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# Autonomic and EEG patterns distinguish transcending from other experiences during Transcendental Meditation practice

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## Abstract

This study compared EEG and autonomic patterns during transcending to 'other' experiences during Transcendental Meditation (TM) practice. To correlate specific meditation experiences with physiological measures, the experimenter rang a bell three times during the TM session. Subjects categorized their experiences around each bell ring. Transcending, in comparison to 'other' experiences during TM practice, was marked by: (1) significantly lower breath rates; (2) higher respiratory sinus arrhythmia amplitudes; (3) higher EEG alpha amplitude; and (4) higher alpha coherence. In addition, skin conductance responses to the experimenter-initiated bell rings were larger during transcending. These findings suggest that monitoring patterns of physiological variables may index dynamically changing inner experiences during meditation practice. This could allow a more precise investigation into the nature of meditation experiences and a more accurate comparison of meditation states with other eyes-closed conditions. © 2001 Elsevier Science B.V. All rights reserved.

*Keywords:* Transcendental Meditation; Alpha power; Coherence; Respiratory sinus arrhythmia; Breath rate; Consciousness

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## 1. Introduction

Basic and clinical research has documented the effectiveness of practice of the Transcendental Meditation® (TM®) technique<sup>1</sup> in decreasing anxiety (Eppley et al., 1989), decreasing hypertension (Alexander et al., 1994a; Schneider, et al., 1995), decreasing atherosclerosis (Castillo-Richmond et al., 2000), decreasing substance abuse (Alexander et al., 1994b), and enhancing self-actualization (Alexander et al., 1991). To understand how TM practice positively impacts mental and physical health, the constellation of psychophysiological patterns during TM practice needs to be understood.

Travis and Wallace (1997) compared physiological patterns during two main experience-categories during TM practice: transcending, described as:

‘...taking the mind from the experience of a thought to finer states of the thought’ (Maharishi, 1969, p. 470)

and Transcendental Consciousness, described as:

‘...silence and full awareness of pure consciousness, where the experiencer is left all by himself.’ (Maharishi, 1963, p. 288)

(see also Travis and Pearson, 2000). In this study, transcendental consciousness was distinguished by autonomic orienting at the onset of 10–40-s-long apneustic breathing periods (slow, continuous inhalation). Constrained by the subjects’ spontaneous experiences, this prior research was only able to compare physiological patterns between these two experience categories during TM practice — transcending and Transcendental Consciousness.

The current study extends these earlier findings by comparing autonomic and EEG patterns during transcending to physiological patterns during ‘other’ experiences occurring within a TM ses-

sion. This ‘other’ category comprises a range of possible experiences when the mind is out of the process of transcending, primarily characterized by an increase in mental and physical activity. Delineating physiological patterns during ‘other’ experiences will complete our characterization of sub-states within TM practice.

## 2. Method

### 2.1. Subjects

A total of 30 undergraduate students were asked to participate in this study, nine females and 21 males, with an average age of 22.50 years (S.D. 2.28, range 17.4–29.6). These subjects had been practicing the TM technique for an average of 5.40 years (S.D. 0.67, range 0.8–11.2).

### 2.2. Choice of physiological measures

Five different categories of physiological variables were measured, which in prior research were sensitive to practice of the TM technique (Wallace, 1970; Dillbeck and Bronson, 1981; Dillbeck and Orme-Johnson, 1987; Taneli and Krahne, 1987; Gaylord et al., 1989; Travis and Wallace, 1999). To index general metabolic levels, breath and heart rate were measured. To index differences in parasympathetic tone, heart rate variability in the breath frequency (respiratory sinus arrhythmia or ‘high frequency’ heart rate variability) was measured (Porges, 1995). To assess differences in sympathetic tone, skin conductance levels were measured (Edelberg, 1967). To index sympathetic reactivity, skin conductance responses to punctuate stimuli during TM practice were recorded. To probe central nervous system functioning, EEG amplitude<sup>2</sup> and coherence were calculated.

<sup>1</sup>Transcendental Meditation® and TM® is registered in the U.S. Patent and Trademark Office as a service marks of Maharishi Foundation, Ltd., and is used under license by Maharishi University of Management.

<sup>2</sup>EEGSYS reports the results of its spectral analysis in ‘base-to-peak equivalent voltages’. Its analysis program calculates power (average of the summed sine and cosine components squared), and then estimates a continuous sine wave, whose power equals the calculated power of the data. The ‘base-to-peak equivalent voltages’ are the base-to-peak amplitudes of that estimated sine wave.

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