field but to spotlight the most relevant aspect of the field, which can be utilized in yoga research.

Implicit cognition

Implicit cognition is a broad term, which encompasses all those cognitive processes that happen, without any or much

awareness about them, but still influence our behaviors. More precisely implicit processes are characterized the process, which happens with a lack of awareness, less cognitive resource, short time and independent of proximal goal.[2] Implicit measures are those, which can measure such influences of implicit processes. Some commonly used related terms are unconscious, automatic, uncontrolled, implicit and subliminal. For an overview of how implicit social cognition functions, the recent book, Banaji *et al.*,[3] should interest naive readers.

Implicit measures

There are many tools used in psychology, which are categorized under implicit measures. They are the implicit association test (IAT),[4] priming[5] Go/No-go association task,[6] the extrinsic affective simon task,[7] etc. For a detailed review of the most popular tools, refer the paper on implicit measures in social cognition by Fazio and Olson[8] One of the common goals of implicit measures is to assess those preferences and attitudes, which may be inhibited due to choice or ignorance. In this paper, we focus on one of the well-researched tools, the IAT. Since its inception in 1998, many papers have been published using this tool in diverse fields and over 50 papers were only on various aspects of its validity and psychometrics. The next popular tool is the priming tool, though equally powerful, but compared with the IATs it has lower internal consistency and effect size.[9] Hence, we focus on the IAT.

The IAT

The IAT was first reported in 1998 by Greenwald *et al.*[4] It is a reaction time task, which requires a certain way of categorization of the shown stimuli on the computer screen. This test measures automatic preferences. These tests require about 5-10 min to complete and have high effect size compared with priming measures. Even for personality domains, like self-esteem, IATs were found to have internal consistencies above 0.80 and test retest reliability ranging from 0.60 to 0.70. IAT's ease of administration, higher effect size and reliability are some of the features, which captured the attention of many researchers. IATs can be constructed and delivered very easily using any stimulus presentation software. Some of the commercial software are Empirisoft, E-Prime, Inquisit, Paradigm, SuperLab, etc.[10] Affect 4.0[11] is a free software, which is capable of doing the same thing.

Structure and procedure of IAT

The structure of IAT can be illustrated using flower-insect IAT. The traditional IAT has seven blocks [Table 1] in which subjects have to respond to the shown stimuli.

In the IAT subject responds to a series of items that are to be classified into four categories: In general, two representing

Table 1: IAT structure

Block	No. of trials	Task	Response key assignment	
			Left key	Right key
1	20	Target discrimination	Flowers	Insects
2	20	Attribute discrimination	Good	Bad
3	20	Initial combined task (practice)	Flowers, good	Insects, bad
4	40	Initial combined task (test)	Flowers, good	Insects, bad
5	20	Reversed target discrimination	Insects	Flowers
6	20	Reversed combined task (practice)	Insects, good	Flowers, bad
7	40	Reversed combined task (test)	Insects, good	Flowers, bad

IAT = Implicit association test

concept discrimination (also known as targets) such as flowers versus insects and two representing attribute discrimination (also known as attributes) such as good versus bad. Targets are those which we are interested in evaluating, here implicit evaluation toward flowers versus insects. Attributes are those qualities with which we want to find the target's association strength. The subjects are asked to respond rapidly without making much error. The right hand side key is to respond for right hand side categories (target or attribute) and vice-versa for left hand key. The position of the target would change to produce congruent and incongruent blocks. Congruent blocks are those in which conceptually associated pairs are present like flowers with good and insects with bad. The feedback on error may[12] or may not be given.[13] Feedback of error is indicated by "X" which prompts the subject to give the correct response. From latencies of congruent and incongruent blocks, IAT scores are calculated. The logic of the test is subjects respond more rapidly in the block where the target and attribute are strongly associated (flowers and good) than when they are weakly associated (insects and bad).

IAT scoring

Psychometrics of IAT has witnessed great streamlining. The latest algorithm provided by Greenwald *et al.*[14] is now widely used in all studies. Summary of steps is as follows:[15]

1. Delete trials greater than 10,000 ms
2. Delete subjects for whom more than 10% of trials have latency less than 300 ms
3. Compute the "inclusive" standard deviation for all trials in Stages 3 and 6 and likewise for all trials in Stages 4 and 7
4. Compute the mean latency for responses for each of Stages 3, 4, 6 and 7
5. Compute the two mean differences (mean Stage 6 – mean Stage 3) and (mean Stage 7 - mean Stage 4)

6. Divide each difference score by its associated "inclusive" standard deviation
7. D = The equal-weight average of the two resulting ratios.

