

7 Recreating Leisure: How Immersive Environments Can Promote Wellbeing

Henry J. Moller, Harjot Bal, Kunal Sudan, and Luke R. Potwarka

Abstract: The connection of virtual reality to holistic healthcare may appear paradoxical on first blush. Yet, a novel paradigm in immersive media technology that seeks to enable an induced state of wellbeing, by creating uplifting states of consciousness rather than generating aversive stimuli or presenting cumbersome tasks for users is now within reach for clinical application. Demand for innovative and patient-centered care to alleviate stress-related and psychosomatic conditions is certainly high in medical and workplace settings. A mental health treatment modality that is effective, safe and free of adverse effects makes up the desirable set of criteria not only from a patient's perspective, but also from the perspective of clinicians who provide healthcare service to patients. As the boundaries between real and virtual, technologically mediated and 'organic' states of consciously experienced presence continue to blur, the need to address this convergence in a therapeutic paradigm is increasingly relevant and warranted. We review the scientific rationale, clinical results and user feedback from patients who have undertaken a standardized course of sensory-based technology-enhanced multimodal meditation to therapeutically address symptoms in a psychosupportive paradigm. Relationships to physiological parameters of human consciousness, rationale to support replicable and evidence-based application in supporting health and wellbeing are reviewed. We highlight the role of 'slow technology' and an inclusive design approach in supporting further development of therapeutics, as well the subjective and experiential nature of the world of inner presence that invite the possibility of further experience design for use in health and wellness. The relevance of leisure states to wellbeing, and specifically the positive experiential learning through inspirational or motivational shifts in consciousness, is described as an important health promotion avenue to pursue on an individual and societal level.

Keywords: Immersive Media; Experience Design; Technology-Enhanced Multimodal Meditation; TEMM; Mindfulness; MBSR; Holistic Health; Consciousness; Leisure; Flow; Health Promotion; Workplace Wellness.

7.1 Introduction to Chapter 7

"To me, the practice of medicine has no real autonomy: it exists by borrowing and making new application of ideas from other disciplines. Without a constant reinfusion from other scientific domains, the practice of medicine would soon become an outmoded routine" Jean-Marie Charcot (Goetz, 2009).



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Meditation is increasingly used by physicians and mental health professionals as a mainstream evidence-based treatment modality and as an adjunctive treatment to other biological or psychological therapies. This is in part based on the desire of many patients to have additional treatment options beyond traditional pharmacotherapy or psychotherapy. Currently, there is increased acceptance of mind-body medicine into mainstream healthcare paradigms. There are many specific styles of meditation practice; the word meditation may carry different meanings in different contexts, and has been applied both in religious/spiritual and healthcare settings. An increasingly popular type of meditation-based psychotherapy has been *Mindfulness-Based Stress Reduction* (MBSR), which allows patients to become more aware of sensations and thoughts that improve or worsen symptoms. Many meditation techniques involve an element of relaxation, which stands quite generally for a release of tension, a return to equilibrium. Relaxation as a mind-body treatment has been studied as a broad-spectrum treatment used to benefit a variety of psychiatric, medical and psychosomatic conditions, ranging from chronic pain to anxiety disorders, insomnia, and hypertension (Wallace & Benson, 1972), and this may in part be related to modulation of EEG (electroencephalography) rhythm (Williams & West, 1975). Presence-enabling experiences may well involve neuromodulation of electrochemical brain systems, and may be enhanced through those neural pathways mediating states of wellbeing such as pleasure or reward.

This paper describes a non-blinded observational clinical evaluation case series for a multimodal sensory-based guided meditation program. The program offers a combination of meditation based on MBSR and audiovisual entrainment with light therapy, a therapeutic technique that aims to satisfy the desirable criteria for available treatment modalities and improve upon the range of existing therapeutic healthcare options. The program can also be administered as an adjunctive psychosupportive therapy, used to enhance the efficacy of other psychotherapeutic or pharmacotherapy strategies.

Given the current relative but growing crisis of confidence in the communication surrounding reliability of reported data relating to the psychological and medical sciences (Pashler & Wagenmakers, 2012), it will be increasingly necessary to adopt new healthcare paradigms that will serve the public's need, and allow for congruence between reported data and lived experience. Informed patients now often seek wellbeing restoration rather than illness treatment as a true healthcare goal (AHHA, 2003); given this fact, the opportunity has arisen for presence-enabling immersive technologies to deliver on the promise of providing credible, safe and effective healthcare solutions. While some applications remain under development in industry and academia in disciplines as diverse as computer science, music and media design, a convergence of these multidisciplinary efforts will push the boundaries towards cutting-edge models of promoting wellbeing, informed by clinical need, available technologies and ethical, reproducible application.

