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Mantra in Meditation: The Effect of Sound on Relaxation

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Abstract

The use of mantra as a tool for meditation is an ancient practice. It is a spiritually rooted discipline, thought to release various types of energy when producing sounds. The study expanded upon previous research, which analyzed the physiological effects of sound in meditation, to examine the "OM" sound and its effect on brainwaves and skin temperature. Participants were asked to complete four meditations: a baseline, silent, guided, and "OM" meditation. Study 1 included a sample population of 30 participants with no restriction on meditation experience. Study 2, with a sample population of 15, included participants with at minimum one month of meditation experience. Participants completed a questionnaire gauging their previous experience with meditation. Raw brainwaves peaks and skin temperature for each of the conditions were assessed. Findings showed a significantly lower number of baseline peaks compared to all other conditions of silent, guided and "OM". There was a significantly higher number of calm brainwave peaks across the silent, guided, and OM conditions. There was a significant difference in first and final temperature for the all of the meditations. Future research may examine effects of relaxation with a sample population of OM experienced meditators.

Keywords: meditation, sound, relaxation effects, brainwave pattern, skin temperature, OM, silent, guided

Mantra in Meditation: The Effect of Sound on Relaxation

Meditation is an ancient practice which has persisted across centuries, cultures, and religions. Typically, not associated with scientific understanding, meditation is rooted in Buddhist and Hindu theology. In its advent of ~5000 BCE, meditative practice spread through the Indus Valley of South Asia (Puff, 2013). Its following exploded as Buddhists and Hindus incorporated meditation into daily routine. Over time, meditation expanded and presented itself in every major religion- namely the Abrahamic traditions. Meditation is diverse in practice but centers around contemplation, emotional balance, and clear thought.

In the 20th and 21st centuries meditation slowly gained favor in Western communities. It has impacted many millions of active and non-active practitioners alike. The physiological effect of this historic and global practice proves to be a powerful one (Ricard, 214). In meditators who have practiced over 10,000 hours, researchers found that activity in pain-related areas of the brain decreased as they grew accustomed to stimuli compared to novice practitioners (Ricard, 2014). The novel ability to field painful stimuli is extraordinary and can benefit in times of crisis or emergency. The physiological benefits of meditation are largely unexplored. The possibilities are countless and have already proven to be scientifically beneficial.

In order to fully understand the impacts of meditation, we must look backwards at its origin and types of practitioners. Given the great diversity of meditative practice, including focused-attention meditation, compassion loving kindness meditation, or transcendental meditation, the impacts of each may be unique. As anxiety and clinical

depression rates explode globally, meditation is one of the key combatting tools (Ricard, 2014). The variation in meditative practice allows it to be accessible to many populations. For instance, sound meditations may be more comfortable for those with attention deficit hyperactivity disorder while centering meditation better suited for religious or terminally ill populations. The impact and implementation of mediation are diversely applicable.

Couched in religious theology, meditation has been an inherently religious practice. While very different than prayer, meditation is philosophically akin to devotional practices. Both stem from a greater religion which is the intention behind the activity. Although meditation has been adapted to fit secular communities, the practice is undoubtably remnant of Buddhist philosophy.

Buddhist Origins

In approximately 500 BC, the world of meditation was transformed by the teachings of the Buddha. Siddhartha Gautama, the first and founding Buddha, was born into a wealthy family in Nepal. He lived a life of lush luxury, oblivious to the struggles of the people around him. In his later life, Siddhartha left his royal enclosure and encountered the concepts of mass poverty, sickness, and death for the first time. In response, Siddhartha searched for answers in an Indian monastery and learned the ways of yogi practitioners. After a while, he pursued life of middle way- a novel philosophy of life without luxury or poverty. After many years, Siddhartha was introduced and regularly implemented meditation into his life. Physical properties of his meditation would include sitting cross legged with hands on knees, back upright,

and eyes closed. After many years and countless hours of meditation, followers of Buddhism would claim he reached a state of enlightenment- a state of being which alleviated suffering and rebirth ("Buddhism at a Glance", 2009).

Based on Siddhartha's lifestyle, Buddhism became a spiritual tradition which focused on personal introspection and growth. Foundations of Buddhism include achieving enlightenment, accepting suffering, and understanding impermanence. The faith is now practiced by hundreds of millions today and in many sects of Buddhism. The two most popular include Theravada Buddhism and Mahayana Buddhism. Theravada Buddhism is most common in Sri Lanka, Cambodia, Thailand, Laos, and Burma. On the other hand, Mahayana Buddhism is most popular in Tibet, China, Taiwan, Japan, Korea, and Mongolia. Both sects aim for enlightenment and primarily employ meditation in their spirituality.

