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Technology-Mediated Devotion: An Autoethnographic Exploration of Self-Tracking in Meditation

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The intersection of technological, emotional and spiritual experiences forms a terrain awaiting thorough exploration. Recognizing the complexity of this connection becomes vital in an era where digital self-tracking technologies are seamlessly woven into our everyday lives. This research explores technology-mediated experiences in meditation and religious practices with digital self-tracking technologies. Using an autoethnographic methodology, the research used the Muse 2 Headband to monitor real-time heart rate and EEG data during spiritual engagements. Drawing inspiration from De Boer's discussion of how technology mediates the relationship between subjective and objective bodies, the core question driving this research was: What insights emerge about subjective and objective aspects of the body when technology acts as a mediator for meditation or spiritual experiences? The aim was to uncover insights that may pave the way for innovative designs of interactive technologies supporting meditation as a devotional practice. In the liminal space between technology and art, between the objective and the subjective, this exploration offers a glimpse into a multifaceted exploration of the human experience, looking for connections between data, emotion, and spirituality in the context of self-tracking practices.

Technology-mediated experiences; autoethnography; artistic practice; meditation

1. Introduction

Religion and spirituality are very complex multi-dimensional phenomena. Spirituality embraces within itself a vast range that encompasses rituals, belief systems, ideologies, and institutions. The intersection of spirituality and technology is becoming increasingly relevant as digital tools for self-tracking have become integrated into our lives. Such technologies not only collect data about the body but also reshape the way we perceive and experience it (Lupton et al., 2018).

Interaction with personal data cannot be reduced to a purely cognitive process; it has important sensory and emotional dimensions, and meaning is shaped and verified within contexts of use. According to a recent study, people have divergent practices in engaging with personal data and increasing concerns about the negative effects of digital self-tracking (Epstein et al., 2016; Ayobi et al., 2017; Figueiredo et al., 2018), which relate to the notion of *"data ambivalence."* It characterizes the ambiguity and uncertainty people feel in interpreting their data and the ethical duty to make sure that it would be soundly used and responded to in these or those particular cases (Lomborg et al. al., 2020).

Starting from exploring the role of self-tracking within the emotional dimensions of technology-mediated spiritual experiences. The equipment chosen for the project was the Muse electroencephalogram (EEG) headband (Muse, 2024)—a device capable of real-time monitoring of heart rate and EEG signals—which has also been used in previous studies (Karydis et al., 2018; Roquet and Sas, 2021). The Muse headband serves as a tool for self-understanding, offering insights into the intricate relationship between the physical and spiritual realms. Regular sessions of self-reflection and meditation unfold in personal devotional practices (in this case, meditation version of Christian) and in specific “sacred” spaces such as home and private spaces. The experience was documented through diary entries, providing a written narrative of the subjective meditation experience, thoughts, and emotions. Data gathered were thoroughly analyzed to reveal how technologies choreograph the relationship between the subjective and objective body.

When it comes to technology-mediated experience, especially in meditation and religious practices, researchers and artists are always looking for new opportunities in this field. We can now easily find

apps and concepts designed to increase mindfulness and present-moment awareness, as well as systems designed to support people in self-reflection and coping with emotions (Niksirat et al., 2017; La Delfa et al., 2019; *Cochrane et al., 2021).* Inspired by De Boer's discussion on how technology mediates the relationship between *subjective* and *objective* bodies (De Boer, 2020), the core question driving this research was: What insights emerge about subjective and objective aspects of the body when technology acts as a mediator for meditation or spiritual experiences? The aim was to uncover insights that may pave the way for innovative interactive technology designs supporting meditation as a devotional practice.

Furthermore, this exploration sought to understand the potential impact of such technologies on personal wellbeing, individual growth, and spiritual development.