Finally, the score is reduced to a D value. Since mean differences are divided by the standard deviation, it is like Cohen's D value. Hence, IAT D is also a measure of effect size. However, a slight point of difference is that in the calculation of the IAT D score, inclusive standard deviation is used that means standard deviation of both practice and test blocks are used. The D score ranges from -2 to $+2$ through 0. Negative score means negative preference toward one of the target objects. This could be reversed also by suitably designing the IAT. In general, a score below 0.35 means weak preference, a score up to 0.65 means moderate preference and above 0.65 means high implicit preference. The sign indicates the direction of preference, i.e., toward which target. The IAT D scores might be influenced by order of taking the congruent and incongruent tasks, recent experience, social setup, familiarity with the stimuli, etc.[1]

Variations of IATs

In recent times, many variations of the IAT have emerged. Firstly to overcome the relative preference assessment, single category[16] and single target[17] IATs are developed. In these IATs, the target to be assessed need not have an opposite counterpart. These are useful where constructs are unipolar. In an attempt to make IAT brief, yet reliable, the brief-IAT[18] was developed. Another variation is personalized IAT,[19] in which participants themselves can choose the category labels and corresponding stimuli, which need to be presented during the test. This personalized IAT is reported to give higher congruence with explicit measures, especially in socially desirable constructs like personality domains. Finally multifactor IAT, in which multiple factors like big five can be simultaneously evaluated.[20] The stimuli in these IATs can be given as words or as pictures. The picture IATs are shown to have low effect size compared with word IATs, however, average latency of response and average errors are less.[21] These various versions of IATs have their own unique advantages and a researcher has a range of choice.

Implicit tools for yoga research

For convenience, yoga research can be classified into clinical and non-clinical. Majority of yoga research has published on clinical aspects because the primary interest in yoga is due to concerns about health and harmony at physical and mental levels. The other side is non-clinical, in which we can categorize all studies related to physical, mental and cognitive development due to yogic practices. This also encompasses higher dimensions of spiritual unfoldment. We shall discuss how implicit tools can be used in these two broad aspects of yoga research.

The clinical use of implicit tools is well demonstrated. The Chapter 23 of the handbook of implicit social cognition[22] describes them elaborately. Here are some of the relevant aspects useful for yoga research. Clinically, relevant aspect of implicit cognition is dissociation of impulsive process and reflective process. Impulsive processes are automatic and associative in nature, where implicit memory plays a key role. On the other hand, reflective processes are more controlled. Taking to unhealthy life-style, natural rhythm and regulation of the body is compromised and the system goes uncontrolled, leading to clinical conditions. Examples of obesity, depression, obsessive compulsive disorder, narcissism, etc., demonstrate some of these aspects. The unhealthy and uncontrolled mind becomes the precursor for unhealthy body.

Yoga is the process of reverse engineering in which more of automatic or implicit processes are brought under conscious control by deliberate practice. According to Integrated Approach of Yoga Therapy,[23] based on the five sheath model of existence, the cause of disease is *Aadhi*. We term *Aadhi* as implicit misattribution effect. Implicit is something that happens automatically without the awareness of the person, hence very subtle hard to perceive, but very strong. Misattribution is attributing some quality or notion about something, which is not true. The effect is that which is caused by such implicit misattributions. Hence, *Aadhi* is the effect which is caused by automatic (implicit) wrong notions (misattributions). Implicit misattribution can happen when we wrongly cognize something and believe it completely. Such strong wrong belief is predominantly an implicit process and about which a person has least awareness and control. Yoga involves systematic training of body and mind along with notional corrections, which reverses the process of implicit misattribution effects through building up the strength of rational discriminating process, which helps in recognizing the weaker reasons behind such implicit misattributions. Gradually the process of desensitization happens that optimizes the process of regulation at the mental level (*manomaya kosha*), at pranic level (*pranamaya kosha*) and at the physical level (*annamaya kosha*). Hence understanding implicit processes might give deeper insights to yoga therapy. One important concept, which emerges from IATs is the correlation between implicit and explicit measures.[24] This is called congruence between implicit and explicit measures. It has been reported that for socially sensitive measures, the implicit explicit congruence would be low, indicating, possible cognitive dissonance. Hence this congruence between implicit and explicit measures could be considered as a marker of state of psychological well-being. Higher the congruence, the greater is the psychological harmony and vice versa.