An interesting hypothesis to consider is the role of induced, simulated or “recreated” leisure as being related to the therapeutic effects of meditative states of wellbeing. In fact, immersive environments can be understood within a leisure studies paradigm; scholars are now employing operational definitions of leisure that extend beyond participation in specific types of activities (e.g., bowling, aerobics), settings (e.g., parks, culture/heritage sites) and time (time away from paid employment). In particular, researchers examining the impact of leisure on health and wellbeing have conceptualized leisure as meaningful experiences. (Kleiber et al, 2011; Mannell & Kleiber, 1997). In this way, leisure is perhaps best understood as a state of mind, characterized by notions of intrinsic motivation and perceived freedom (Kleiber et al., 2011). Most leisure episodes, for example, invoke a wide range of feelings and cognitions, the essence of experience. Leisure experiences, whether occurring in settings simulated, virtual, or real, authentic or artificial, have come to be seen as primary aspects of leisure and recreational behaviour (Kleiber et al. 2011).

“Many researchers believe that to understand the impact of leisure on health, wellbeing and other domains of daily life, they not only need to be able to assess what people do in and as their leisure but also what they are experiencing while they do it and then how they make sense of, or construe, the experience” (Kleiber et al., 2011, p. 101).

Indeed, past researchers (e.g., Wessinger & Iso-Ahola, 1984) have argued that the inherent restorative properties, functions, and motivations associated with leisure experiences contribute to its efficacy in reducing stress and subsequent improvements in mental health among individuals. Moreover, leisure may have the capacity to induce an inspired psychological state, promote wellbeing in the form of positive affect and life satisfaction (Thrash et. al, 2010).

7.2 Innovative Research and Industry Applications

Reproducible technology-enhanced meditation sessions are increasingly being incorporated into therapeutic programs to meet the needs of patients seeking mental health care with safe and effective symptomatic relief of stress-related symptoms such as anxiety, insomnia and depression. In parallel to this, the fast pace of technology in work environments, and the impact of this on health is being described (Heusser, 2013). Many of today’s patients are unable to readily practice meditation on their own because they find it hard to rehearse mental imagery or meditative affirmations, particularly if suffering from psychiatric illness or trauma that impacts neurocognitive capacity. These patients may lack imaginal capacity for visualization exercises: “...some patients refuse to engage in the treatment, and others, though they express willingness, are unable to engage their emotions or senses” (Difede & Hoffman, 2002, p. 529). A further roadblock that might impede the effectiveness of meditation-based relaxation

therapies is the consistency and quality of the user's experience, i.e., standardization. Meditation also requires intensive and repetitive practice by patients, who may have difficulty performing their practice autonomously. This has led to a clinical demand for developing standardized meditation techniques that can readily be provided to patients in a safe, effective and reproducible manner.

7.2.1 Related Research Projects at Other Centres

Outside of medical settings, technology-aided relaxation and meditation is also an increasingly popular phenomenon. In addition to offering a more standardized protocol, technology can afford a more complete experience — one that is multimodal and highly responsive. The *Confronting Pain: Redefining Mobility* (CPRM) lab at Simon Fraser University has been actively involved in designing immersive therapeutic experiences simulated by technology (<http://www.confrontingpain.com/projects/>). The 'Virtual Meditative Walk' program developed by the CPRM lab uses a combination of a projected virtual environment, a unidirectional treadmill, and biofeedback sensors to offer users a relaxation experience tailored to the level of their engagement (Gromala et. al, 2011). Another CPRM project, 'Sonic Cradle', based on the crux of mindfulness meditation offers users a highly responsive audio interface that responds to respiration patterns (Vidyarthi, Riecke, and Gromala, 2012). The lab is also involved with immersive virtual reality approaches to therapy. Similarly, the *Calming Technology* lab at Stanford University, directed by Neema Moraveji, is developing relaxation and meditation-based applications for new technologies (<http://www.calmingtechnology.org>). 'Breathwear' is a recent project from Moraveji's lab that uses the iPhone to bring to the awareness of the user their breathing patterns throughout the day (Wongsuphasawat, Gamburg, Moraveji, 2012). The project is designed around the concept of calm technology — a practice that involves intentionally creating technologies to operate and communicate in the periphery of a user's attention, in an effort to demand less engagement from the user (Weiser and Brown, 1996).

Health design researcher Patrizia Marti also provides insight into novel projects that demonstrate an appreciation for the human body and an interest in preserving user autonomy in wellbeing practices through the several industrial design projects studied in her book, *Enabling through design: explorations of aesthetic interaction in therapy and care*. (Marti, 2012) From interactive rolling pins that are to be used by patients suffering from dementia and their caretakers in order to foster a sense of empathy to mini-mattresses for babies that send digital signals to a mother's respective belt about the needs of their child, there are multiple projects that have ventured to blend healthcare and innovative design via novel technology explorations.

7.2.2 Related Gaming Applications

Also gaining momentum with employing relaxation, reflective, and meditative elements in technology-simulated experiences is the gaming industry. Video game developer ‘thatgamecompany’ has garnered critical acclaim for their titles ‘flOw’, ‘Flower’, and ‘Journey’ (Chen, 2012). All games infused virtual landscapes simulating nature in an abstract manner and instead of using text and narrative to provide context, the games were more focused on subtle onscreen movements responsive to user input, encouraging free exploration, followed by moments set up for mental reflection. Co-founder Jenova Chen credits much of his influence to the work of Hungarian psychologist Mihaly Csikszentmihalyi whose psychological construct of presence related to *Flow* was largely implemented in Chen’s teams’ work to design games that are slower and less adrenaline-driven than recent popular titles (Adu Poku, 2013). The related world of serious games with educational and/or therapeutic potential merits a longer discussion but is related to the use of leisure in fostering productivity and wellbeing on an individual and collective level.