2. CONTEXTUALISING MEDITATION

2.1 Why meditation?

The idea came from personal experience during the pandemic years of 2020-2022, when I spent time in quarantine at different places: Iceland, Hong Kong, Shanghai, and Sichuan. Being alone in a room ranging for periods of one to two weeks led me to ponder the relationships between space and people, as well as people and technology. These solitary moments made me think about deeper human needs: reflecting and finding spiritual connection in the solitude of a physical space.

My interest in meditation rose. Meditation has gained increasing popularity and recognition in recent years as a means to foster mindfulness and cultivate inner peace. Thus, I began a journey of self-discovery. My focus was on the changes that a meditating individual undergoes at a physical and psychological level. With current mobile phones and wearable devices, I have delved deep into the ways technology is changing meditation.

2.2 What types of meditation?

Meditation, derived from the Latin word *meditari*, meaning "to engage in contemplation or reflection," is a multifaceted practice with various forms and approaches (Hussain and Bhushan, 2010). It has deep roots in Eastern traditions. We can see examples of meditation research coming from Buddhism (Sterling & Zimmerman, 2007) and Taoism (Henchoz et al., 2021, whereas in the West, the Christian meditation tradition presents a unique form. Christians have always talked about meditation and sometimes under the name ‘contemplation’ or ‘daily devotions’. In this tradition, as Richard J. Foster explains in his book *Celebration of Discipline*, contemporary meditation is often viewed as an effort to empty oneself of thoughts and distractions, allowing the release of one's mind. Conversely, the Christian variety of meditation seeks not to rid the mind of thoughts but rather to make room for God's occupation of the individual with Himself (Foster, 1978). This approach aligns with the teachings of early Christian mystics like those elder from the Desert Fathers of the Fourth Century advised as recorded in *The Wisdom of the Desert*: *"Apply yourself to silence, have no vain thoughts, and be intent in your meditation, whether you sit at prayer, or whether you rise up to work in the fear of God (Merton, 1970)."* This view underscores meditation as a path of self-realization and spiritual growth, a movement toward the affirmation and realization of one's real nature in unison with the divine. Therefore, it also gives prominence to the tradition within Christianity for silence, solitude, and inner prayer as central constituents of meditation. This study is based on meditative experiences situated in the Christian faith.

2.3 Meditation meets techno-spirituality

To date, there is no single definition of some terms, such as meditation and spirituality, that can be easily summarized or applied to all research. For the purposes of this exploration, I define meditation as simply opening our hearts to God. In other words, what I feel meditation means to me is that in meditation we learn about ourselves and why we exist, meaning that in meditation we are not running from, but finding ourselves—meaning that in meditation we are not denying ourselves but affirming ourselves. St. Augustine expressed this very simply and beautifully: *“Man must first be restored to himself that, making in himself as it were a stepping-stone, he may rise thence and be borne up to God (Nataraja,2024).”*

Building on this understanding, I adopt Sinnott's definition of spirituality: *“Spirituality is one’s personal relation to the sacred or transcendent, a relation that then informs other relationships and the meaning of one’s own life […] Religion […] refers to practices and beliefs related to a particular dogma system (Sinnott, 2001).”*

The notion of ***“techno-spiritual practices”*** is probably the most used term in the human-computer interaction (HCI) field at present. This term was coined by anthropologist Genevieve Bell***,*** which describes the utilization of technology to enhance religious activities and encounters (Bell, 2006). As the COVID-19 pandemic unfolds, spiritual practices continue to adapt and change in response to the challenges of social distancing or isolation. Despite the strong interest in researching techno-spirituality,

there are still gaps and challenges in this under-explored area.

3. SELECTING THE EEG MEASURING INSTRUMENTATION

Studies have attempted to infer real-time meditation state by monitoring participants' electroencephalogram (EEG) signals during meditation practice (Potts et al., 2019; Cochrane et al., 2020). Among them, many projects use Muse's brain-sensing headbands in their research. Previous research has demonstrated the effectiveness of the Muse headband in measuring event-related brain potentials and meditative states (Cochrane et al., 2020, Roquet, 2021). Other brain-trackers on the market include Melon and Emotiv.