Recent development in stress research is the introduction of the perseverative cognition theory. According to this, greater cause of stress is constant rumination and repeated processing of worrying thoughts, both anticipatory and retrospective. This can happen unconsciously also, terming it as unconscious perseverative cognition, which is believed to be a major determinant of stress.[25] The unconscious influence can be studied using IAT tools.[26]

For a non-clinical application in yoga, implicit measures can be used in situations where there is a serious threat of self-presentation bias, or social desirability. One example is an assessment of *triguna*. *Triguna* is a personality concept according to Indian Psychology. *Sattva*, *rajas* and *tamas*, are its three factors. When questionnaires to assess *triguna* are administered in a yoga population, the participants by virtue of their knowledge of the concept *triguna*, may bias their responses in order to be socially desirable. In those conditions, we may use implicit tools for assessment. Likewise other constructs, which are difficult to self-report or where social desirability is a concern, implicit measures may be utilized as a potential solution.

YOGA-IAT: ASSESSMENT OF IMPLICIT ATTITUDE TOWARDS YOGA

Overview of the experiment

We present the yoga-IAT (Y-IAT) to evaluate a person's inherent preference towards yoga. Can we assess a person's preference towards yoga, without asking them to self-report? The Y-IAT was constructed in the same fashion as described in an earlier section. However, the only difference was we chose one category instead of two. Hence this is a single target IAT.

MATERIALS AND METHODS

Subjects

The study was conducted in a Yoga University, in southern India. It was conducted over a period of 7 months (August 2012-February 2013) and five independent samples were taken. The samples constituted of students of both long and short term yoga courses. The total sample size was 69 (27 males) with a mean age 27.17 ± 7.14 ($n = 48$, as the age and explicit preference were not obtained in one of the batches of 21 subjects) and range (18-47 years). We present the results combining data of all the five independent samples.

Methods

The whole experiment was administered through computers using Inquisit 3.0 stimulus presentation software.[27] The assessments were performed in a batch of three to four participants. The procedure and requirement for the test were explained to the participants. After informed consent, the subjects typed demographic details and took the Y-IAT and later an explicit rating scale to rate their preference toward yoga on a five- point likert scale (very strongly dislike, strongly dislike, neutral, strongly like, very strongly like; −2 to +2). The order of taking congruent and incongruent tasks in the Y-IAT was balanced across the subjects.[14] The whole test session lasted for about 5-10 min.

In the Y-IAT, a series of words related to yoga were shown to subjects on the computer screen. Each stimulus had an inter trial interval of 250 ms. The subjects had to respond by pressing the appropriate response key on the keyboard, to indicate whether the shown stimulus was on the left hand side or right hand side. "E" key was assigned to the left hand response and "I" key was allotted for right hand response. The subjects had to respond as quickly as possible without making much error. If an error occurred, they had to correct it and proceed further. The target words, related to yoga were: *Yama*, *Niyama*, *Asana*, *Pranayama*, *Pratyahara*, *Dharana*, *Dhyana* and *Samadhi*. Attribute category words were, for "Good" category: Good, Superb, Pleasure, Beautiful, Joyful, Glorious, Lovely and Wonderful; and for "Bad" category: Hurt, Sorrow, Painful, Poison, Accident, Fearful, Bad and Dirty. Selection of these words related to yoga category was based on the assumption that any student of yoga course would know these eight fundamental words from the *Patanjali's Yoga Sutras*. However, mental representations of these words in various individual may vary. The single category Y-IAT had five blocks; the first block (20 trials) was attribute practice, in which subjects had to categorize words, which were of categories "Good" and "Bad". Next block was the combined practice block, which also included category "Yoga." In this block, subjects had to categorize words related to one of the earlier mentioned categories. There were 20 trials in this block. The third block was the test block, same as second block with 40 trials. In the fourth block, the target word changed position from left hand side to the right hand side or vice-versa. This block is called practice block for reversed target and had 20 trials. The fifth block had a similar structure that of the fourth one with 40 trials [Inquisit script for Y-IAT is available with author on request].