As discussed earlier, it is now increasingly theorized that leisure experiences have a health promoting effect, and particularly around mental wellbeing. Much of this research seems to originate from the proposed discovery of flow states. Researchers (e.g., Csikszentmihalyi, 1975; 1990; Csikszentmihalyi & Kleiber, 1991) have theorized that leisure episodes that result in flow experiences have the potential to contribute to feelings of self-actualization and positive mental states (see also the open access book: “Enabling Positive Change: Flow and Complexity in Daily Experience”, De Gruyter Open, 2014). Flow experiences occur when the challenge presented by the activity matches the skills possessed by the individual, which can result in a centering of attention, a loss of consciousness, and an inability to keep track of time (Csikszentmihalyi, 1975). Csikszentmihalyi (1990) describes flow experiences as, “*the best moments of people’s lives*” and they occur when “*a person’s body and mind is stretched to its limits in a voluntary effort to accomplish something difficult and worthwhile*” (p. 3).

7.3 Clinical Background

7.3.1 About Technology-enhanced Multimodal Meditation (TEMM) and Light and Sound Meditation (LSM)

Technology-Enhanced Multimodal Meditation (TEMM) used in this study is an extension of an established treatment modality known as *Light-and-Sound Meditation* (LSM). LSM is an auto-suggestive relaxation/meditation technique using standardized sounds, music or meditation scenarios delivered through headphones paired with visual stimulation consisting of repetitive flickering of lights delivered via goggles at a frequency of 4-10 Hz using LED while the patient’s eyes are closed. The light

stimulation typically slows the EEG frequency and enhances the auto-suggestive capacity of the meditation program (Inouye, Sumitsuji and Matsumoto, 1979). Treatment sessions typically involve providing an audiovisual meditation/relaxation session in a supervised clinical setting.

Research and clinical experience dating back to French neuropsychiatrists Pierre Janet, Jean-Marie Charcot and other neuroscientists at the turn of the 20th century has found that for many people LSM triggers a pleasant dissociative state similar to that achieved through deep meditation and/or hypnosis, through entrainment of EEG activity (Janet, 1925; Toman, 1941; Adrian & Matthews, 1934; Walter & Matthews, 1949). LSM has been researched in a number of psychiatric applications, and at this point there is a growing body of evidence documenting its broad-spectrum clinical utility. Clinical researchers have found that repetitive LSM entrainment is effective in facilitating relaxation, meditative, and hypnotic mental states associated with alpha (8-12Hz) or theta (4-8 Hz) activity as well as promoting improvement in numerous mental and physical disorders with a psychosomatic basis (Barlow, 1960; Lane et. al, 1998; Budzynski et. al, 1999; Markland, 1990). There is now an emerging medical and psychological literature demonstrating efficacy and safety of this variant on meditation in a wide variety of psychiatric, psychosomatic and neurological conditions, ranging from anxiety including post-traumatic stress to depression, ADHD, various pain disorders and substance dependence (Cantor & Stevens, 2009; Thomas & Siever, 1989; Patrick, 1996).

LSM has also been described in the literature as “audiovisual entrainment”, “light-and-sound neurotherapy”, and “light-and-sound stimulation”, with most research on mechanism of action focusing on the calming effect of the audiovisual stimulation on psychological and neurological function, as manifested by a relaxation response. As previously described, promotion of theta and alpha EEG activity may facilitate an immersive state of “absence” from externally oriented sensory stimuli into which patients can oscillate with respect to being in a state of externally oriented “presence” (Moller 2006; 2008). Also described as “inner presence” by Finnish neuroscientist and neurophilosopher Antti Revonsuo (2006), this complex consciousness process involves the processing of sensory stimuli and consolidation with previously integrated information, very similar to that described in the psychobiological process of dreaming (Moller & Barbera, 2006). In this model, inner presence experienced through the process of dreaming could be considered the most primordial form of virtual reality, also described as “protoconsciousness” by American psychiatrist and consciousness researcher Allan Hobson (2009).

TEMM improves upon the therapeutic benefits of LSM by incorporating haptic sensory stimulation (gentle massage, heat, vibration) in addition to audiovisual cues, through a specialized chair that the patient rests upon during the meditation process (see *Figure 7.1* below). Furthermore, while basic LSM audiovisual content more typically involves exposure to repetitive binaural sounds or music paired with light therapy, in TEMM the standardized content of the more sophisticated meditation scenarios seek to mimic and on a therapeutic level, reprogram autonomous thought processes. The audio



Figure 7.1: TEMM-LSM setup demonstration

component typically involves exposure to a standardized guided meditation invoking a relaxing scenario such as a nature scenario (e.g., walking in a meadow or sitting on a beach) accompanied by repetitive positive affirmations to enhance a participant's self-esteem or psychological outlook. Through the TEMM therapeutic process unhelpful maladaptive cognitive processes can be interrupted and remediated during the multimodal autosuggestive meditation program, resulting in a “reset” state analogous to more invasive psychiatric neurostimulation paradigms such as electroconvulsive therapy (ECT) or repetitive transcranial magnetic stimulation (rTMS), as described by O'Connor et al., 2005 and Lipsman et al, 2014, but without harmful or distressing adverse effects to the patient. Upon completion of TEMM, a desired therapeutic outcome is a state of calm and deep mental and physical relaxation, with a residual awareness of the positive psychotherapeutic content of the meditation session.