The Muse 2 EEG headband (Figure 1) is a 4-channel EEG measurement device capable of delivering real-time EEG signal data via wireless connection (Bluetooth Low Energy). The device is simple to set up, because its electrodes can be connected to the skin without any liquid. The headband can connect to smartphones, computers, or microcontrollers via Bluetooth. Being able to directly transmit and map data, make this device an ideal candidate for my future artistic creations.

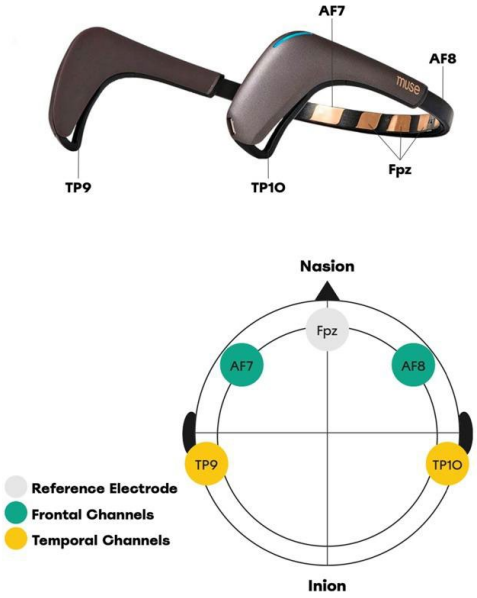

Figure 1: *Muse 2 headband sensors overview and a top-down view of the EEG electrode positions.*

4. AUTOETHNOGRAPHY AS A METHOD

This project adopts an autoethnographic research methodology that entails a thorough examination and analysis of personal experiences (Lucero, 2018). I believe this approach suits the sensitive subject of religion and spirituality well, as it allows researchers to have a first-person experience, which might also reveal subtle feelings and unique insights that may otherwise be ignored. Although it is challenging to articulate and share one's own life experiences in academic discussions, the generated knowledge is of great value. Homewood reported the results of an 18-month long autoethnographic study of using a Fitbit fitness tracker whilst having long COVID (Homewood, 2023). Mah and Hespanhol shared lived experience of *Tonglen*, a Tibetan Buddhist meditation technique, offering a way to understand and share personal knowledge related to spirituality (Mah and Hespanhol, 2020).

Figure 2: *First author meditating in her room while wearing the Muse 2 EEG headband.*

On January 2024, I started this self-exploration journey from a first-person perspective that went on for 84 non-consecutive days (Figure 5). Each meditation session lasted 30 minutes. Figure 2 shows one meditation session I did in my room, with the Muse 2 headband on the head, mobile phone aside and sitting still on my yoga mat.

After that session, data were collected in two ways: an overview report from the Muse mobile app about identified meditation states and bio-signal graphs (including brain activity tracking, heart rate, breathing and posture detection), and my retrospective journal about the experience. Sometimes after the meditation practice, I took a photo with my phone to record the scene and environment that move me (Figure 3). The two authors of this paper conducted an analysis of all the journals using affinity diagramming (Lucero, 2015), with valuable support from a fellow researcher.

During this period, in addition to my familiar practices such as praying and *Lectio Divina* adapted from Bishop Stephen Cottrell's instructions (Astley et al., 2012), I also tried different Christian contemplative techniques, such as meditating with icons. I also incorporated some personalized elements, such as adding worship songs, following devotional plans on the *YouVersion Bible App* (YouVersion, 2023), or using prayer and fasting materials provided by my local church.

