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WELL-BEING COMMUNITY – THE PSYCHOLOGICAL AND PHYSIOLOGICAL BENEFITS OF COMMUNAL SOUND INTERVENTIONS & VIBROACOUSTIC TECHNOLOGY

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This article discusses a Western adoption of communal Eastern well-being practices primarily focusing on contemporary sound wellness interventions. Three spiritual well-being practices are explored, their historical origins are defined, and psychosomatic effects compared. The article seeks to understand the psychological and physiological advantages of combining community and sound. The aim is to better understand how meaningful communities are formed through sound baths and how they can improve well-being. The benefits of audible tactile sound and results from current research into audio/tactile vibroacoustic technology are discussed. Interdisciplinary, the article highlights the best methodological practices for quantifying the effects of sound baths and vibroacoustic technology. Referencing cognitive and psychological insight, it synthesises empirical and theoretical knowledge to advance intellectual discourse. Implications for further research are explored, and a future for sound therapy is hypothesised.

Keywords: sound baths, music therapy, holistic well-being, communal well-being interventions, sonic perception, vibroacoustic technology.

1. Introduction

This article discusses how meaningful communities can be formed through sonic interventions, specifically sound baths, and seeks to understand the advantages of combining community and sound, how communal listening is different, and in what ways it is psychologically and physiologically beneficial. With a background in cognition, the author is a researcher focusing on the therapeutic utility of sound, sonic frequencies, and audible/tactile sound emitted by vibroacoustic technology (as further discussed in section 3).

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The article begins by exploring the aural sense, explaining how vibration is biologically integrated from blood to brain to bone (Bartel & Mosabbir, 2021), before discussing the prevalence of sound, music and silence in community. As examples of Eastern spiritual practices that endorse holistic well-being, self-care and community, yoga, mindfulness meditation and sound baths are discussed with respect to their sonic and communal elements. Spiritual interventions effectively strengthen communities as spirituality can enhance compassion and altruism (Saslow et al., 2013). Holistic well-being is a perspective on health that places equal weight on its psychological, physical, social, and spiritual aspects (Jiwattanasuk et al., 2022; Mahatthanadull & Mahatthanadull, 2020). The psychological and physiological value of assimilating sound and community for holistic well-being in the three interventions is explored, with a focus on sound baths' aptitude for meaningful community building.

Incorporating elements of music therapy and Mindfulness Based Stress Reduction (MBSR) (Kabat-Zinn, 2003), sound baths use sound as a therapeutic tool and, in a communal setting, foreground awareness of the present moment. As an amalgamation of therapeutic components, vibration, sound, and community, the article postulates the efficacy of sound baths to improve holistic well-being both intra-individually (within each individual) and inter-individually (between individuals) in the community. The article then explores the utility of tactile sound for well-being improvement and addresses contemporary research in the field of vibroacoustic technology before a proposition for the future of music therapy and a final discussion.

1.1 Spiritualism and community in crisis

Driven by the innate human desire for connectedness (Martino et al., 2017), community is a historically prevalent integral necessity for the growth of individual identity and collective ideology. Long predating the contemporary world as a prerequisite for survival, it continues to play a pivotal role in supporting belonging, purpose and need fulfilment. While contemporary communities may assimilate new trends and technologies, those of antiquity remain. These include spiritual communities – in this context, *spiritual* refers both to religion as an organisation of beliefs and practices and, more broadly, to existentialism as an innate human search for meaning (Sargeant & Yoxall, 2023). This article references spiritualism from an existential perspective. Members of spiritual communities are united by meaning-making, subjective experience and senses of agency, purpose and peace. Many widespread spiritual communities were formed in the Axial Age (500–300 BCE), which was a period marked by significant psychological and behavioural change (Baumard, Hyafil, & Boyer, 2015) and a turn away from local concerns towards transcendence, collectivity and community. A shift occurred in ways of being from 'short-term strategies' such as resource acquisition towards 'long-term strategies' of self-control and cooperative interaction (Baumard,

Hyafil, Morris, et al., 2015). Evidently, community and spirituality have cultural longevity, supporting meaning-making, connection and cooperative behaviour.

Compared to our ancient ancestry, modern humans have changed, though the mammalian brain has not. The contemporary cognitive value of community was illuminated in recent times during the COVID-19 pandemic. This period was marked by a ruthless upheaval of global normalcy as a departure of individual autonomy, freedom, independence, agency and health. A renewed spotlight shone on community as a resource for cohesion and resilience in times of disaster (Fan et al., 2020; Ludin et al., 2019; Townshend et al., 2015). In this new world of crisis, a disparate search for a 'new normal' was supported by the intricate value of community, which was reinstilled by individuals activating online community forums (Hanley et al., 2019; Patel et al., 2021; Stevens et al., 2022) and video-conferencing platforms (Tudor, 2022), who sought meaning-making, coping mechanisms, communal identity and well-being. During this time, community received global reappraisal.

A physical and psychological threat was experienced globally, initiating a pervasive health crisis. World psychological distress was at 50% during the pandemic (Nochaiwong et al., 2021), and a prior Western scepticism of alternative medicine was challenged (Gale, 2014; Gordon et al., 2023; MacLennan et al., 1996). Previously split by Western science, there was a prominent surge in communal Eastern holistic practices supporting the mind-body connection (Danylova et al., 2021). The severed connection between brain and body became markedly outdated, with scholastic knowledge edging to bridge the gap (Matko et al., 2021). Practices originating in Eastern spiritualism previously termed 'alternative' were assimilated – terminologically now 'integrative' or 'complementary' medicines (Huemer et al., 2024; Jia et al., 2024; Kolasinski, 2025; Ng et al., 2023; Subbarao et al., 2024). Spiritual practitioner popularity grew exponentially alongside mindfulness knowledge dissemination (Lopez et al., 2021; López-Ramón et al., 2023) and a hyper-prioritisation of self-care rituals and interventions (Narasimhan et al., 2023; Ridzuan et al., 2020).

1.2 Listening, sound and music, the body and resonant frequency

The psychological benefits of community are well documented, nurturing well-being and mental health by reducing anxiety, stress and symptoms of depression, and supporting emotional connection and social identity (Bowe et al., 2022; McMillan & Chavis, 1986; Park et al., 2023). This article seeks to understand the psychological and physiological advantages of combining community and sound, as in sound baths (a meditative communal sonic experience in which 'bath' refers to sonic frequencies that 'bathe' the participant, see section 2.2).