7.4 TEMM Clinical Study

We have recently reported the results of a prospective observational pilot study investigating the efficacy and tolerability of technology-enhanced multimodal meditation incorporating LSM in reducing perceived stress and enhancing relaxation and mood in a group of twenty adult patients undergoing medical care for stress-related disorders (Moller & Bal, 2013).

It was hypothesized that a course of technology-enhanced multimodal meditation incorporating LSM would be rated by patients as effective in reducing self-reported stress, while also improving self-rated relaxation and mood, all of which are associated with positive and health-promoting leisure states. Specifically, it was predicted that patients would show improvements in self-ratings of 5-point Likert scale indications of stress, mood and relaxation following completion of the program. It was also anticipated that a broad-spectrum effect would be noted for a variety of stress-related conditions. It is also important to note that due to the nature of the light oscillation that is a part of the TEMM-LSM experience, patients were warned about the theoretical risk of migraines or seizures during the consent process. These theoretical risks were mentioned as cautionary information, even though they have no strong relevance to the TEMM-LSM experience.

7.4.1 Study Design

In this study, following medical screening and evaluation of symptoms and life events, patients were asked to provide self-ratings section on relaxation, stress and mood (using a 5-point Likert scale). Use of psychiatric medication was allowed for those who required so or wanted to continue with medication while participating in the program. Patients with epilepsy, psychotic illness and those who were pregnant were excluded from the study. Study endpoints included the assessment of short-term and long-term efficacy and tolerability of a meditation protocol administered twice weekly for a total of 6 to 21 sessions.

Treatment session duration was typically 30-40 minutes, and treatment plan typically involved one to two sessions weekly for a total of 6 to 20 sessions.

Themes addressed within the meditation sessions included ‘dealing with stress’, ‘relax’, ‘balancing your moods’, ‘creative problem solving’ and ‘overcoming anxiety’, chosen by the treating clinician based on clinical impression following initial patient assessment.

Following completion of the course of therapy, patients were invited to complete a feedback form in which they were asked to describe initial symptoms or concerns leading to treatment and overall impression of the treatment. 5-point Likert scales were used to assess:

- Effectiveness of the LSM treatment for initial symptoms or concerns (1 = not at all effective, 2 = somewhat effective, 3 = neutral, 4 = quite effective, 5 = highly effective)
- Adequacy of the duration of sessions (session length: 1 = too short, 2 = somewhat too short, 3 = neutral, 4 = somewhat too long, 5 = too long)
- Adequacy of the number of sessions (treatment plan length: 1 = too few, 2 = somewhat too few, 3 = neutral, 4 = somewhat too many, 5 = very many)

Another set of 5-point Likert scales were also used to allow patients to rate symptom-based self-states before and after the treatment plan, including level of tension, stress and mood state. Lastly, patients were invited to provide open-ended qualitative feedback regarding additional observations and comments. *Table 7.1* outlines patient information and initial qualitative feedback of overall impression of their therapy.

Table 7.1: Patient information and initial qualitative feedback

Gender	# Sessions	Symptoms/Concerns	Overall Impression
F	7	Stress	Very good
F	12	Depression	Slightly helpful
F	21	Stress, anxiety, depression	Calming
M	6	Anxiety, sleep issues	Helpful, leveled out anxiety
F	18	Sleep issues, stress, tension	Improved sleep, calmer and more relaxed
M	8	Stress, sleep issues	Relaxing, calming
M	10	Stress, tension	Impressive
F	10	Insomnia, back pain	Relaxing, improved sleep
F	11	Depression, stress	Relaxing, calming
M	11	Depression, stress	Boost in energy, relaxing
F	15	Brain chatter, stress, sleep issues	Nice way to relax
F	10	Emotionally frozen/blocked, sad	Helpful
F	10	Low energy, depression, stress	Relaxing
M	9	Sleep issues, anxiety	Very helpful for stress reduction, lessens anxiety, relaxing
F	12	Anxiety	Very good, can better understand self
F	13	Anxiety, sleeplessness	Can control anxiety, can sleep without interruption
F	12	Insomnia	Good, very beneficial for stress
F	20	Anxiety, insomnia, stress	Loved it, improved sleep, very beneficial, relaxing
F	15	Anxiety, stress, sleep issues	Worthwhile, helpful
F	8	Stress	Positive

7.4.2 Findings: Data Analysis and Results

This section presents the findings from the patient assessments described in the previous section. Quantitative data across all subjects was calculated into mean values. ANOVA-based statistical analysis was employed to determine significance of difference for repeat measures, before and after assessments of tension, stress and mood. As described above, full demographic information is available in our original publication of the clinical study (Moller & Bal, 2013).