Figure 3: *My meditation setup, featuring the equipment used, a view of the room's window, and a brief diary entry.*

5. The Quantified Spirituality: Wrestling with Data and Doubt

As I mentioned earlier, after each meditation session, the Muse App provides a data report on my experience (Figure 4). According to the app's documentation (MuSE 2 Starter Guide, 2023):

- **Mind**: These results help users understand how often their brain was active, neutral, or calm during meditation.
- **Average Heart Rate**: This graph presents the average heart rate, as well as the highest and lowest heart rates recorded during the session.
- **Stillness**: This reflects the amount of notable movement during the meditation.

In the early stages of using the headband, I placed great emphasis on the results reported by the Muse App. I was deeply intrigued by those quantified data, as it offered a new dimension of self-awareness by summarizing changes in my body's signals overtime. However, it soon led to feelings of disheartenment whenever my scores were low. Even a slight drop in my "calmness" score made me question the depth of my spiritual experience. This self-tracking experiment gradually became a source of anxiety. I found myself distracted during meditation, worried about achieving a particular score.

My experiences so far revealed that I achieved high scores in the following situations: when focusing on gratitude (31% on Day 48); during uninterrupted prayer (45% on Day 47); after participating in church activities (51% on Day 10 and 45% on Day 87); and when I attempted guided sessions for warm-up before meditation (72% on Day 28). However, I came to realize that the true essence of my meditation is not about attaining a higher score but rather about embarking on a path of self-discovery and individual development. Through this realization, I have come to appreciate meditation as a profound practice that extends beyond surface-level achievements, enriching my understanding of both me and God. Just as I wrote on Day 81: *"I am not striving for high scores, but rather, I aim to continue training myself in spiritual practices, maintaining a dialogue with God, and nurturing my desire for communion and to draw closer to Him."*

The design of the Muse headband and its features are intended to provide a personalized meditation experience, as stated on their website: *"The goal is a greater percentage of calm than neutral or active."* However, in my case, I discovered that a higher calmness percentage does not always correlate with a deeper spiritual experience. Similarly, I have not found any consistent patterns when it comes to average heart rate and bodily stillness. For example, there were sessions where my average heart rate was 74 beats per minute, body stillness was 23%, and my mind calmness score reached 53%. Yet, on other days, even with a lower average heart rate of 64 beats per minute and a significantly higher body stillness of 65%, my mind calmness score dropped to 0%.

I have had experiences similar to those described in Homewood's autoethnographic study (Homewood, 2023). In her account, the embodied knowledge produced is seen as distinct from the data produced by her Fitbit. These conflicting feelings have led me to question the role of tracking devices in meditation practice. Can one's focus on God be adequately captured or defined by a quantifiable—yet often unstable—score? For example, while my overall meditation experience may be focused and emotionally charged, the final Muse data may not reflect my subjective emotional experience. In my autoethnographic account, I started to ask what is the relationship between these numerical outputs and one's spiritual experience? What kind of data is more important in spiritual experiences? While previous research using the Muse showed event-based results (Przegalinska et al., 2018), I have only found a pattern so far, where I was more likely to be detected and classified as "calm" when I closed my eyes and prayed.

Overall, the challenge is unique when it comes to quantifying something as intangible as faith. I do not consider these quantitative data to be a complete assessment of my meditation level or spiritual experience. However, this does not mean the data are "fake" or insignificant. The connection between the data and my personal experiences is

meaningful, as it encourages deeper reflection on how these signals fit into my life.