1.2.1 Listening

Listening is a subconscious natural act for those who are not hard-of-hearing or d/Deaf (Becker, 2010). Otolaryngologist Alfred A. Tomatis suggested that humans are able to listen before conception (Tomatis, 2005) as a mother's voice can travel via bone oscillation of her spine to the ear of the unborn (Sowodniok, 2016). The foetus is concurrently subject to the surrounding sounding world from which it exists in-uterine. Even at this premature stage of life, "sound mediates a unity between self and environment" (Truax, 1984) and between Self and Other. We are perceptive of our sonic environment long before we learn to speak, or indeed are fully formed.

Lacking 'ear-lids' (Jonas, 1954), the aural modality is forever 'on' and yet primarily occurs on the periphery of being (Merleau-Ponty & Smith, 1996). Affected by mood, motivation, emotional state and social context (Dibben, 2001), we are often unsuccessful at disentangling ourselves from its automaticity and rarely cognisant of it. Ethnomusicologist Judith Becker defined listening as prescribed in our identity and notions of personhood as influenced by individual knowledge structures and beliefs (Becker, 2010). Not only personal, aurality is also relational and situational as determined by cultural and contextual understanding (Herbert, 2012). Thus, community can influence how, why and what we listen to, and experiences of listening in communities will be nuanced. This article questions how communal listening differs in the context of sound baths and how this facilitates meaningful communities.

1.2.2 Sound and music

As the primary topic of interest, sound is now defined. Sound is vibration which travels through particles in a medium (air, water, gas, etc) that the ear and body interpret as sound. The wavelength of a sound is termed frequency, which is measured in Hertz (Hz) and corresponds to the pitch or tone of a sound. The frequency of a sound is determined by the rate at which vibration occurs. High-pitched sounds vibrate rapidly (approximately 2000Hz or more), while low-pitched sounds move more slowly (frequencies lower than 300Hz). With the exception of sine waves (single tones), all sound waveforms have a core frequency, called the fundamental tone, and accompanying tones of different frequencies, called overtones and harmonics. Sounds can be made by many sources, from humans clapping, to traffic, to nature, while music is organised or arranged sound. Sound baths (further discussed in section 2.2) constitute a form of improvised music, as the organised playing of different instruments. Relative to their location, they are sometimes paired with sounds of nature, which adds to their therapeutic effect (Alvarsson et al., 2010; Proverbio et al., 2018; Stobbe et al., 2022). Both sound and music constitute vibrations or transferable energies which can affect "lower-level coping mechanisms and higher-level…cognitive functioning" (Welch et al., 2022).

One definition of music therapy is that it is the medicinal use of music to improve quality of life (Raglio et al., 2015). Facilitated by a music therapist, groups or individuals are invited to listen to and/or participate in music-making by playing instruments, singing, clapping, humming or similar. Effects include and are not limited to: rehabilitation, awareness of Self and Other, improved confidence, independence, communication, concentration and attention (Bunt et al., 2024; Wigram et al., 2002). The therapeutic efficacy of music is broad, from war-crime victim reintegration (Osborne, 2012), to paediatric patient care (Hendon & Bohon, 2008), rehabilitation for criminals and substance abusers (Ghetti et al., 2022) and psychiatric disorder improvement (Freitas et al., 2022). This is an illustrative and non-exhaustive list. Well documented are the effects of music and sound with respect to motivation, pleasure, stress management, emotion regulation and bodily movement (Engel et al., 2022; Mao, 2022; Vuust & Kringelbach, 2010).

1.2.3 The body and resonant frequency

Vibration is integral to human bodily functioning. It is omnipresent from the atomic cellular, all the way up to sensorial perceptivity. Heart contractions, nerve impulses and resonant frequencies of groups of cells all require vibration. Resonant frequencies are naturally occurring vibrations (resonance) within the body (see Figure 1). Liquid, tissue and bone all have different resonant frequencies. The whole body has a fundamental resonant frequency determined by variables including height, mass, and the height-to-mass ratio (Brownjohn & Zheng, 2001; Randall et al., 1997). Resonant frequencies synchronise with external sonic vibrations, such as when riding a train (Lucas & Ko, 2020) or standing near a speaker at a music festival.

Resonant frequencies can be used therapeutically. Sine waves can activate area-specific resonant frequencies, while complex tones as in music, can affect multiple areas simultaneously (Ala-Ruona et al., 2015; Fernandez, 1997). Clinical research into vibration is broad with results quantifying hemodynamic, neurological and musculoskeletal effects like blood clot dissipation (A. Hoffmann & H. Gill, 2012; Andrew Hoffmann & Harjit Gill, 2012), relief from neuromuscular disorder-induced spasticity (Katusic et al., 2013), and improvements in balance, mobility and muscular strength (ElDeeb & Abdel-Aziem, 2020; Zhang et al., 2014). Supporting recumbent whole-body vibration, vibroacoustic research extends this line of enquiry. As discussed in section 3, vibroacoustic technology emits low-frequency sine waves and/or music within the range of human hearing to provide a tactile sonic experience. Therapeutically, it can increase circulation, relax muscle groups, improve mobility and reduce pain and stress (Campbell, 2019; Fooks & Niebuhr, 2024a). Sound baths, discussed in section 2.2, are communal sonic interventions that combine instruments with resonant frequencies primarily of low-pitch fundamental tones, overtones, harmonics, and solfeggio frequencies. Solfeggio frequencies are specific tones hypothesised to have