The results shown in *Table 7.2* and *Figure 7.2* indicate that on average the TEMM treatment program was found to be significantly effective in addressing the symptoms and concerns of subjects, with a mean rating of 4.15 points on the 5-point Likert scale. The layout of the treatment was favourably evaluated, with mean ratings for both session and program duration near 3 points on the 5-point Likert scale, known as the neutral point. There was a slight trend towards patients desiring longer individual sessions or longer program duration; one patient received 21 sessions based on a voluntary request for an extra treatment beyond the intended program plan.

The results shown in *Figure 7.3* indicate that on average there was a noticeable decline in perceived levels of tension ($p < 0.001$) and stress ($p < 0.001$), before versus after the program, reported by study subjects. For changes in mood states of patients there was a similarly positive shift ($p = 0.019$).

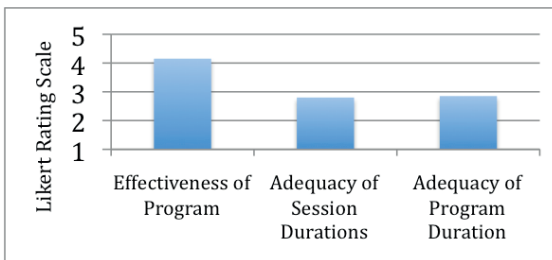


Figure 7.2: Program review assessment: treatment plan

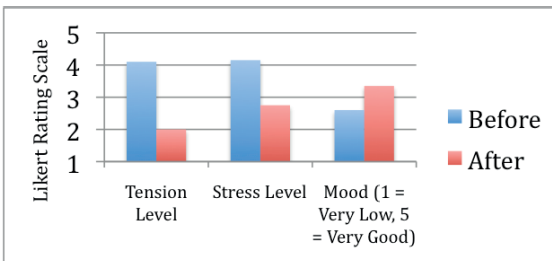


Figure 7.3: Assessment of treatment efficacy: before and after

Table 7.2: Assessment for before and after treatment mean values

	Before	After	Statistical Significance ($p < 0.05$)
Tension Level	4.10	2.00	$p < 0.001^*$
Stress Level	4.15	2.75	$p < 0.001^*$
Mood	2.60	3.35	$p = 0.019^*$

7.4.3 Qualitative Subject Feedback

A summary of the voluntary qualitative feedback received from patients through the additional comments section is shown as follows:

- Over 50% of patients specifically commented on the capacity for TEMM to help them relax and better deal with their stress and anxiety.
- TEMM was consistently reported to have helped initiate an introspective dialogue for a select number of patients — these patients reported more self-awareness of emotions and anxieties and are better able to cope with them outside of the LSM treatment.
- Some patients also articulated on their appreciation of the design of the TEMM-LSM program; using different sensory and psychological elements in combination seems to create a complete and powerful experience.
- Some patients agreed firmly that TEMM has successfully induced actual sleep states but they felt that this would be best to experience before they actually go to bed at night rather than feeling quite sleepy after the session has ended and then having to go on with their day.
- Common feedback from patients to our centre has been that the “thought stopping” and “resetting” after-effects frequently last for multiple hours, while novel insights and residual mind-body wellbeing states often last for up to a week or more.
- It is relevant to note that no adverse effects were reported during this study.

7.5 Discussion

7.5.1 Clinical Study Review: Key Insights

It is emphasized that this study was not intended to be a comparative study to other forms of therapy such as pharmacotherapy or psychotherapy. It was intended to explore the clinical utility of TEMM with an LSM component as an adjunctive therapy for patients and to widen the range of available options for patients. Furthermore,

in recognition of the heterogeneous nature of stress-related illness, no specific diagnostic category was chosen; rather patients who self-identified as seeking this stress-reduction therapy suffered from a range of symptoms including disturbance of sleep, mood, anxiety and somatic tension.

This study was also intended to be a usability study. This means that aside from therapeutic benefit, we had a keen interest to understand how a ‘user’ (i.e., patient) evaluates a program, device or technique — with additional focus on the integration of new technology in health care. Thus, of interest was both evaluation of how effective the technique is, and if there might be ways to improve upon it (such as making sessions shorter/longer or less/more frequent). On these items, mean ratings of patient satisfaction with individual treatment session duration and overall program length at a neutral level (3 points on the 5-point Likert scale), suggested that patients found their treatment regimen ‘just right’, despite the variation in total number of sessions. This could be seen as analogous to satisfaction ratings with other mental health therapies of variable duration. The standardized format of meditations used might suggest a manual-driven approach of a set number of sessions. However, having the flexibility to ‘dose’ session frequency and program length based on individual patient need appears to enhance the therapeutic experience for patients. Presence-related engagement with the therapeutic across multiple senses was considered a holistic therapeutic benefit, however, there was some variation in awareness and recollection of the specifics of the guided meditation they had experienced. This is reminiscent of the phenomenology of a vacationer returning from a journey or trip and being able to remember and integrate novel thought patterns and/or behaviours observed and experienced into their daily routine.

7.5.2 Neurophysiology and Eurochemical Aspects to Consider

It is emphasized that this study was not intended to be a comparative study to other forms of therapy such as pharmacotherapy or psychotherapy. It was intended to explore the clinical utility of TEMM with an LSM component as an adjunctive therapy for patients and to widen the range of available options for patients. Furthermore, in recognition of the heterogeneous nature of stress-related illness, no specific diagnostic category was chosen; rather patients who self-identified as seeking this stress-reduction therapy suffered from a range of symptoms including disturbance of sleep, mood, anxiety and somatic tension.