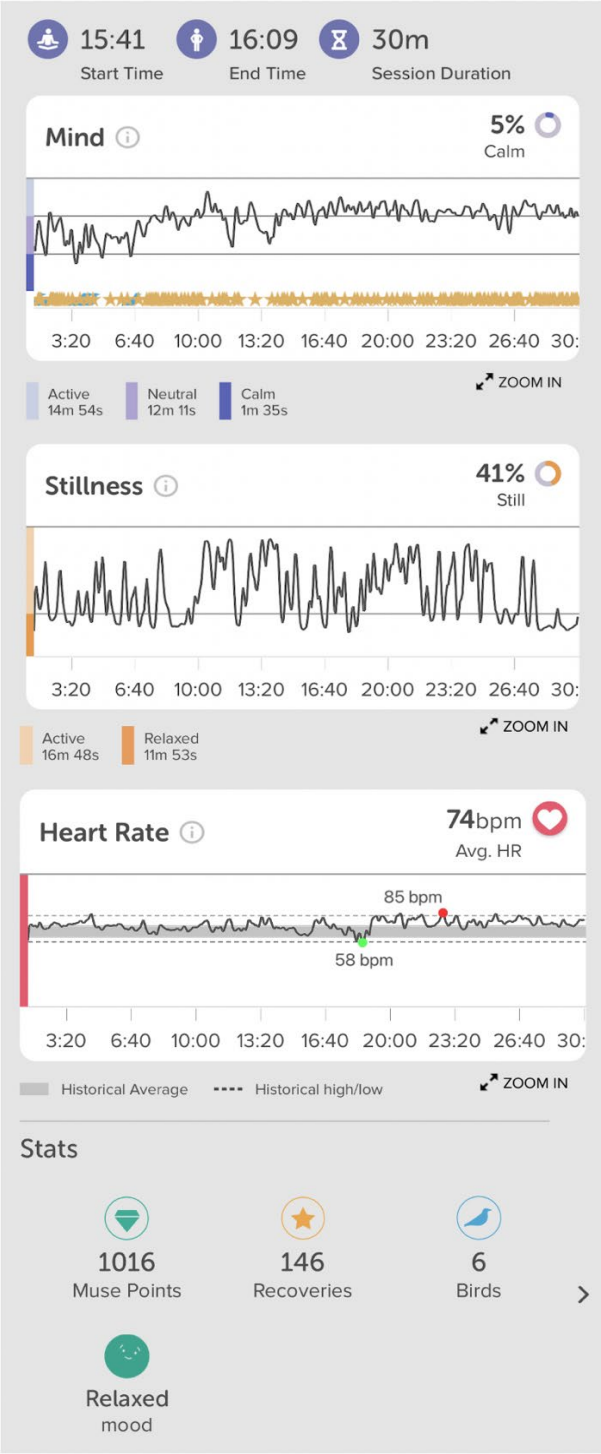

Figure 4: *A sample report from the Muse App for each meditation session, including metrics for Mind, Stillness and Heart Rate.*

6. Embodied Devotion: A Tapestry of Data and Meditation

Several sensory elements formed part of my spiritual experiences. I paid more attention to the feelings from different parts of my body during meditation. Throughout the entire meditation practice, I found myself becoming more aware of the changes in my body. For instance, the slow and repetitive deep breaths not only helped relax my body but also made me aware of the cold air passing through my nostrils: *"I feel the inhalation and exhalation through the nose. The cold air entering my nose seems to cool down my thoughts. (Day 9)"*

In my diary entry on Day 47, I wrote, *"I felt as if there was a concentration of hot energy in the centre of my forehead. This was not the first time I had this feeling. I have encountered it before during moments of intense prayer and strong thoughts."* This sensation was something I often experienced during my daily prayers as well. I also found that practicing focusing on my breath and adjusting my posture helped me gradually relax and redirect my attention to God during meditation.

As I continued my meditation practice, I found the auditory stimuli affect my meditation experience in different ways. Real-time audio feedback from the Muse App impacted my meditation experience and elicited both positive and negative responses. On one hand, sometimes, the audio cues did lead me on to staying focused as I wrote on Day 11: *"I turned down the background sounds and turned up the chirping of the birds, which I felt would help me become aware of my state during the meditation."* Missing these cues or being constantly distracted, however, has been disruptive and sometimes even stressful.