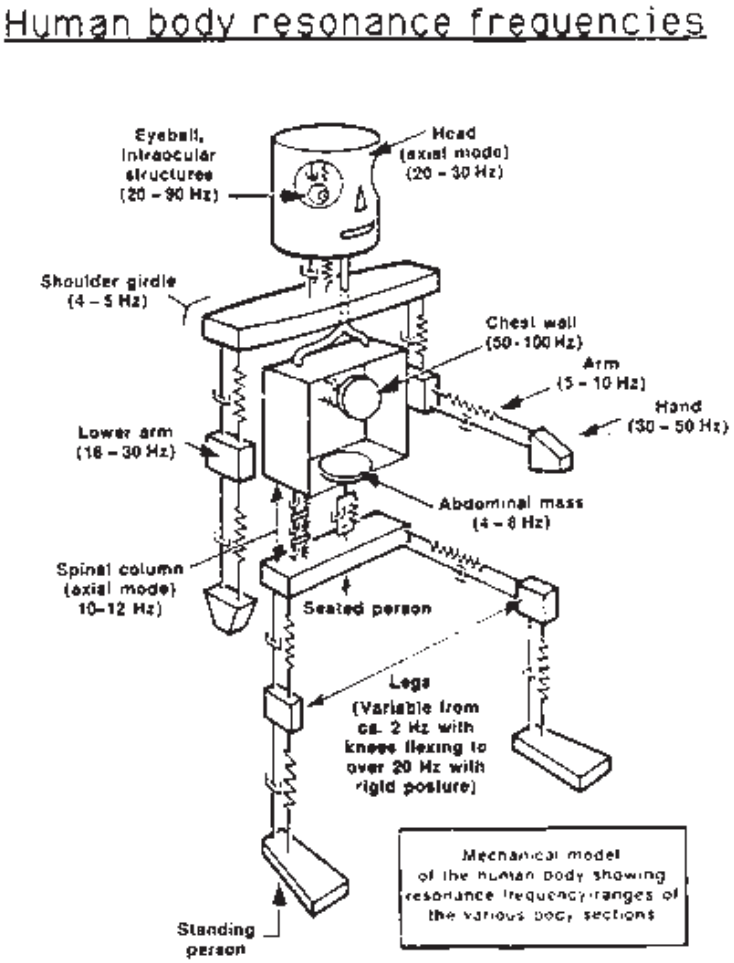


Figure 1. Approximate human body resonance frequencies (Hasa et al., 2018, p. 2).

beneficial physiological and psychological effects (Akimoto et al., 2018; Calamassi et al., 2020; Lane, 2023; Yang et al., 2023). Unlike in vibroacoustic interventions, as there is no physical contact between participant and instrument, vibration is not localised. The physical and cognitive effects of sound baths boast induced relaxation, reduced anxiety and pain, improved mood and spiritual well-being, and fostered community and group bonding (Goldsby et al., 2017; Koetting, 2023a, 2023b).

2. Sound, music and silence in community

Community attributes importance to aurality. Communication is integral as discussion and dialogue facilitate knowledge sharing, a sense of belonging, collective identity and healing (Brownstone et al., 2023; Russinova et al., 2023). Equally as fundamental are sound, music and silence. They strengthen inter-individual bonds, support introspective awareness, and heighten comprehension of The Other (*The Other* here as external energy – of others in the group and/or spiritual energy) (Lewis, 2019; Riker, 2022). Sound, music and silence are unique in facilitating community building as they support

active and passive engagement. Consider a group of carol singers in which seven are singing, and three are mouthing lyrics with an audience of ten spectators – a sense of community is built and supported here between active participation, passive reception and a blurring of the two. Communities use sound and music to strengthen identity, unity and communal practice. Examples at social, political and sporting events include chanting, call-and-response, and synchronised rhythmicity like clapping, as well as specific musical genres to reinforce unity. Spiritual community examples include gospel and choral traditions as in Catholicism and Christianity; synchronised chanting in the public Islamic call to prayer Fajr Adhan; sung mantras in shamanic Indian rituals or derived from Hebrew phrases and prayers as in Judaism; and silence like that used by Quakers and Trappist monks. Neuroscientifically, music can support communities via the neurotransmission of oxytocin which plays a primary role in social bonding. Oxytocin can be increased by a sense of togetherness, which is supported in communities by group singing or chanting, music listening, shared physical movement, and synchronised physiological responses as in heart rate and blood pressure (Grape et al., 2003; Nilsson, 2009; Olsson et al., 2013; Vuust & GeBauer, 2014; Yang et al., 2023).

The therapeutic use of music in community has a marked history. Flutes and lyres were used by communities in Ancient Greece to improve sleep, digestion and mental aliments. Aristotle described flutes as purifying and likened the emotive qualities of music to purgatory medical treatment (Aristotle, 2007). In the same text, he describes musical harmony and melody as transcending class divide, gifting pleasure and relaxation to the masses. Native Americans use rhythmic chanting, drums, and polyphonic singing to facilitate tribal and spiritual connection. Native American flutes, primarily those of lower pitch, can increase cognitive alpha activity, a brain wave state associated with heightened relaxation and meditation (Miller & Goss, 2014). The work of John et al. (2021) shows how flutes affect the parasympathetic nervous system to elicit a 'rest and digest' response (John et al., 2021). Aboriginal Australians use the didgeridoo to support well-being and communal healing during ceremonies and death rituals. The sound of this instrument has been shown to reduce stress, improve mood, heighten relaxation and reduce anxiety by stabilising the autonomic nervous system (Lee et al., 2019; Philips et al., 2019). In the Nordic countries (Denmark, Norway, Sweden and Finland), music therapy is widely used in communal contexts to support communal participation, bonding, isolation avoidance, social-emotional health, public health and well-being (Balsnes, 2018; Batt-Rawden, 2018; Saarikallio & Baltazar, 2018; Stensæth, 2018).

Sound and music used in communal contexts have extensive benefits, including: embodied music cognition, which is when interacting with sonic stimuli engages sensorimotor, cognitive, emotional, and energetic capabilities to improve cognitive, physical and social functions (Engel et al., 2022);

movement and dance, that combine motor activity and coordination with emotions, social interaction and sensory stimulation; enhanced kinaesthetic empathy, which is the neural basis for Self-Other compassion; cognitive entrainment, as the synchronisation of rhythmic brain activity with external and/or internal rhythmic events, occurring both in neural oscillatory synchronisation, and physiologically as alterations in pulse, breathing-rate and movement in-time with a beat; endorsing Flow, a cognitive state of synchronised neural entrainment associated with immersed mental involvement, deep enjoyment and creativity (Csikszentmihalyi, 1990) – communal flow benefits include competence development, need fulfilment, improved sociality, relational quality, and well-being (Magyaródi et al., 2022); emotion regulation, both down-regulation to reduce emotional intensity as in music therapy (Bjørke & Beck, 2023; Gebhardt et al., 2018; Stene, 2023; Stige & Aarø, 2011; Wärja & Bonde, 2014), and up-regulation through activation of areas associated with reward and emotion (Blood & Zatorre, 2001), increasing network connectivity, dopamine release, and emotional involvement (Gerra et al., 1998; Menon & Levitin, 2005; Salimpoor et al., 2011).

As evidenced, perceiving sound and music communally can be psychologically and physiologically beneficial. Integral, they can empower communities by strengthening interpersonal bonds and intra-individual relationships to a much greater degree than the mere structuration of community in-itself.

2.1 Silent communal practice

Silence is also crucial in community and although intangible, it is perceived. When space is 'held' for silence, time is granted for self-reflection, and it in-itself as a phenomenological object to be observed (Chion, 1994). Though vibrations do not pervade the ear drum, it is experienced by their distinct lack. By definition, silence is the absence of sound waves, although excluding anechoic chambers, even minute vibrations always exist (Rumsey & McCormick, 2009). Paradoxically then, silence constitutes a subtle yet significant immaterial sound (Bruinsma, 1992). Perceived silence maintains a level of sacrality unlike any other sound, and holding silence in communal settings is a powerful engaging act. When cognisant of silence, notable outcomes include relaxation and improved well-being and gratitude (Pfeifer & Wittmann, 2020; Skalski-Bednarz et al., 2022). Silence is widely used in spiritual communities as a vessel for prayer and contemplation. Mindfulness meditation, yoga and sound baths all facilitate and endorse the reception of silence and sound, as discussed in the following section.