Qualitative patient feedback suggested that TEMM-LSM might be particularly helpful for sleep-related symptoms if used in the afternoon and evening. Based on patient responses and feedback, it might be hypothesized that a more general relaxation response that is also anxiolytic and mood-enhancing underpinned the benefit of this therapy. However, the audiovisual entrainment of EEG state towards ‘absence’-like alpha and theta states also implies that TEMM’s mechanism of action

may occur through a hypnosis-like therapeutic power-nap with psychological therapeutic benefit derived from the autosuggestive auditory meditation themes administered by the therapist. The fact that there was variability in what separate sensory modality aspects of the TEMM-LSM patients found especially therapeutic echoes the intended multimodal psychotherapeutic experience design alluded to as “dream simulation therapy” (Moller & Barbera, 2006), in which subliminal insertion of pleasant immersive “synthetic” media experiences into sleep-like “organic” states of consciousness can be used to enhance mental and spiritual wellbeing.

Relationship of electrophysiology to neurotransmitter regulation is also important to consider, especially in the facilitation of wellbeing and positive affect; key systems include the dopaminergic and serotonergic (5-HT) systems; 5-HT has been linked to happiness and also sleep regulation and dopamine has been shown to be involved in reward response (Meyer & Quenzer, 2005). Studies in animal models have shown the absence or blocking of serotonin to be linked to depression, in a study by Smith and colleagues (2009) the precursor to serotonin, tryptophan, was withheld and showed an increase in sadness as reported by subjects. Dopamine is involved in reward behavior, which is released from the ventral tegmental area (VTA). Also noteworthy are the cognitive deficits, which may include attention deficits related to dopamine deficits. In studies on rats and primates, observations were made on attention loss via lesions or dopaminergic blocking (Nieoullon, 2002). This is suggestive on how the two neurotransmitters may be involved via activation from TEMM-LMS therapy, as patients report greater affective states after a therapy session.

Another transmitter/receptor system to take into consideration is the cannabinoid system. Two key molecules involved are, δ -9-THC and CBD, the former works on CB1 receptors and the latter on CB2 receptors. CB2 receptors are involved in immunosuppressive/anti-inflammatory response, which could decrease pain, and CB1 receptors, which respond to the psychoactive component. Anandamide, a neurotransmitter produced naturally by the brain has also been isolated in chocolate; the neuroreceptors for anandamide are the same ones to which TJC, the psychoactive ingredient in cannabis binds to (Mechoulam & Fride, 1995). Anandamide in chocolate may therefore contribute to the feeling of wellbeing reported by “chocoholics”. Mahler et al (2007) describe a “hotspot for sensory pleasure” via anandamide in the nucleus accumbens, suggesting an enhanced “liking for sweet reward” and sensory pleasure system that one might consider an optimal leisure state. Behavioural responses to CB1 activation include a relaxed, euphoric state and also increased sensitivity to sensory input (Meyer & Quenzer, 2005), this in combination with TEMM may further the state and feeling of wellbeing. Anecdotally, patient response to the combined use of TEMM and cannabinoid therapies at our centre have shown success in alleviation of various stress-related symptoms such as mood, anxiety and sleep disturbance but it warrants further investigation if the combined usage would be beneficial to augment TEMM therapy.

7.5.3 Physiological Findings and Clinical Outcomes

Although no physiological measures were taken from users due to the application-oriented nature of our recently reported study (Moller & Bal, 2013), we noted previous studies conducted with the brainLight TEMM system in supporting data that is primarily qualitative. A study by Peters and colleagues (2013) evaluated the use of the brainLight system in a workplace wellness study. brainLight sessions were administered during rest breaks as part of a corporate health promotion program. The researchers evaluated users through EEG and HRV (heart rate variability) and noted frontal EEG slowing as well as a reduction in HRV both during and after the sessions. A study on emotion detection and universal access by Stickel et. al, used the brainLight system as a means for inducing relaxation via *Steady State Visual Evoked Potentials* (SSVEP) (Stickel et. al, 2009). While the brainLight system may not have been a central component in this study, EEG and HRV were used to study control users' baseline data upon the induction of a relaxation state. While the researchers remain unclear on the specific effectiveness of brainLight, induced relaxation was in some instances found to be correlated with successful task completion affected by motivation and reward system activation.