Meditation became a way to take control of the mind so that it may be focused and peaceful (Sutherland, 2015). The Buddha's teachings rejected duality of the mind and body. Instead, it aims to unify the two. Enlightenment is the transformation of this perspective-to be entirely accepting of oneself so that the world becomes uncomplex. From the very inception of Buddhism to its current practice, meditation has been an instrumental aspect.

Other Eastern Disciplines

Simultaneous to the Buddhist tradition, three other religions formed, creating what is now known as the "golden century". Jainism, Taoism, and Confucianism were all created with an essential emphasis on meditative practice. Jainism in India was

founded by Mahavira. It has emphasis on self-purification, self-discipline, and non-violence. The Jain meditation techniques involve mantra repetition, gazing, and breath awareness. Taoism in China was founded by Lao Tze. This practice emphasizes unity with the Tao or cosmic life relations. Finally, Confucianism was founded in China by Confucius. It focuses on morality, community life, and self-contemplation.

Meditative Practice in the Abrahamic Religions

As civilization progressed and meditative practice expanded throughout the globe, the world's most prominent religions adapted meditation to fit their doctrine. In Judaism, Christianity, and Islam, meditation serves to strengthen each spiritual practice. In the context of Abrahamic religions, meditation is a supplement to prayer. It enhances the connection to God, the people around you, and to yourself. Each religion offers variations of meditative practice which increases accessibility to the contemplative thought.

Judaism

In Judaism, there are a number of meditations available depending on what is best suited for the practitioner. One method of meditation in Judaism involves chanting. It is common to use the Thirteen Attributes of God and wear a tallit during this recitation ("Introduction to Jewish Meditation", 2019). In this case, a person would recite the Thirteen Attributes of God as a form of meditation. Another example is a silent meditation. The Talmud states that sages would "be still for one hour prior to each of the prayer services, then pray for one hour and afterwards be still for one hour more" ("Introduction to Jewish Meditation", 2019). Another type of practice is to focus

on the names of God while reciting or visualizing. The last type of Judaic meditation is to meditate with the goal of Ayin consciousness- a "no-state" which creates a sense of connection to God. This can be attained through a multitude of exhalations, usually 70 or more. A subset of Ayin meditation is known as Hitbodedut, which is the practice of emptying oneself mentally and refilling with spirit and vision. These types of meditations are practiced in conjunction with the overall doctrine of Judaism. They are used a supplementary tool to bring oneself closer to God ("Introduction to Jewish Meditation", 2019).

Islam

Meditation is an integral part of the Islamic faith. It is practiced as a supportive tool to become closer to God, a way of reflection, and an escape from daily life. The last prophet, Prophet Muhammad, practiced meditation throughout his life. Prophet Muhammad is known to have the Quran revealed to him in his later years. As a way to escape from the corrupt society surrounding him, the Prophet would venture to Mount Hira, a cave in which he would reflect, contemplate, and be mindful. During this time, the first verse of the holy Quran was revealed. Many Muslims continue to follow in this tradition of introspection and reflection, particularly, as a way of combatting the negative influences of society.

Muslims adhere to a strict discipline of five prayers throughout the course of the day. The first begins before sunrise, the second at midday, the third in the afternoon, the fourth at sunset, and the last at sunset and midnight. Each prayer follows an exact order of movements and recitations. During prayer, Muslims focus solely on the

presence of, and relationship with, God. They recite predetermined words throughout each movement of prayer. The persistent and obligatory schedule of prayer provide a daily escape from stressors, recentering to God, and internal peace.

Another form of meditation is known as Tafakoor, a state of reflection and contemplation of the world's injustices and creation of God. This specific type of meditation is not focused on relaxation but rather offers time for meaningful thought. Instead of aimlessly thinking, Tafakoor allows for focus, attention, and problem solving.

Another form of mediation in Islam is part of the Sufi sector which is an inherently more mystical and spiritual branch of the religion. Sufi Muslims consume most of their time with reflection on God and aim to fill their minds and hearts with total love of God. Each of these meditations connect religion with mindfulness-an important aspect of human society which leads to undiscovered benefits.

Christianity

In Christianity, meditation finds itself reimagined once more. In Psalm 1:2, there is a clear revelation to meditate: "his delight is in the law of the Lord, and in his law, he meditates day and night". Meditation is an active form of Christianity but presents as reflection and mindfulness. One form of Christian meditation is to ponder on the texts of God. This has been practiced as early as the fourth century AD in the form of "*lectino divina*" or sacred reading. There are four stages to lectino divina-reading, discursive meditation, affective prayer, and contemplation. The second and fourth stages are active meditations in which the participant ponders the text and allows the meaning to resonate with themselves.