2.2 Communal Eastern well-being practices: yoga, mindfulness meditation and sound baths

Mindfulness meditation, yoga and sound baths are rooted in spiritual traditions of the Eastern hemisphere. Meditation is a practice of self-reflection

and spiritual enlightenment that has been used by civilisations in India, China, and Egypt for millennia. It was popularised in the West during the mid-20th century by medical doctors and advocates of alternative medicine, including Dr. Jon Kabat-Zinn and Dr. Deepak Chopra (Chopra, 2020; Kabat-Zinn, 2018). This article is concerned with mindfulness meditation which focuses on non-judgemental awareness on the Self and present moment.

Ancient India is the birthplace of yoga, a practice combining physical movement with a meditative mindset and breathing exercises. It is used for exercise, well-being improvement, mental/physical balance, and spiritual liberation. Now endorsed in the West by communities since the early 20th century, healthcare system acknowledgement is still establishing and growing (McCall, 2014; Todd, 2022). Promoting well-being, reducing stress and improving mental health, meditation, yoga and music are now widely used integrative Western medicines (Chopra et al., 2023; Feneberg & Nater, 2022; Feneberg et al., 2023; Gangadhar & Porandla, 2015; Singphow et al., 2022; Valosek et al., 2021).

Sound baths derive from an assimilation of ancient sonic communal practices and New Age spiritualism. Their conception is contested, although they are inspired by healing and meditation practices of Australia, Tibet and Nepal (Goldsby et al., 2017). Sharing the therapeutic benefits of yoga and meditation, they have gained increasing popularity in the West in recent decades which continues to grow. Sound baths facilitate meaningful communities by fostering togetherness, group bonding and strong interpersonal connections (Koetting, 2023b). As discussed in section 2.3, the effect of instruments used during them has been quantified, though no two participants are affected in the same way. Sound bath facilitator Anne Bergstedt defines the experience as "a very internal practice" whereby individuals are subject to a range of physical and cognitive sensations, most commonly a deep state of relaxation (Ries, 2020). Exact sound bath configuration is not precise as individual facilitators define formats, though common features persist:

- Primarily experienced in communal group settings.
- Participants may lay in the supine position or another comfortable position, with their eyes closed on a yoga mat or similar.
- A blanket is provided as body temperature drops at rest (Kräuchi et al., 2000).
- Sessions vary in duration from forty minutes to one hour.
- Instruments used often derive from Tibetan culture and may include singing bowls, chimes, tuning forks, gongs, rainsticks, kalimbas, handpans and tongue drums (see Figure 2).

Figure 2. Sound bath at Soho House Copenhagen, March 2024 (images by the Author).

Figure 2 is now described to outline the practice of a sound bath: participants laying on their mats were invited to close their eyes and instructed through a breathing exercise to support physiological relaxation. A mindfulness meditation (full-body scan) was then narrated to focus cognisance on presence and physical bodily sensation. Instruments were then played with sounds intentionally overlapped while participants lay placidly.

Mindfulness meditation and yoga can be conducted individually and in group settings, while sound bathing is commonly a communal activity. Live and pre-recorded music is often used during yoga and meditations to support well-being and relaxation. The practices can also be combined, such as the full-body scan in the above example, and yoga-sound baths as hosted by the community centre Folkehuset Absalon in Copenhagen (Folkehuset Absalon, 2024). The community element of all three accommodates a collective contribution to meaningful practice that is both individually and collectively (as inter- and intra-) beneficial via the mind-body connection and commitment to a holistic whole (Cheshire et al., 2022; Russo, 2019).

All three group interventions have a spiritual phenomenological element – the shared experience of energy and resonant frequency. Awareness of bodily resonant frequency can be colloquially understood as the experiential difference between ‘feeling low’ as opposed to ‘on a high’. In much the same way one experiences one’s own energy, as energy extends outside the body (Shields et al., 2017), individuals are receptive to other bodily energies in their proximity. Thus, in communal and group settings, individuals perceive both their own (Self) and others’ (Other) energies. A communal hyper-focus

on the omnipresence of energy heightens existential awareness and improves meaningful group dynamics.

Notably, sound baths can facilitate a unique sense of meaningful community as they constitute a space held by community members for one another that is non-communicative, with a focus that is both Self and Other orientated (Tannous, 2024a, 2024b, 2024c). Participant loci of attention is directed both inward (to psychosomatic awareness, bodily energy and mindful self-reflection), and outward (to instrumental sound, resonant frequencies and energies of others in the shared physical space). Sound baths support the synergy of multiple vibrational energies perceived together, constituting the sonic audible, silence existing before, between and after sounds (Bruinsma, 1992), and resonant frequencies (instrumental and bodily). It's this delicate fostered energy field that makes each sound bath unique and supports a meaningful communal experience. Without each separate element, the experience would be changed and thus, no sound bath is replicable. Sound baths only exist in the present moment with the aforementioned energies working in tandem, which recordings cannot capture (Henricks, 2023). This requirement for presence supports each participant as a necessary integral factor in the holistic experience, drawing them into a purposeful communal identity. Well-being and mindfulness are centralised in a calm, shared setting of solitude and solidarity. Like group meditation, sound baths enable individuals to create meaningful space for one another using neither interaction nor communication. A form of 'pro-active self-care' (Parker, 2018), mental well-being is supported in an aurally-aided space facilitating heightened cognisance of sound and meaningful community. Primary elements of mindfulness meditation – self-awareness and presence – are foregrounded, and alike yoga, mind-body connection, holistic health and energies (resonant frequencies) of one's Self and the Other are centralised. Danish locations hosting sound baths continue to grow in line with interest and demand, as do new facilitators and styles, like those pairing traditional sound bath instrumentation with electronic elements to "connect the sonic and the remedial" (Aurras, 2024).