7.5.4 Socioeconomic and Societal Benefits

We wish to point out the potential societal benefit of health promotion on a preventative level through TEMM therapy, for example, if more closely linked to workplace health management services. Specifically with difficulty in regularly scheduling predictable vacations or other leisure events, the notion of “bringing leisure into the workplace” may be a promising avenue to pursue for employee wellbeing and productivity. Recalling the earlier comparison made above in this section, the acute as well as residual effects of such simulated or recreated leisure states is able to approximate real experiences, and perhaps even deliver these more efficiently and predictably. Specifically in preventative workplace initiatives involving high levels of leisure state flow to promote wellbeing, immersive environments can have benefits that extend beyond the level of the individual. Driver and Bruns' (1999), for example, suggested the “leisure benefits chain of causality”. Their chain of causality attempts to show how improvements in individual-level health (e.g., that result from immersive environments) can have broader societal implications and economic benefits (e.g., reduced health care costs, improved economy from more productive workers). *Figure 7.4* depicts a process whereby recreational relaxation creates economic benefits, first for the individual at the micro-scale, then the employer, and ultimately country's economy at the macro-scale (Crompton, et al., 2005). Thus, the pragmatic benefits of a safe, reliable and effective technology-enhanced meditation program with the ability to promote mental health and enhance productivity must be emphasized, particularly if it can readily be operationalized into a modern workplace setting.

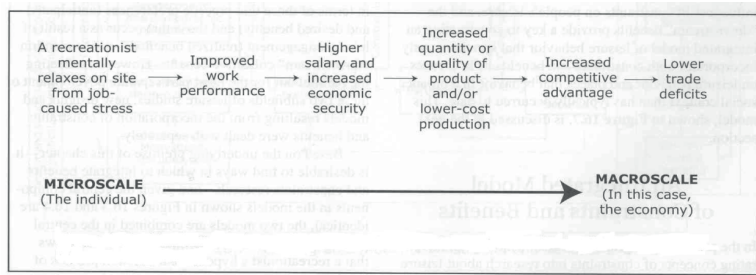


Figure 7.4: The Leisure Benefits “Chain of Causality” (Source: Crompton et al. (2005, p. 249).

7.5.5 Holistic Aspects of TEMM Therapy

The multimodal and experience-based nature of TEMM-LSM also has an element of holistic or integrative therapeutic effect; it would seem that the progress made by a patient during this kind of multimodal meditation would trickle into different facets of the patient’s life, allowing him or her to carry the benefits of treatment over into issues that may be beyond the scope of initial symptoms or concerns. Various other analogous therapies (in the form of research projects) that look to enhance wellbeing are exploring the multimodal/multisensory approach to meditation/relaxation induction or training. Biofeedback used to regulate the TEMM experience based on user performance specifically looks at bringing not only the technology closer to the body, but also the experience. Measuring of respiration patterns to augment meditative experience is a trend observed in projects at both SFU’s CPRM lab and Stanford’s Calming Technology lab, as discussed in Section 2.1. The authors of this paper plan to launch a new TEMM research project that brings the body more intimately into the meditation/relaxation experience in the near future under a similar clinical study setup. The upcoming project involves teaching healthy breath-work while displaying visual imagery that depicts positive healing experienced by the user’s body as he or she progresses with the experience. This approach ventures further into the realm of spiritual holistic health interaction while conditioning users in a way that refers to the concept of respiratory psychophysiology. It is also noteworthy that TEMM appears congruent with recent reports of utility of mindfulness exercises that include meditation, stretching, and acceptance of thoughts and emotions in veterans with combat-related post-traumatic stress disorder (King et al., 2013). In particular, the inclusion of haptic/somatosensory elements of TEMM may be congruent with the difficult-to-define mind-body benefit of stretching incorporated into meditation, which can also be seen in other forms of therapeutic exercises such as Tai Chi.

7.5.6 Personalized Medicine Aspects to TEMM and Immersive Wellbeing Environments

The ORGONA series, currently a collection of two TEMM-like experiences that engage users in healthy breath-work, serve as musings for innovative healthcare design that have also been tested and documented as well-received supportive therapy modalities (see *Figures 7.5* and *7.6*). ORGONA (the first iteration, http://harjotbal.com/?st_portfolio=orgona) interfaces primarily with the body in order to empower physicality; input is taken in the form of exhalation detected by a miniature microphone (shown in *Figure 7.5*). The game allows users to stand in front of a screen onto which is projected a backdrop of a natural environment as well as a lively cloth with pseudo-realistic motion physics. The cloth responds to breath input and, upon interaction, shoots up into the air as if it were being swept up by a gust of wind.

The second iteration, ORGONA Prana (http://harjotbal.com/?st_portfolio=orgona-prana) is an engaging multimodal healing experience simulated by technology. The function of this experience is to reinforce healthy breathing technique, borrowed from yogic meditation, through physical and psychological conditioning. This is explored by using audiovisual cues that reference the holistic concept of chakras – a concept that brings the body into the healing experience through metaphor and analogy (shown in *Figure 7.6*). The visual symbolic acts of healing and transcendence through the subtle energy body are intended to positively impact the user – having effects that are both calming and empowering, ideally allowing for transformative shifts in attitude regarding personal health. Notions of embodiment, as related to autonomy and sense of agency over one’s own wellbeing are emphasized by the design – superimposed healing led by the user’s control.

Both iterations of the ORGONA series offer immediate interactive feedback that allows users to navigate the experiences with respect to individual performance, referred to as “responsive aesthetics”. This feature allows the therapy modality to parallel and perhaps even refresh the concept of “personalized medicine” – the monitoring of performance and/or adjustment of treatment based on the individual patient more so than on a demographic or standard of treatment for a particular diagnosis. It is also likely that the ability to extract data via new technology devices, while patients/users are performing interactive wellbeing exercises, will be a leading innovative approach to tailoring therapy creating a performance history so that patients and practitioners can have a more detailed view of a user’s trajectory.