Another form of Christian meditation is to actively allocate attention to the presence of God and his words. It is thought that the best time for this reflection occurs at night, in the morning, and once throughout the day. In this manner, the presence of God is felt right before and after sleep and throughout the day. This creates a continuous reflection and connection to God.

Overall, meditation is a prevalent part of the Abrahamic religions. While individually, Judaism, Islam, and Christianity, employ meditation in different aspects, they all use meditation as a tool of reflection on God and the self. Meditation, in this context, appears differently than historically the type of Buddhist meditation that is practiced today. However, meditation has been tied to spirituality and has taken many forms.

Entering the Western World

Meditation was confined to the Eastern part of the world. Despite its early origins and prevalence across Asia, there was a lack of medium for practice to have spread further. In the 1800s and early 1900s, transportation was expensive and often took weeks of travel. Therefore, meditation only spread across water boundaries in the 20th century.

A yogi, Swami Vivekanda, popularized meditation in the United States. His presentation at the Parliament of Religions in Chicago garnered excitement for the meditative practice. As a result of his influence, several yogis and Buddhists moved to United States. Some of those included Mararishi Mahesh Yogi, who taught transcendental meditation, and Swami Rama, who started the Himalayan Institute. In

this manner, meditation was taught in a westernized context. In the 1960s and 1970s, meditation became popular amongst the youthful generations. Since then, meditation has exploded in popularity amongst secular circles. It has now become the subject of considerable scientific exploration.

Applying Scientific Understanding

Vedic Recitation

In 2017, researchers Travis et al. explored electroencephalogram (EEG) patterns in 37 participants while listening to Vedic recitation and while practicing transcendental meditation. The researchers defined transcendental meditation as a state which transcends mental activity to reveal a state of silent self-awareness and underlying thinking. Transcendental meditation is state of being rather than thinking and consciousness that it is free from changing mental content.

Participants were attached to thirty-two scalp sensors. They were then asked to perform a fifteen-minute transcendental meditation. Afterwards, they to listened to a one-hour Vedic recitation; the first five minutes of the sound was the Swasti Path, which is recited for the well-being of the world. This was followed by ten minutes of recitation to Ganesh-which is thought to remove obstacles from life. The next forty-five minutes were varied. During the recitation, they were asked to press a button during periods of inner silence during each condition. These button presses were used to select two-minute periods. After the recitation, subjects answered one question: "What did you experience when listening to Vedic Recitation?" (Travis et al., 2017).

Researchers were testing the effect of transcendental meditation and Vedic recitation on EEG patterns of the brain. They found a significantly higher coherence between frontal, parietal and frontal-parietal theta2 and alpha1 coherence pairs when listening to live Vedic recitation compared to TM practice (Travis et al., 2017). Additionally, the subjective descriptions of inner experiences when listening to Vedic recitation yielded three higher-order codes that parallel the changes in brain patterns (Travis et al., 2017).

This study shows significance in both Vedic recitation and transcendental meditation effects on the body. More importantly, it shows a more significant physiological difference while listening to the Vedic recitation compared to the transcendental meditation. This suggests the spiritual context of the recitations are essential to maximize impact on the body.

Centering Prayer

In 2009, researchers Johnson *et al.* explored the effects of centering meditation on women with recurrent ovarian cancer. Centering meditation is defined as a structured meditation practice that helps individuals develop an awareness of reality. It is similar to concentration methods which focuses the mind on breathing or mantra. Mantra recital helps the mind from wandering. Centering meditation has proven effective in populations of people with mental illness, immunosuppression, and cardiac issues (Johnson et al., 2009).

Participants were asked to participate in centering prayer sessions during chemotherapy infusions over the course of nine weeks. Each session was led by

centering prayer teacher. Researchers used qualitative assessments to gauge influence on mood states, spiritual well-being, and quality of life. Participants were asked to complete a series of detailed questionnaires at beginning of first session and end of the last.

Participants completed the Profile of Mood Scales-65 item scale in which respondents rate anxiety, depression, anger, vigor, fatigue and confusion, the Functional Assessment of Chronic Illness Therapy-Ovarian-39 item scale, Functional Assessment of Chronic Illness Therapy–Spiritual-Expanded and investigator designed demographic questionnaire.

Results showed both psychological and physiological benefits. There was a significant decrease in anxiety, anger and depression. There was a significant increase in spiritual well-being. After the study, at six months postintervention, anger significantly increased suggesting centering prayer meditation was most effective at reducing anger.

Each meditative practice is unique and yields interesting physiological effects on the body. While most meditations generally provide decreased anxiety, depression, and anger, each meditation provides its own benefits. In an era of increasing anxiety and depression, it is imperative to study all aspects of meditative practice. With variety, meditators can choose from a selection of meditation types to find a practice that is well suited to their circumstances. Individuals may choose a meditative practice that aligns with their religious faith or mental health requirements. The unique properties of each meditation type and its individual effects provide opportunities for maximum accessibility to practitioners and non-practitioners alike.