Intrigue extends beyond the field, inspiring new musical genres like *Healing House*, which combines Eastern instrumentation and spiritual mantras tuned to solfeggio frequencies (Pereira, 2016) intended to "heal you on a cellular level" (Lincoln, 2024). Shared musical preference also defines communities. A manifestation of this with respect to sound healing is the popularity of *Ecstatic Dance.* A tribalistic community, it incorporates embodied spiritualism through dance where holistic well-being is foregrounded. Defined as a space to "be our unique selves and connected to a common source" (Ecstatic Dance, 2024b), members come together to move freely and engage in the embodiment of music. Facilitating mind-body awareness, interconnection and spirituality, it supports "dance in a safe and sacred space" (Ecstatic Dance, 2024a). Music produced for it references

spiritualism and contemporary themes. Sonic elements include natural sounds like rainfall and animals, up-beat rhythm sections of eclectic instrumentation, and electronic elements from the dance and trance genres. The phenomenon has gained global attention since 2000 and continues to grow in popularity as a non-profit organisation of communities worldwide. Well-being practitioners even use it to foster their communities, offering a "rave meets ritual" in which music and unity are catalysts for "altered states of consciousness…liberation, bliss and euphoria" (Afro Trance Dance, 2024). Today, the Ecstatic Dance community in Denmark has approximately two thousand members and continues to grow (Ecstatic Dance Denmark, 2024; Ecstatic Dance Denmark Community, 2024). These examples highlight how sound and music can support meaningful communities.

Mindfulness meditation, yoga and sound baths are no longer bracketed as alternative in the West and are established holistic health rituals that have become popular, medication-free practices endorsed by Western medical practitioners and communities alike.

2.3 Psychological and physiological effects

Sound baths as a communal intervention lack research, though studies assessing the effects of their instrumentation have been conducted. Electroencephalography (EEG) research indicates it is the resonant frequencies of these instruments that may be psychologically and physiologically beneficial by synchronising brain waves as a form of neural entrainment (Kim & Choi, 2023), affecting whole-body resonant frequencies (Ahn et al., 2019) and inducing lower frequency brain wave states, mimicking the cognitive effects of meditation (see Figure 3).

Singing bowls are used therapeutically to promote deep relaxation, enhancing emotional and physical well-being. Walter & Hinterberger (2022) assessed a 'singing bowl massage' by placing singing bowls in physical contact with participants. Results show that overall EEG frequency significantly reduced, illustrative of a meditative, more mindful cognitive response. Subjective reports describe greater vitality during the intervention and feelings of happiness, satisfaction, security, and connection afterwards (Walter & Hinterberger, 2022). This is consistent with research by the same authors that found participant global EEG activity decreased during meditation compared to a resting awake state (Hinterberger et al., 2014). Often during meditation, theta and delta activity increase. The work of Kim & Choi (2023) shows that theta band activity synchronise with beating singing bowls, indicative of a relaxed meditative cognitive response (Kim & Choi, 2023). Delta brain waves are associated with deep relaxation, and Seong-Geon Bae & Bae (2019) found these increased during a singing bowl stimulation. They suggest a frequency band below 200Hz to be most efficacious, postulating it may also affect resonant frequencies in the body to induce a calming response (Seong-Geon Bae & Bae, 2019). A study by Rio-Alamos et al. (2023) found

a Tibetan singing bowl treatment to reduce self-reported anxiety and saw significant reductions in alpha band power, a state associated with attention and working memory, after just a single session (Rio-Alamos et al., 2023). Similar cognitive effects are seen during meditation, in contrast to yoga, when cortical activity often increases (De & Mondal, 2020). Indicative of improved mental functioning, this is common in exercise as areas of the brain work together. During yoga, individuals are often focussing on the poses and their breath. Thus, physiological parallels can be drawn between sound baths and yoga using heart rate variability (HRV).

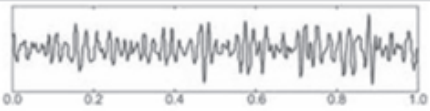
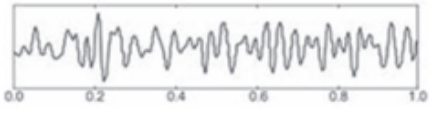
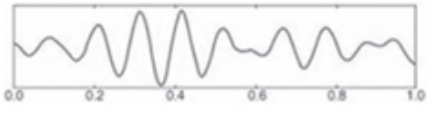
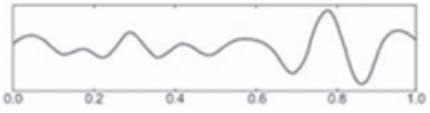
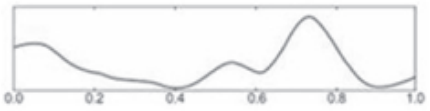
Band	Frequency (Hz)	Activity	Wave Form
Gamma	More than 30	Fastest brain wave; processing of information from different brain areas	
Beta	12 – 30	Alert consciousness; active thinking, concentration; focused or anxious	
Alpha	8 – 12	Relaxed, lucid, calm and peaceful	
Theta	4 – 8	Light sleep, meditation, or deep relaxation	
Delta	Less than 4	Deep dreamless sleep or deep state of meditation	

Figure 3. Human brain waves (Goldsby & Goldsby, 2020).

HRV is a measure of activity in the vagus nerve, termed vagal tone, which plays a crucial role in emotion regulation (Balzarotti et al., 2017). HRV measures vagal tone as it is a neurophysiological indicator of sympathovagal balance (which reflects activity of the sympathetic and parasympathetic nervous systems). Low HRV illustrates sympathetic nervous system activity (‘fight or flight’), and high HRV indicates activity in the parasympathetic nervous system (‘rest and digest’). Strengthened vagal tone supports well-being and prosocial behaviour (Beffara et al., 2016; Edwards & Pinna, 2020). Mindfulness meditation, yoga and specific instrumental frequencies can all increase HRV, illustrating less cognitive and physiological stress and a relaxation response (Kirk & Axelsen, 2020; Saharsh et al., 2020; Zou et al., 2018). Breath work is a psychologically and physiologically soothing tool used by all three practices. Externally-paced breathing is commonly used by

facilitators at the onset of sound baths and throughout meditation and yoga. Sharpe et al. (2021) showed deep breathing to have a calming effect, as indicated by increased RMSSD (a metric of beat-to-beat variability in heart rate) (Sharpe et al., 2021). The same effect was found in breathing exercises conducted during yoga and meditation (Chhabra et al., 2024; Saoji et al., 2019; Tisdell et al., 2024). Psychosocially, yogic breathing can also enhance social connectedness (Kanchibhotla et al., 2024), thus improving community dynamics during all three interventions.