RESULTS

R statistical software was used for analysis.[28] Scoring of Y-IAT were done using the improved scoring algorithm[14] (R script for scoring Y-IAT available with author on request). Mean latencies for each block were measured. The block in which "Yoga" is paired with "Good" is called compatible block and the block in which "Yoga" is paired with "Bad" is called incompatible block. D score is obtained by the difference of mean latencies of incompatible and

compatible blocks and then whole divided by the pooled standard deviation. The positive score indicates the positive implicit evaluation toward yoga and negative score suggests negative implicit evaluation toward yoga.

We discarded seven subjects from analysis because the Y-IAT showed a negative D score. As negative scores could strongly influence the mean, we removed them. An additional reason to consider these negative scores as outliers is: We assume that all those participants who came for yoga courses must be having a positive inclination toward yoga. Their explicit scores support this assumption. Hence, any negative score would mean that the subject does not belong to the intended population. Further three subjects were removed for their high response error rate (>20%).[16] After removing these 10 outliers, we observed an average D score of 0.346 ± 0.25, ranging from 0.001 to 0.896. The mean latency was 1024.17 ± 300.10 ms. They had an average error rate of 4.38% (after treating outliers). The mean explicit score was 1.26 ± 0.59 showing strong positive preference toward yoga. The implicit-explicit correlation was found to be: $r = 0.18$ ($t = 1.14$, $df = 37$, $P = 0.264$). This correlation reflects low implicit-explicit congruence.

DISCUSSION

The objective of the current study was to find out whether we can assess implicit preference toward yoga using the IAT paradigm. The selection of the sample was appropriate as they expressed strong explicit preference toward yoga. The results showed moderate implicit preference towards yoga in this study sample. These preliminary results suggest that we can measure implicit preference toward yoga. Nearly 90% of the participants had shown various degrees of positive implicit preference toward yoga. The low correlation is an indication of possible extraneous influence through self-presentation biases; hence, it becomes further interesting to study the influence of social desirability factors on implicit preference towards yoga. In the current study, no measure of self-presentation bias was taken, so we could not find its mediating effect.

Y-IAT's application is restricted to those who are familiar with yoga, as the category label and stimuli used were words related to yoga. Moreover, IATs may not be able to reflect the actual preference always, as they may be clouded by the person's strong belief. For instance, if we happened to wrongly believe something, those wrong notions would be reflected in implicit assessment. However, this discrepant information is highly valuable both clinically and for general research.

We suggest further studies to evaluate discriminant validity, i.e., to find out if a sample of non-yoga subjects, show negative or weak preference toward yoga. Predictive validity should also be attempted as the current study does not predict the outcome of yoga practice or adherence to yoga practice. As a further step, an attempt should be made to reproduce and generalize the results in different samples. Specifically for Y-IAT, other psychometric properties need to be evaluated. Another general requirement for implicit cognition studies in yoga research is a development of normative pool of visual and verbal stimuli. The international affective picture system[29] and the affective norms for English text[30] are databases that provide a set of normative emotional stimuli for experimental investigations of emotion and attention. Development of such databases for yoga studies would help develop evidences, which can be compared across experiments. Mechanism of cognitive refinement brought about by yogic practices is intricate and definitely involves unconscious or implicit factors. Realizing this necessity of the hour, resorting to implicit tools is highly encouraged.

Development of Y-IAT will have application in academic settings especially in yoga universities to assess the growth of students and their inherent interest toward yoga. We can also evaluate if explicit score or implicit score predicts better the future academic performance. Furthermore, IATs can be used to assess those constructs, which are difficult to self-report. Therefore this IAT paradigm, which promises to overcome self-presentation biases, can be used in the field of yoga.

CONCLUSION

In this article, we have attempted to present before the yoga researchers a new tool for exploration, the IAT. Necessary details of the use of this tool in yoga research were discussed using Y-IAT. Relevant materials are provided to design new experiments and scoring them. We emphasize that Implicit measures would find immense application in the field of yoga, where no work has been done using this tool. Promotion and wide use of implicit tools can bring new evidences to yoga research.

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