Materials and Methods

Data was collected during a psychological study with a total sample size of 45 participants. The study was conducted in separated into two phases: the preliminary and experimental phases. In the preliminary phase, or study 1, 30 participants were recruited. The experimental phase, or study 2, contained 15. In the first study, participants were selected from a sample demographic with varied meditation experience. This ranged from no prior experience to daily meditations. In the study 2, the sample population of participants was restricted to at minimum one month of meditation experience. This varied from daily to once every two weeks. Participants were recruited through flyers posted around Trinity College campus (see Fig 1 and 2), emails to departments, and fitness organizations. Most, but not all, participants in study 1 were affiliated with Trinity College as a student, professor, or faculty member. All participants in study 2 were affiliated with Trinity College a student, professor, or

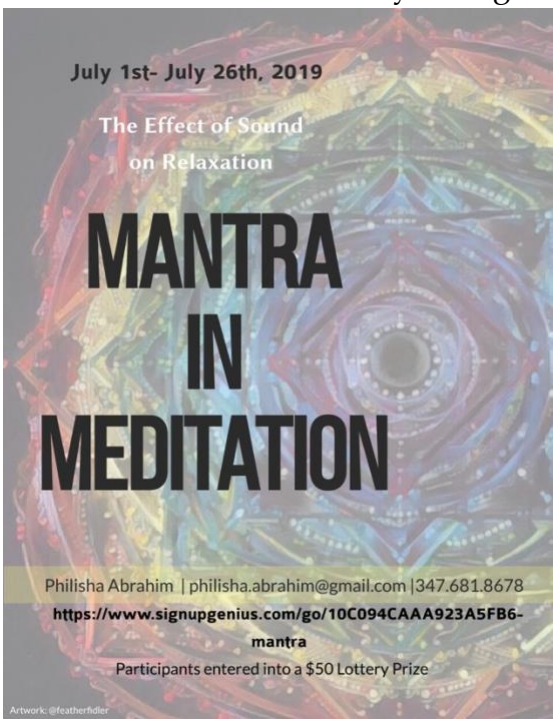

Fig 1. Recruitment flyer for Study 1.

Fig 2. Recruitment flyer for Study 2.

faculty member. Participants were offered a $50 lottery for participant in study 1 and a $100 lottery prize for participation in study 2.

The independent variable of the study was the type of meditation and experience level of meditation. The dependent variable was effect of relaxation which is indicated by the number of brainwave peaks and average skin temperature. This is a within-subjects design with each participant completing a series of four meditations. Participants were asked to complete a baseline study for one minute followed by the silent, guided, and OM meditations for five minutes each. There was a one-minute break in between each of the four mediations in which participants were instructed to remain active for the entirety of the one-minute. They were encouraged to pace, repeatedly squat, or perform jumping exercises. During baseline, participants were asked to not use electronic devices. The order of the silent, guided, and OM meditations were randomized across all participants to account for any residual affect the meditations would have on the succeeding one. The entirety of a session took between 30-35 minutes to complete.

Meditation Experience

Name:

Age:

Gender:

Have you meditated alone before?

Do you meditate regularly?

How often do you meditate?
Select an option which best reflects your experience:

- Daily
- More than once per week
- Once per week
- Once every two weeks, once per month
- Once every few months
- Not often

Fig 3. Questionnaire to gauge participants' meditation experience.

Immediately, a full explanation of the study design was relayed to the participant. Before any of the meditations, participants were asked to listen to "OM" sound

produced by the administer and asked to follow along twice for consistency in Om sound production. Participants were then asked to complete a consent form. For the study 1, participants were asked about their previous meditation experience, if any. In study 2, participants completed a questionnaire asking for age, gender, and if they "Have [you] meditated alone before? Do you meditate regularly? How often do you meditate?" (see Figure 3).

To measure brainwave patterns, the Muse 2: The Meditating Sensing Headband (InteraXon, Inc., Toronto, Ontario, choosemuse.com) was used. For skin temperature data collection, a galvanic skin response (GSR) temperature sensor was used. Before the baseline meditation, both devices were connected to the participant. The Muse headband was placed on the forehead and the GSR skin temperature sensors were placed on the right index and middle fingers. The Muse headband would be adjusted or shifted on the forehead if connectivity was lost or slowed. The GSR skin temperature sensors were removed after every meditation to allow the participant to freely move around.

In the event that a participant fell asleep, an agreed upon tap on the shoulder was administered. If the Muse headband lost connectivity during the meditation, a tap on the shoulder and notification of headband adjustment would be given. If participants were noticeably and extremely struggling with breath, the administrator would inquire if a break was needed and instruct the participant on how to adjust their breath for the study.