With respect to spiritual sound practices, Gunjan & Banshi (2019) compared laying in the supine position with the sound of Himalayan singing bowls, to find that the latter not only increased parasympathetic activity, but that stress significantly reduced after just a twenty-minute session (Gunjan & Banshi, 2019). Saharsh et al. (2020) found that pairing a Himalayan singing bowl intervention with meditation significantly increased parasympathetic nervous system activity (Saharsh et al., 2020). Bidin et al. (2016) placed Tibetan Bowls physically onto participants to find similar results, as well as significant decreases in skin conductance metrics showing lower arousal, anxiety and involuntary mental activity (Bidin et al., 2016). Didgeridoos can also stabilise autonomic balance, with results by Lee et al. (2019) showing a sustained reduction in LF/HF ratio over ten weeks (high LF/HF ratio is indicative of sympathetic dominance) (Lee et al., 2019). A systematic review of singing bowl therapies by Stanhope & Weinstein (2020) assessed their subjective and objective outcomes. Results found that they can reduce distress, depression, anxiety, fatigue, confusion, tension and anger (Stanhope & Weinstein, 2020). Vibroacoustic technology also relaxes vagal tone and achieves EEG results similar to those of meditation, as discussed in section 3.2.

3. Tactile sound and well-being

Evidenced by resonant frequencies and a perception of silence, the human ability to listen is not confined to the aural sense. Physically perceptive, we can also interpret sound via connective tissue, muscle and bone mass (Sowodniok, 2016). Vibroacoustic technology heightens the sonic experience by adding tactile cues to sound through hardware devices that emit audible sound and time-aligned kinetic low-frequency vibration. Music, sound and/or soundscapes are optimally designed for the intervention. Physical contact between the technology and recipient enables low sonic frequencies to be heard and physically felt. Low frequencies in specifically designed music and/or sound are experienced not just audibly (through air transmission) but also kinetically (via stimulation of nerve endings in deep tissue and muscle mass), haptically (through nerve ending stimulation in skeletal joints), and tactilely (in nerve endings on the outer skin), as well as through bone con-

duction. It's postulated that sound bathing stimulates these ways of listening. Tactile transducers are already used in vibrational music therapy (Chamberlain, 2001; Eagleman, 2015; Palmer & Ojala, 2022; Walker et al., 1987), and in Norway to support neurodivergent and deafblind communities (Tomaskirken, 2023). Vibroacoustic effects are diverse, ranging from mood management (Braun Janzen et al., 2019; Campbell et al., 2019; Chesky & Michel, 1991; Chesky et al., 1997; Naghdi et al., 2015; Patrick, 1999; Rüütel et al., 2017), to induced relaxation (Patrick, 1999), depressive symptom reduction (Braun Janzen et al., 2019; Mosabbir et al., 2022; Sigurdardóttir et al., 2019), improved well-being and stress reduction (Fooks & Niebuhr, 2024a; Kantor et al., 2022).

3.1 Current vibroacoustic research: method and analysis

During 2023 and 2024, vibroacoustic research was conducted by the author of this article in Copenhagen at the National Institute of Public Health, the University of Southern Denmark (Statens Institut for Folkesundhed, Syddansk Universitet). Soundscapes designed specifically for each study referenced brain entrainment research and the psychological effects of repetitive rhythmic structures (Stupacher et al., 2022; Thaut et al., 2014). Cognitively restorative sonic elements in the soundscapes included bird song, water, wind, isochronic tones (single repetitive tones naturally occurring in nature), 40-80Hz bass frequencies, and low-pitch Eastern instrumentation of solfeggio frequencies (Bartel et al., 2017; Buxton et al., 2021; Mosabbir et al., 2020; Stobbe et al., 2022).

The study used EEG, ECG and speech prosody biosignals to quantify effects. Speech prosody is the melody and rhythm of speech (Gobl & Chasaide, 2003; Patel et al., 2011). Measuring changes in voice quality, it is a sensitive marker of emotional state (Almaghrabi et al., 2023; Fooks & Niebuhr, 2024a; Sluijter & van Heuven, 1996) with 80-90% accuracy (van Rijn et al., 2023). Psychoacoustic voice assessment tools using prosodic markers have been designed in Denmark for use in music therapy (Storm, 2013). Prosodic markers used in the study included pitch, timbre, loudness and variability. To elicit these, participants read aloud a text of emotionally colourful speech before and after the intervention (Ben-David et al., 2016).

The study conducted in 2023 analysed the efficacy of vibroacoustic technology on stress reduction and well-being improvement (Fooks & Niebuhr, 2024a, 2024b), while the 2024 study compared the effects of the modality with a guided mindfulness meditation (Fooks & Niebuhr, 2025a, 2025b). Results were split into two papers: one for speech prosody and the other collating EEG and ECG results. For both studies, participants lay on a Danish-designed vibroacoustic module (VibroAcoustics, 2023).

In the 2023 study, forty participants experienced a forty-five-minute vibroacoustic stimulation (VSM). Speech prosody analysis showed that after VSM, participants read more slowly, with a deeper voice, at a lower

loudness with less variability, while smiling. The latter result as illustrated by a shorter vocal tract shown by a significant difference in the third fundamental frequency of the voice (the third harmonic above the fundamental tone) (Erickson et al., 2009). Participants also spoke with fewer and shorter pauses in a softer, breathier, more relaxed voice timbre (Fooks & Niebuhr, 2024a). All results are markers of heightened relaxation indicative of improved well-being.

The EEG and ECG paper of the same year assessed cognitive, physiological, and psychological stress. Measuring concentration, Theta/Beta ratio (TBR) results quantified VSM as having a concentration-enhancing effect. Measured by the Beta/Alpha ratio (BAR), VSM reduced alertness indicating participants became more relaxed. Frontal/Alpha Asymmetry (FAA) is a measure of well-being related to motivation, positive emotions, and emotion regulation (Kelley & Hughes, 2019), which VSM slightly improved (Fooks & Niebuhr, 2024b). Physiologically, VSM significantly decreased heart rate and increased parasympathetic nervous system activity (as increased RMSSD and HF, and reduced SDNN and LF) (Fooks & Niebuhr, 2024b).

The 2024 study of thirty-six participants compared VSM (VSM) to a guided mindfulness meditation (MEDI) and control (CONT). A VSM soundscape shared characteristics with the 2023 study, with reverberation and electronic harmonies added. The MEDI group experienced a recorded guided mindfulness meditation narrated by a mindfulness practitioner (Alidina, 2024), and the CONT group experienced no stimuli. All conditions lasted twenty-minutes to assess whether effects were sustained after shorter stimulation. All results are preliminary.

EEG data showed that during VSM, FAA increased, indicating improved participant well-being. This result was not consistent with the MEDI group (see Figure 4). BAR significantly decreased for MEDI, showing meditation made participants more relaxed (see Figure 5), with similar though non-significant changes for VSM (Fooks & Niebuhr, 2025b). In the 2023 study, BAR significantly decreased during VSM, and this 2024 result may be attributable to shorter VSM exposure.