Visual stimuli also played a role in my meditation. Occasionally, I would observe the surrounding environment with my eyes, and at times, I noticed flickering lights behind my closed eyelids. During meditation, I had the habit of starting and ending with a prayer, so instinctively, I would have my eyes closed. There were several occasions when I distinctly felt the glinting light and shadows behind my closed eyelids. They did not have a specific shape, but I could sense an undulating motion, as if a candle flame were flickering. However, when I opened my eyes to gaze at the scenery outside, especially during moments of quiet and relaxation. I was experiencing what I recorded on Day 49: *"I opened my eyes and looked out the window...The Finnish flag was hung on the flagpole outside the window at some point. Occasionally the wind blows and the flags spread out a little. I think looking out the window also makes me feel calm and grounded."*

These visual cues added unexpected delights to my meditation experience. From January to April, the cold, icy world outside my window gradually melted into spring. Observing the changes in nature also led me to contemplate God's creation and appreciate the small details and beauty of everyday life during my meditation.

Yuniarwati *et.al* conducted a meditation program for Catholic business people along four dimensions of spiritual well-being, which include caring about community or social issues, loving and appreciating nature, strengthening faith in God, and discovering the true self and the meaning of life (Yuniarwati et al., 2020). Their findings corroborate my own experiences, where both personal and environmental factors contributed to a deeper, more embodied spiritual practice.

7. A TECHNOLOGY-MEDIATED INQUIRY

While deeply personal and self-constructive, spirituality is also impacted significantly by external influences. Some, like Kaewkitiponga et al. (2023), hold the view that there are two forms of such external factors: the "*mediators*" that facilitate the emergence of spiritual experience and external factors that affect the practice itself. Post-phenomenology reveals that technologies can never be neutral, for they are not only tools passively lying before us but also active agents in the constitution of the self and the world. "Technologies co-determine how subjectivity and objectivity are constituted" (Verbeek, 2005), Verbeek states, and hence, the very nature of technologies is to influence perception, and the very being of spiritual practices. Thus, as we infuse digital tools in spiritual practices, new mediators arise that complicate while enriching the experience.

Johan Redström (2008) used the term "*use design*" to describe how users redefine the intended use of a device through their interactions and by rejecting or modifying the initial design. I believe that the Muse headband was not originally designed for religious purposes, and my use of this device has to some extent redefined its application. My goal is not to test and evaluate all its modes and functions, but rather to use the device as a recording tool within the context of my research, helping me understand the feelings and tacit knowledge experienced by practitioners during meditation.

There were moments when I feel like a lab rat in one's own spiritual experiment. The very act of inquiry began to alter the experience itself, making me acutely aware of how new technologies can impact familiar religious and spiritual practices. Through this research, I had explored different Christian contemplative practices that I had not previously engaged in. This has undoubtedly expanded my faith experiences. However, the intervention of the self-tracking device has also modified my habitual self-devotion, such as the fixed 30-minute duration compared to my previous more free-flowing practice. In this particular context, the use of self-tracking devices has to some extent changed the way I engage with my religious practices, bringing both positive and negative impacts to my established routines.