Delving further into the concept and current trend of personalized medicine, while also working with the innovative affordances of new technology, TEMM-like experiences that foster a greater sense of autonomy and empowerment in the user (patient) seem to be an ideal design project for a truly innovative healthcare paradigm. In most of the mentioned related research projects (see Section 2), the use of physiological sensors attached to the user’s body was a necessary means through which performance related data was collected. From a design perspective it is critical



Figure 7.5: ORGONA

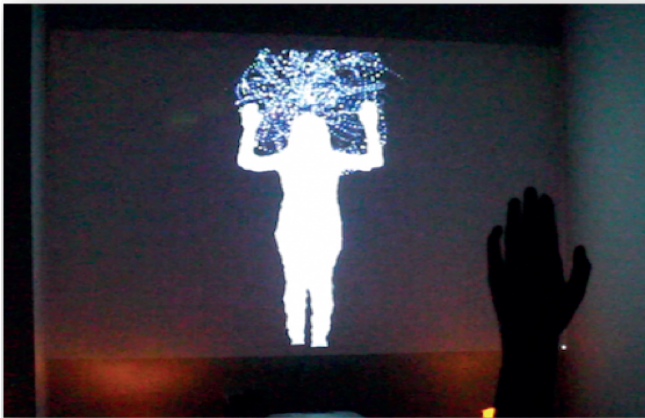


Figure 7.6: ORGONA Prana

to determine the dialogue that is imposed onto the user when he/she is ornamented in computing sensors that may act as physical and visual reminders of the user's connection to a machine that is used to make both the explicit and subtle workings of their body intelligible. Thus, an argument can be made against autonomy and agency over one's own healing experience in such projects, a paradigm similar to that associated with taking pharmaceuticals. In order for autonomy and empowerment to be realized in the context of an innovative wellbeing experience, the user should find that the system conforms to his/her reality and physicality, as opposed to the reverse — a concept that Patrizia Marti refers to as “enabling through design” in her research on responsive aesthetics for therapy and care (Marti 2012).

Certainly, there are rich opportunities for creating technologically-mediated inner presence states that may be a far more individualized and personalized approach to wellbeing, both mental and physical depending on the multimodal and sensory nature of the experience design process. A fundamental issue for the development of such technologies is to design inclusively for both accessibility by impaired people and effectiveness of the therapy. These technologies mostly refer to the concept of “cognitive orthoses” or “cognitive prosthetics”, that is compensatory strategies that alter the patient’s environment and are directed to an individual’s functional skills (Marti, 2012). Through inclusive design conceptual frameworks, we are also actively exploring development of assessment tools with high usability for use in clinical and research endeavours involving individuals with a wide range of ages, abilities, cultural/linguistic backgrounds.

An avenue to better understand how to personalize immersive environments with therapeutic intent will be to conduct focus groups with TEMM users who have interacted with and experienced presence in their healing and wellbeing journeys. Given the multifaceted, multimodal nature of TEMM, it is both a challenge and opportunity to have so many variables available to modify, ranging from light colour and frequency, to selected immersive visual naturescapes, to the audio content (both musical and textual content of any phrases contained within the meditation programs, and to the haptic elements of touch, warmth and vibration. Clarifying differences between individuals and linking qualitative “lived experience” reports to clinical data. This is part of the iterative process of designing for health and wellness that frames a creative scientific approach that allows for both methodical and serendipitous discovery. The possibilities of personalized experience design of immersive wellbeing environments appear wide open for future work, discovery and implementation.

7.6 Conclusion to Chapter 7

The initiative for this exploration of “recreating leisure” was primarily driven by clinical demand for safe, effective and tolerable mental health therapies. The demonstration of benefit in this broad-spectrum clinical population suggests that TEMM provides symptomatic relief from stress-related symptoms for a relatively wide range of symptoms. This is important to mental health clinicians as it may widen the range of therapeutic options, improve quality of life and reduce burden of suffering for a large number of patients in a standardized, replicable and easily administrable manner. The very positive qualitative and quantitative user feedback also suggests that as patients generally reported enjoying their TEMM sessions and programs, this form of therapy might have a low stigma that is possibly associated with other mental health therapies, and perhaps even contain some hedonic properties to contribute to a healing experience sought out by patients. This may set the stage not only in healthcare settings, but also in workplace wellness initiatives.

We have advocated for the creation and operationalization of simulated leisure-oriented states as an innovative and pragmatic wellbeing intervention on biomedical, public health and economic development levels. We are intrigued by the consideration that it is the element of “flow” related to presence states also induced in leisure experiences may be a primary active ingredient. This notion of creating a state of wellbeing, rather than attacking a state of illness certainly is attractive both from a patient-centered perspective and from a clinician safety-tolerability standpoint, and highlights the potential of virtual environments as healthcare tools that may have a synthetic basis, but are still holistically oriented for therapeutic impact. If “feeling good” means freedom to be at your best, this is a compelling direction for therapeutic aspects of presence-enabling technologies to head towards vis-à-vis health and wellness.

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