Speech prosody results from 2024 show participants spoke with longer pauses after MEDI, indicating increased relaxation. This finding was not replicated by VSM. Additional speech metrics are currently in processing, and will be discussed in the final paper (Fooks & Niebuhr, 2025a).

ECG data is currently being pre-processed. In accordance with 2023 results and existing vibroacoustic, sound therapy and meditation research, the authors hypothesise that parasympathetic nervous system activity will increase significantly during both VSM and MEDI, which will not be consistent in the CONT group as results will be affected by participant cognitive disposition (such as energy, mood and stress levels).

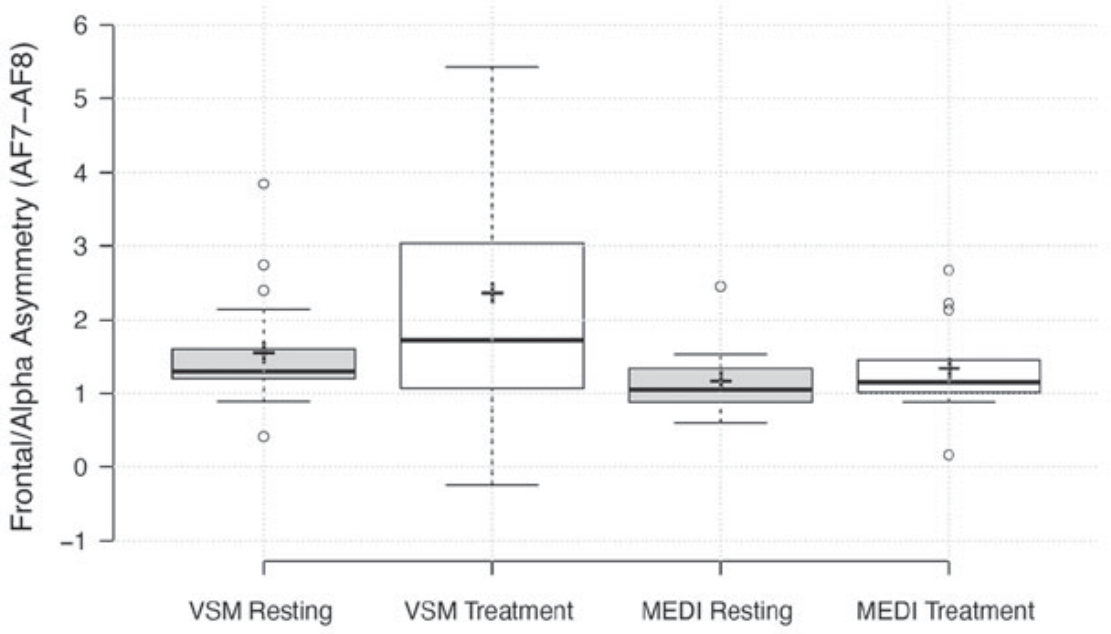


Figure 4. VSM and MEDI Frontal/Alpha Asymmetry (FAA).

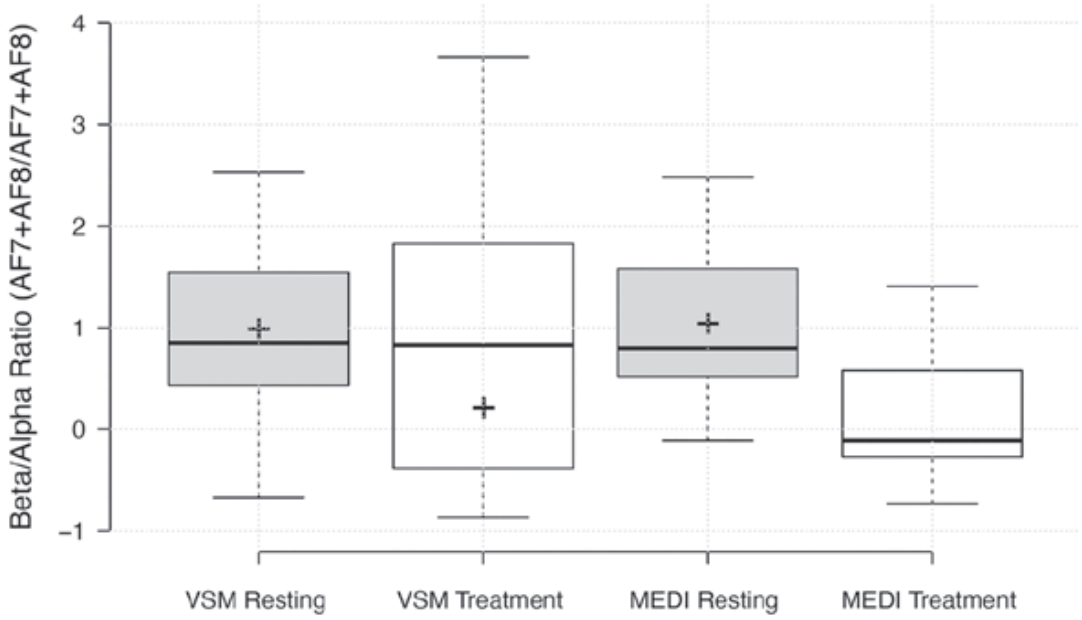


Figure 5. VSM and MEDI Beta/Alpha Ration (BAR).

3.2 Implications for future research

EEG, ECG and speech prosody biosignals are proficient at measuring sound and vibration effects on the brain and body. Sound bath and vibroacoustic research could use these metrics to understand how different resonant frequencies affect individuals.

In future research, additional metadata variables such as weight, height and age, could be considered, in addition to lifestyle factors such as sleeping patterns, consumption habits, exercise, work and self-care routines. Qualitative analysis of questionnaires and first-person verbal accounts could

facilitate subjective insights. The development of psychometric tests could compare rational vs abstract thinking styles to understand if it is indeed those with a greater openness for spirituality and existentialism who gain more from sound baths and vibroacoustic experiences (Saher & Lindeman, 2005). As individual participant variables need to be considered, all would facilitate comprehension as to how and why users are affected, aiding the tailored design of therapeutic sonic interventions to meet specific needs.

Current vibroacoustic and sound bath research is limited outside a clinical setting. Regarding vibroacoustic technology, no study to date has assessed its effect communally. KUNE is a community-focussed festival in Denmark that hosted a communal vibroacoustic installation in 2022. Designed to reduce overstimulation as "a place where [festival goers] can share the stillness" (KUNE, 2023), a large event tent fitted with a vibroacoustic floor lit only by wall projections of motion graphic artwork, housed ambient vibroacoustic soundscapes and yoga workshops. Vibroacoustic technology is well suited to facilitate groups, collective well-being and connect meaningful communities. These formats of vibroacoustic technology – those combining community with holistic well-being practices – lack quantification. There is extensive opportunity for research in this field, which would significantly advance understanding of communal sonic practices, vibration on the body, and therapeutic sonic interventions.