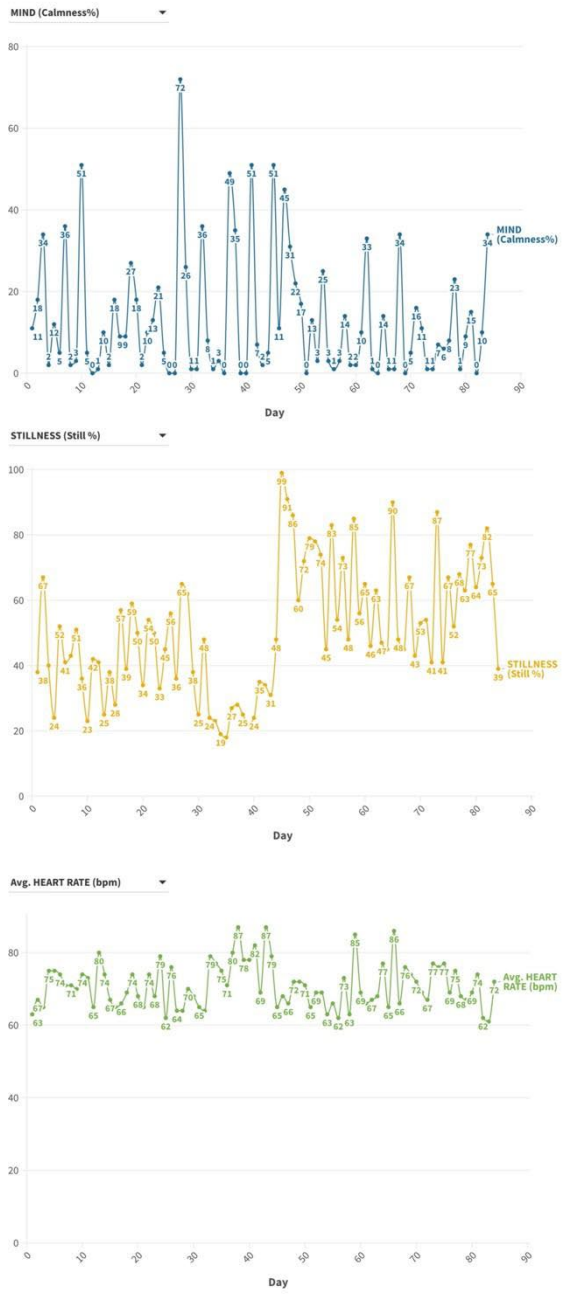

Figure 5: *84 days of biological data reports from the Muse App.*

There is no good or bad technology in spiritual practice. What matters is how these technologies are used and the meaning we derive from them. As De Boer argues (2020), "there are many occasions in which there is a disharmony between objective and subjective body." For example, self-tracking devices tend to amplify certain aspects of our health or behavior, encouraging us to make changes based on the data collected. This can both empower and constrain us when we begin to view ourselves through the metrics these devices provide.

However, the reliability and appropriateness of such devices like Muse in spiritual contexts remain a matter of debate. These devices cannot be compared to medical devices, and their data should be interpreted with caution. Yet, as a personal "Real-Time Meditation Coach", if we view through a broader lens, beyond their medical or scientific origins, such technologies can support users to reflect on the nature of spiritual experiences.

8. CONCLUSION

It would be hasty to draw conclusions at this stage. Meditation as a spiritual discipline is about the wholeness of mind and spirit—wholeness of our total being. The silence of meditation allows us to move from the surface to the depth of being, where the Divine dwells.

Our purpose was not to exhaustively evaluate every method and feature of meditation offered by the Muse Headband App, but rather to use the device as a recording tool within the context of a study. This approach helped us capture the subtle feelings and implicit knowledge that meditators experienced during meditation. As the Roman Catholic priest and Benedictine monk John Main emphasized (Main, 2006): *"Meditation is the process in which we take time to allow ourselves to become aware of our infinite potential in the context of the Christ-event […] Learning to meditate is not just a matter of mastering a technique."*

Additionally, we acknowledge that spirituality also involves engagement with others as well, either through collective religious practices like Sunday services or through different individual rituals like self-devotion. For this reason, it is important to look for spirituality in a variety of ways to fully understand its impact. The first author admits her understanding of the Christian faith is limited, and that different Christian denominations have different practices and emphases. We respect the different views on techno-spirituality among different religions, also those that are *"spiritual but not religious."*

In the liminal space between the objective and the subjective, this exploration opens a private spiritual journey where personal data becomes a medium for poetic expression and the body itself becomes an artistic presence. In this sense, this research project offers a glimpse into the complexity of human experience, with emphasis on how data, emotion, and spirituality intertwine within the field of self-tracking practices, hence encouraging a more sensitive consideration about the way modern technologies influence our spiritual lives. We invite readers to reflect on the evolving nature of spiritual practices in this tech-saturated world.

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