Data for brainwave patterns were collected by counting the number of brainwave peaks for three brainwave frequencies per meditation. The frequencies were outputted by the Muse device and demarcated as active, neutral, and calm. Peaks were counted if they were immediately preceded and succeeded by a downward dip. For each session, a participant would have 12 brainwave data points indicating number of peaks. For skin temperature, a minimum of three data points was collected for each meditation, one at 0 Minutes, 2.5 minutes, and 5 minutes. Raw skin temperature data was then converted onto a 21-point scale. The leftmost '2' data indicator was converted to 1 and the rightmost '2' indicator was converted to 21. The in-between data points were converted along the 21-point scale, with 0 being 11.

Results

There was not a significantly higher effect of relaxation in the OM mediation compared to the silent, and guided meditations. There was a significantly higher effect of relaxation in silent, guided, and OM meditations compared to baseline.

Study 1

Brainwave Peaks

In all levels, the silent, guided and OM conditions are significantly higher than the baseline condition F (6, 174) =17.89, p<.001, η^2=.38. In the active level, the silent (M= 3.23, 95% CI [-.09, 6.53]) and guided (M= 2.13, 95% CI [.75, 3.51]) conditions are significantly higher than the OM (M= .80, 95% CI [-.04, 1.64]) condition. In the neutral level, the baseline condition (M= 10.23, 95% CI [8.34, 12.13]) is significantly lower from the silent and guided conditions. In the calm level, the baseline condition (is

significantly lower than the silent, guided and OM conditions, indicating an increase in relaxation and calm brainwave peaks in all conditions.

In the active level, the base condition (*M*= 1.20, 95% CI [.18, 2.22]) is not significantly different than the silent (*M*= 3.23, 95% CI [-.09, 6.53]), guided (*M*= 2.13, 95% CI [.75, 3.51]), or OM (*M*= .80, 95% CI [-.04, 1.64]) conditions. The silent condition (*M*= 3.23, 95% CI [-.09, 6.53]) is significantly higher than the base (*M*= 1.20, 95% CI [.18, 2.22]) and OM (*M*= .80, 95% CI [-.04, 1.64]) conditions. The guided (*M*= 2.13, 95% CI [.75, 3.51]) condition is significantly higher than the OM (*M*= .80, 95% CI [-.04, 1.64]) condition.

In the neutral level, the base condition (*M*= 10.23, 95% CI [8.34, 12.13]) is significantly lower from the silent (*M*= 19.47, 95% CI [13.92, 25.02]) and guided (*M*= 25.70, 95% CI [19.44, 31.96]) conditions. The base (*M*= 10.23, 95% CI [8.34, 12.13]) condition is not significantly different than the OM condition (*M*= 16.20, 95% CI [10.50, 21.90]. The guided condition is significantly higher than the all other conditions.

In the calm level, base (*M*= 4.13, 95% CI [3.07, 5.19]) is significantly lower than the silent (*M*= 42.67, 95% CI [35.04, 50.29]), guided (*M*= 41.17, 95% CI [33.11, 49.22]) and OM (*M*= 42.83, 95% CI [35.57, 50.10]) conditions. The silent (*M*= 42.67, 95% CI [35.04, 50.29]), guided (*M*= 41.17, 95% CI [33.11, 49.22]) and OM (*M*= 42.83, 95% CI [35.57, 50.10]) conditions are not significantly different from each other.

There was a highly significant increase in brainwave peaks from the baseline condition to the silent, guided, and OM conditions F (3, 87) = 51.53, p<.001, η^2 =.64. The

Table 1. Main effect of Condition on Brainwave Peaks – Study 1.

Condition	*M*	*SE*	95% CI
Base	5.19	0.43	4.32 – 6.06
Silent	21.79	1.32	19.10 – 24.48
Guided	23.00	1.17	20.61 – 25.39
OM	19.94	1.34	17.20 – 22.68

Note. N = 30.

number of brainwave peaks in the base condition (M= 5.19, 95% CI [4.32, 6.06]) is significantly lower than the silent (M= 21.79, 95% CI [19.10, 24.48]), guided (M= 23.00, 95% CI [20.61, 25.39]) and OM (M= 19.94, 95% CI [17.21, 22.68]) conditions (Table 1). The silent, guided and OM conditions are statistically similar.

The number of brainwave peaks in each level were significantly different than each other F (2, 58) = 84.97, p<.001, η^2=.75. The mean number of brainwave peaks in the

Table 2. Main effect of Level on Brainwave Peaks – Study 1.