4. Discussion and conclusion

The effect of sound on the body is immensely complex, with more presently known about the benefits of community. In communal settings, sound facilitates community building, be this in the context of a sound bath or as an organ does for a church congregation. Unlike other communities requiring proactive input, in sonic communities, active and passive participation are synergetic – consider how listening to live music demands nothing from audience members but presence.

In sound baths, sound and meaningful community together foster a space for improved physical, psychological, individual, collective, and spiritual well-being, in summary they:

- Induce relaxation via increased parasympathetic nervous system activity;
- Endorse a cognitive relaxation response in brain wave states;
- Reinforce a Self/Other relationship, thus promoting morality, autonomy and purposefulness;
- Support intra-individuality through need-fulfilment, the mind-body connection, heightened self-awareness, agency and mindfulness, thus facilitating cognitive development;

- Support inter-individual relations through sociality, solidarity, spirituality, connectedness, energies and thus relational quality;
- Strengthen meaningful communal identity by improving intra- and inter-individual holistic well-being through awareness of presence and resonant frequencies of oneself, instrumentation, and others in the group.

Additionally, although facilitator training exists, nothing is to stop non-practitioners from buying singing bowls and forming new communities, highlighting sound bathing's flair for community building. In much the same way that vibroacoustic technology is efficacious due to direct bodily contact with vibration, live sound bath instrumentation can positively effect bodily resonant frequency synchronicity (Pereira, 2015). Thus, the live element of sound baths not only supports communal gathering but also physiological relaxation and psychological well-being via heightened cognisance of the present moment (as in MBSR). Although sound baths and vibroacoustic technology require quantification outside of a clinical setting, first-person verbal accounts highlight their shared effects, which correspond with spiritual experiences:

Quotes from sound baths participants (Aurras, 2024):

> *"A unique immersive experience that made me feel as if I reached a temporary state of transcendence."*
>
> *"I could feel the vibrations of the instruments going through my body."*
>
> *"It helped me to relax, breathe deeply and be more centred, each bath was unique."*

Quotes from vibroacoustic participants (Fooks & Niebuhr, 2024b):

> *"It was a feeling of wanting to transcend, feeling my whole – a unity between my mind and body."*
>
> *"Once in a while I came back to focusing on what's going on, the music, vibrations, I felt totally connected."*
>
> *"I could really match my breath work, it was cathartic, relaxing and calming."*

Despite the recognised value of community for well-being improvement, communal interventions still lack medical endorsement. Social prescribing (SP) is a community-centric medical approach for improving health and

well-being adopted in some countries and not yet by others, including Denmark (Midtgaard et al., 2023). It is seemingly a medical endorsement of the psychological value of community whereby healthcare professionals 'prescribe' individuals to community groups, activities and services to meet "practical, social and emotional needs" (NHS, 2024). Mimicking SP, further quantification of the cognitive and physical effects of sound baths and vibroacoustic technology are required before they are clinically recognised and/or medically regulated. However, potential implications after an extensive research and development period are broad.

As with all prospective treatments, discussions in the healthcare sector must be had between policymakers, medical practitioners, and patients as respective end-users. With regards to using communal practices to improve well-being, are patient needs met with these interventions? Do these (or other) holistic interventions appeal and, irrespective of the health benefits, would patients be open to, enjoy and/or prefer communal versus individual treatment approaches? Considerations for practical implementation include: in which locations would these interventions occur (clinics, hospitals, specialised spaces), and to what capacity? Who facilitates these sessions, and further, who regulates these practitioners? Who is best equipped to design new training modules to ensure procedural standardisation, consistency and treatment safety? Indeed, prior to all of this, for sound baths and vibroacoustic technology to be integrated therapeutic treatments, extensive research must be conducted into both. Specifically, what instruments and which frequencies are beneficial for what aliments (are some better as adjunct treatments for depression or reducing stress than others, for instance)? And in what ways are combinations of frequencies effective? To ensure maximum treatment quality, levels of vibrational force need to be analysed and tested for any adverse effects. Areas of further investigation are extensive, with variables including effect differences of gender, age, ethnicity, and socioeconomic status; effect longevity, optimum exposure time and treatment regularity (are there cumulative or diminishing returns on repeated exposure?); and placebo and control group trials need to be conducted. Evidenced, both interventions require more extensive research to improve knowledge of their effects and to whom before practical, safety and economic factors can be considered.

Sound bathing is a communal practice supporting meaningful gathering, mental health and collective holistic well-being that shares psychological and physiological benefits with yoga and meditation, and its popularity is forecast to grow. It is reasonable to assume that the research landscape will follow suit, recognising it as worthy of investigation. Vibroacoustic technology also requires further research, though together, they could constitute the future of sound therapy. Future research could collate the two interventions – a communal vibroacoustic sound bath. Methodologically, a within-subjects study design would facilitate community analysis, with two conditions

measured: one with audio/tactile stimuli and another to measure communal silence. A live sound bath with relaxation properties could be paired with low frequencies of the same effect that are transmitted through vibroacoustic technology. A second condition of neither audible nor tactile stimuli could measure the effect of silent communal practice. ECG and EEG metrics would quantify the effects of this sonic community-based therapeutic intervention. Insights from this study and similar could first be used to refine existing music therapies, with the potential to develop into a new field of therapeutic sound research. Future development of sound therapy could consolidate sound baths and vibroacoustic technology into one therapeutic intervention combining the benefits of instrumental resonant frequencies, vibrotactile sound, meaningful community and spirituality, for holistic well-being improvement. An additional advantage of this modality would be strain reduction on mental healthcare systems as it could accommodate large groups concurrently and facilitate resilience due to the communal support network (Patel et al., 2017). This research would require an inter-disciplinary approach, linking the psychological, physiological, psychosocial and psychobiological factors of these interventions that could together constitute a cornerstone for the future of sound therapy.

The contemporary world is fraught with psychological challenges. New technologies and a permacrisis (as multiple wars, increasing living costs, a series of natural disasters and extreme weather conditions) have all contributed to global discontent. The design and adoption of new therapeutic approaches that support holistic psychological and physiological well-being and meaningful communal practice are more pressing than ever. Sound baths and vibroacoustic technology are both key here. Having discussed how sound baths foster meaningful communities, and the potentiality for vibroacoustic technology to do the same, this article highlights a demand for furthered interdisciplinary research into both and postulates a new arena for therapeutic sound interventions.

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