Level	*M*	*SE*	95% CI
Active	1.84	0.48	0.85 – 2.83
Neutral	17.90	1.65	14.53 – 21.27
Calm	32.70	1.86	28.90 – 36.50

Note. N = 30.

active level (*M*= 1.84, 95% CI [.85, 2.83]) is significantly lower than the neutral level (*M*= 17.90, 95% CI [14.53, 21.27]) which is significantly lower than the calm level(*M*= 32.70, 95% CI [28.90, 36.50]), F (2, 58) = 84.97, p<.001, η^2=.75 (Table 2). The calm level produced the highest mean number of brainwave peaks across all conditions.

Skin Temperature

The difference between the first and final levels across the silent, guided, and OM conditions were not significantly different F (2, 58) =1.28, p=.29, η^2=.04. At the first, 0-minute level, the silent (*M*= 8.97, 95% CI [7.40, 10.53]) and guided conditions (*M*= 7.93, 95% CI [5.87, 9.99]) are not significantly different (Table 3). The OM condition (*M*= 12.37, 95% CI [10.47, 14.26]) is significantly higher than all other conditions, indicating

Table 3. Main effect of Level * Condition on Skin Temperature – Study 1.

Level	Condition	*M*	*SE*	95% CI
First (O Minutes)	Silent	8.97	.77	7.40 – 10.53
	Guided	7.93	1.01	5.87 – 10.00
	OM	12.37	.93	10.47 – 14.26
Final (5 Minutes	Silent	5.87	5.87	6.04 – 8.79
	Guided	5.63	3.63	4.04 – 7.53
	OM	6.20	6.20	7.50 – 11.07

Note. N = 30.

lower initial relaxation.

At the five-minute increment, the silent (*M*= 5.87, 95% CI [3.39, 8.35]), guided condition (*M*=3.63, 95% CI [1.59, 5.68]) and OM (*M*= 6.20, 95% CI [3.43, 8.97]) conditions are not

significantly different from each other, indicating a significantly similar effect of increased relaxation across all conditions.

In the silent, guided, and OM conditions, the difference between temperature is significant F (2, 58) = 5.72, p<.05, η^2 =.17. The silent condition (M=7.42, 95% CI [6.04, 8.79]) is significantly lower than the OM condition (M=9.28, 95% CI [7.50, 11.07]). The guided condition (M=5.78, 95% CI [4.04, 7.53]) is significantly lower than both silent (M=7.42, 95% CI [6.04, 8.79]) and OM conditions (M=9.28, 95% CI [7.50, 11.07]) (Table 4).

Table 4. Main effect of Condition on Skin Temperature – Study 1.

Condition	*M*	*SE*	95% CI
Silent	7.42	.67	6.04 – 8.79
Guided	5.48	.85	4.04 – 7.53
OM	9.28	.87	7.50 – 11.07

Note. N = 30.

There was a highly significant effect of time from the first level to final level F (1, 29) = 30.24, p<.001, η^2=.51. The 5-minute increment is significantly lower (M=5.23, 95% CI [3.71, 6.76]) than the 0-minute increment (M=9.76, 95% CI [8.53, 10.98]) indicating significant relaxation across all the silent, guided, and OM conditions over the 5-minute period (Table 5).

Table 5. Main effect of Level on Skin Temperature – Study 1.

Level	*M*	*SE*	95% CI
First (O Minutes)	9.76	.60	8.53 – 10.98
Final (5 Minutes)	5.23	.75	3.71 – 6.76

Note. N = 30.

Study 2:

Brainwave Peaks

In all levels of active, neutral, and calm brainwave peaks, the silent, guided, and OM conditions are significantly higher than baseline, F (6, 84) =6.61, p<.01, η^2=.32. In the active level, the baseline condition (M=1.00, 95% CI [.28, 1.73]) is not significantly different than the OM (M= .93, 95% CI [.19, 1.67]) condition. The guided condition (M= 2.87, 95% CI [.30,5.44]) is significantly higher than the baseline and OM conditions. The silent condition (M= 7.00, 95% CI [.48, 13.52]) is significantly higher than all conditions. In the neutral level, baseline (M= 10.47, 95% CI [8.48, 12.45]) is significantly lower than the silent (M=34.20, 95% CI [24.85, 43.55]), guided (M= 32.87, 95% CI [22.51, 43.22]), and

OM (*M*= 24.33, 95% CI [13.06, 35.61]) conditions. The OM condition *M*= 24.33, 95% CI [13.06, 35.61]) is significantly lower than the silent (*M*=34.20, 95% CI [24.85, 43.55]) condition. In the calm level, baseline (*M*= 5.53, 95% CI [3.42, 7.65]) is significantly lower than the silent (*M*=24.93, 95% CI [16.35, 33.52]), guided (*M*= 29.20, 95% CI [17.28, 41.12]), and OM (*M*= 40.80, 95% CI [28.83, 52.77]) conditions, indicating an increase in relaxation across all conditions. The OM condition (*M*= 40.80, 95% CI [28.83, 52.77]) is significantly higher than the silent (*M*=24.93, 95% CI [16.35, 33.52]) condition but not significantly different than the guided condition (*M*= 29.20, 95% CI [17.28, 41.12]) indicating the frequency of calm brainwave peaks increased the most in the guided and OM conditions.

In the active level, the baseline condition (*M*=1.00, 95% CI [.28, 1.73]) is not significantly different than the OM (*M*= .93, 95% CI [.19, 1.67]) condition. The guided condition (*M*= 2.87, 95% CI [.30,5.44]) is significantly higher than the baseline and OM conditions. The silent condition (*M*= 7.00, 95% CI [.48, 13.52]) is significantly higher than all conditions.

In the neutral level, baseline (*M*= 10.47, 95% CI [8.48, 12.45]) is significantly lower than the silent (*M*=34.20, 95% CI [24.85, 43.55]), guided (*M*= 32.87, 95% CI [22.51, 43.22]), and OM (*M*= 24.33, 95% CI [13.06, 35.61]) conditions. The OM condition *M*= 24.33, 95% CI [13.06, 35.61]) is significantly lower than the silent (*M*=34.20, 95% CI [24.85, 43.55]) condition.

In the calm level, baseline (*M*= 5.53, 95% CI [3.42, 7.65]) is significantly lower than the silent (*M*=24.93, 95% CI [16.35, 33.52]), guided (*M*= 29.20, 95% CI [17.28, 41.12]),

and OM (*M*= 40.80, 95% CI [28.83, 52.77]) conditions. The OM condition (*M*= 40.80, 95% CI [28.83, 52.77]) is significantly higher than the silent (*M*=24.93, 95% CI [16.35, 33.52]) condition.

Table 6. Main effect of Condition on Brainwave Peaks – Study 2.

Condition	*M*	*SE*	95% CI
Base	5.67	.35	4.91 – 6.43
Silent	22.04	.66	20.63 – 23.46
Guided	21.64	.45	20.67 – 22.62
OM	22.02	.53	20.88 – 23.16

Note. N = 15.

Table 7. Main effect of Level on Brainwave Peaks – Study 2.

Level	*M*	*SE*	95% CI
Active	2.95	0.92	0.99 – 4.91
Neutral	25.47	3.28	18.42 – 32.51
Calm	25.12	3.41	17.80 – 32.43

Note. N = 15.

The baseline condition is significantly lower than the silent, guided, and OM conditions F (3, 42) =300.16, p<.001, η^2=.96. The base condition (*M*=5.67, 95% CI [4.91, 6.43]) is significantly lower than the silent (*M*=22.04, 95% CI [20.63, 23.46]), guided

(*M*=21.64, 95% CI [20.67, 22.62]), and OM (*M*=22.02, 95% CI [20.88, 23.16]) conditions. The silent (*M*=22.04, 95% CI [20.63, 23.46]), guided (*M*=21.64, 95% CI [20.67, 22.62]), and OM (*M*=22.02, 95% CI [20.88, 23.16]) conditions are not significantly different than each other (Table 6). The levels of active, neutral, and calm are all significantly different than each other F (2, 28) =14.50, p<.001, η^2=.51. The active level (*M*=2.95, 95% CI [.99, 4.91]) is significantly lower than the neutral (*M*=25.47, 95% CI [18.42, 32.51]) and calm levels (*M*=25.12, 95% CI [17.80, 32.43]) (Table 7).

Skin Temperature

The difference between the first and final levels across the silent, guided, and OM conditions were not significantly different F (2, 28) =1.31, p=.29, η^2=.09. At the 0-minute increment, the OM condition (*M*=11.93, 95% CI [7.76, 16.11]) is not significantly different than the silent (*M*=13.73, 95% CI [10.60, 16.87]) or guided (*M*=9.00, 95% CI [6.06, 11.94]) conditions (Table 8). The guided condition (*M*=9.00, 95% CI [6.06, 11.94]) is

Table 8. Main effect of Level * Condition on Skin Temperature – Study 2.

Level	Condition	*M*	*SE*	95% CI
First (O Minutes)	Silent	13.73	1.46	10.60 – 16.87
	Guided	9.00	1.37	6.06 – 11.94
	OM	11.93	1.95	7.76 – 16.11
Final (5 Minutes)	Silent	5.33	1.87	1.32 – 9.35
	Guided	4.80	1.39	1.82 – 7.78
	OM	6.80	1.67	3.23 – 10.37

Note. N = 15.

significantly lower than the silent condition (*M*=13.73, 95% CI [10.60, 16.87]), indicating a higher initial relaxation in guided.

At the 5-minute increment, the silent (*M*=5.33, 95% CI [1.32, 9.35]), guided (*M*=4.80, 95% CI [1.82, 7.78]), and OM (*M*=6.80, 95% CI [3.23, 10.37]) conditions are not significantly different from each other, indicating a significantly similar increase in relaxation across all conditions.

The silent guided and OM conditions are not significantly different from each other F (2, 28) =1.29, p=.29, η^2=.08. The silent (*M*=9.53, 95% CI [6.81,12.26]), guided (*M*=9.90, 95% CI [4.40, 9.40]), and OM (*M*=9.34, 95% CI [6.20, 12.53]) conditions are statistically similar (Table 9).

Table 9. Main effect of Condition on Skin Temperature – Study 2.

Condition	*M*	*SE*	95% CI
Silent	9.53	1.27	6.81 – 12.26
Guided	6.90	1.17	4.40 – 9.40
OM	9.37	1.48	6.20 – 12.53

Note. N = 15.

The 5-minute increment is significantly lower (*M*=5.62, 95% CI [3.34, 7.95]) than the 0-minute increment (*M*=11.56, 95% CI [9.76, 13.35]), indicating significant relaxation across all the silent, guided, and OM conditions F(1, 14)=26.05, p<.005, η^2=.65 (Table 10).

Table 10. Main effect of Level on Skin Temperature – Study 2.

Level	*M*	*SE*	95% CI
First (O Minutes)	11.56	.84	9.76 – 13.35
Final (5 Minutes)	5.64	1.07	3.34 – 7.95

Note. N = 15.

Discussion

This study was conducted to test the effect of relaxation, through brainwave peak patterns and skin temperature, of various sounds in mediation. We manipulated the type of sound in meditation to examine if the OM sounds led to an increased number of calm brainwave peaks and lower skin temperature. The results suggest there was not a significant increase in calm brainwave peaks and lower skin temperature in the OM meditation compared to the silent and guided meditations. There was a significant effect of relaxation, higher calm brainwave peaks and lower skin temperature, in each of the silent, guided, and OM conditions. To our knowledge, this is the first study to examine the relaxation effect of the OM sound through brainwave peak patterns and skin temperature.

It is possible that the OM sound was not relaxing for participants who did not regularly produce it. In Study 1, there could have been a high discomfort factor as many participants were not experienced meditatiors and did not have experience producing the OM sound. In Study 2, the restricted sample demographic attempted to control for

the discomfort factor but proved that experienced meditators (not in the OM meditation) may still experience discomfort. This would reduce the relaxation response in the OM sound specifically. In reference to the significantly high number of calm brainwave peaks and low skin temperature, in all of the mediations, this proves the three types of meditation to be relaxing. Study 1 particularly proves, across all demographics of age, race, and gender, meditation is physiologically relaxing.

While our findings proved effects of relaxation, there are future ways to improve upon the study. In procedural design, the baseline condition was limited to one minute of observation. While this allowed for immediate assessment of brainwave patterns and skin temperature, it did not provide adequate comparative data for the silent, guided, and om condition at the two, three, four, and five-minute marks. Suggestions for future research would include increasing the baseline condition to the same length of the meditations.

Due to the COVID-19 pandemic, the data sampling from participants was severely shortened. The sample size of Study 2 was half of Study 1. If time permitted, Study 2's sample size would be the same size, if not longer, than Study 1.

Future research on the differences in different types of meditations are necessary to understand the range of stimuli which can cause relaxation effects. With increasing rates of anxiety, attention disorders, and depression, relaxation techniques are necessary. The varying types of meditation in this study use different types of sound, making it accessible for a greater number of people. The production of sound, listening to sound, or silence in meditation can greatly change a person's willingness to continue

and implement the practice of meditation in daily life. With the significant effects of relaxation found, it is important for people to access the practice. Future research can assess the differences in meditations which only produce sound or only listen to sound. Future research can also examine the relaxation effect of the OM sound in experienced OM meditators.

The findings of this study can be used in early childhood development, education, and adjustment. Particularly in children with mood or attention disorders, meditative practice can be helpful to adjust their behavior. Various types of meditation can be used in place of disciplinary practices in schools, foster homes, or juvenile detention centers. To manage anger, stress, anxiety or any other negative emotion, meditation can be effective. Adapting meditation into daily life, for at least 5 minutes, can produce effects of calming and emotional balance.

In older age groups, meditation can just as helpful. The calming effects of meditation can be implemented in daily life to generally reduce stress. It can also be introduced to stressful environments such as, jails, rehab centers, state homes, college environments and more.

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