

DESIGNING FOR MINDFUL MOMENTS

FOSTERING WELL-BEING THROUGH INTERACTION DESIGN

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ABSTRACT

In today's fast-paced world, where technology often drives our daily lives, the need for mindfulness and well-being has never been more important. This thesis explores how interaction design can create moments of awareness that can support well-being. It is guided by three main research questions: How can a designer design *for*, *with*, and *through* mindfulness? How can interaction design cultivate mindfulness and create spaces for awareness? What is the intersection between mindfulness, technology, and the role of the designer? These questions explore mindfulness not just as a personal practice but also as a more conscious way of thinking about design.

This research combines theory, personal reflection, and design experiments to better understand the role of mindfulness in design. Inspired by my mindfulness journey through illness and healing, the thesis focuses on how design can help people reconnect with their body and mind. I also reflect on the challenges of designing for mindfulness, such as the distracting nature of digital technology and translating mindfulness into interactive experiences as a scaffold to cultivate moments of mindfulness.

The key project in this thesis is *The Walking Muse*, an interactive design inspired by walking meditation. The project uses music and biofeedback to interact with people's walking pace, inviting them to bring awareness to their bodily movements and bring body and mind together, to evoke mindfulness through embodiment. It leverages predictive processing theories which suggest that the brain works by constantly predicting sensory input and updating its model when predictions are wrong to engage the synchronisation of the mind and body.

This work is an example and experiment for designing *for* mindfulness (creating mindful experiences), *with* mindfulness (using mindfulness practices during the design process), and *through* mindfulness (embracing mindfulness as a design philosophy). It explores how interaction design can contribute to a more consciously designed world and a more conscious way of living.

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INTRODUCTION

When considering my master's thesis, I began with a question: What can I, as a designer, contribute to the world? I came to a profound realization: life itself is the greatest problem we face. Why do we exist? What is our purpose? Why must we suffer? What does it mean to live well? These existential questions have occupied my mind since my teenage years, shaping my inner world. As someone in her mid-twenties who values introspection and self-awareness, I wondered: What insights from my own experiences can I share through my thesis? Could this thesis serve as both a reflection of my journey and a gift to others? If design is about shaping a better world, then why not grapple with one of life's most profound challenges: suffering. Could I explore a path toward peace and healing, inspired by the teachings of Buddhism and Eastern philosophy?

This Master's research in interaction and experience design situates itself within the field of designing for mindfulness. This field explores the intersection of technology, design, and mindfulness practices.

Research Questions and Objectives

1. How can designers design *for*, *with*, and *through* mindfulness?
2. How can interaction design cultivate mindfulness and create spaces for awareness?
3. What is the intersection between mindfulness, technology, and the role of the designer?

The research explores the development of design to cultivate moments of mindfulness. I experiment with designing for mindfulness through interactive design in the field of experience design, utilizing technology. While the research delves into the intersection between design and mindfulness, it does not begin with the intention of design serving as an instrumental application or device. Instead, I explore my journey as a designer engaging with mindfulness. I hope to communicate reflections that arose from my mindfulness practices, encouraging designers to reflect on their role in designing for mindful moments. It acts as a speculative guide to evoke collective well-being, fostering understanding of ourselves and our relationship to the world and searching for ways to mindful living.

MINDFULNESS AND DESIGN

THE LESSON IN RHYTHM IN WELL-BEING

Growing up, I was a curious and ambitious child. I questioned everything, from "What's for dinner?" to "Who am I?" and "Why am I here?" My parents, like many Asian parents, worked tirelessly to secure my future. They enrolled me in violin and ballet lessons, instilled discipline, and celebrated my academic successes. I often told myself, "I must work hard; I can't let them down." But this relentless drive for perfection took its toll. At 14, I developed transverse myelitis and meningitis, a life-threatening illness that hospitalized me for a month and left me relearning basic functions like walking and eating.

One vivid memory from that time stands out. My doctor had suggested hemodialysis if I showed no signs of recovery, but my father calmly said, "Give her time to try to get better. No rush." His words gave me strength, reminding me that healing couldn't, and should not be rushed. Yet, I also remember a day in the hospital corridor when my mother urged me to walk faster. I had just begun to stand and take steps after lying in bed for days with a urine bag, finally able to move again. Her words triggered something deep within me, and I had my first cry in the hospital. It wasn't frustration or anger, it was the overwhelming realization of how hard I was trying, and how fragile I felt. That moment crystallized a profound truth for me: healing requires time, patience, and an attunement to one's own rhythm.

This experience left indelible marks on my body, mind, and family. It also taught me an invaluable lesson on health. Confronting mortality at such a young age, I resolved to follow my passions and live life fully.

My journey toward healing introduced me to mindfulness and meditation during my bachelor's studies, when I researched design for ADHD. While I continued meditating sporadically as a product designer, these practices often faded into the background. Still, the pursuit of wellness remained constant, drawing me toward self-discovery, family dynamics, spirituality, mindfulness, and the existential questions of life.

As I began my master's thesis, through introspection, I remembered what I had learned: healing begins when we slow down, live mindfully, and reconnect with ourselves. This insight, rooted in my personal experiences, became the hypothesis for my thesis, a starting point for further exploration.

"There is no agony like bearing an untold story inside you" (Hurstons, 2006). I attempt to give voice to my untold story. This thesis is not only a prescription for my younger self but also a gift to anyone seeking healing, balance, and mindfulness in their own lives. Through sharing my journey, I hope to inspire others to reflect on their own rhythms, slow down, and reconnect with their inner worlds.

THE ART OF DOING NOTHING: REFLECTION ON PRODUCTIVITY AND CREATIVITY OF DESIGNERS

Productivity has always been something I cared about since I was young. My kindergarten teacher said I was slow in doing things. In primary and secondary school, I had to go to tutoring sessions right after classes, and even on weekends, I couldn't sleep in because I had to participate in various extracurricular activities and competitions. Looking back, it feels like I barely had any time for fun or rest. I felt like a seemingly bright and polished shell, constantly pushing myself in Hong Kong's highly competitive environment to become the "perfect" student my parents envisioned—marks of 90 weren't enough; I had to aim for 99. After falling ill in high school, I learned to slow down and started courageously pursuing things I was passionate about. But I always felt that I had to do even better in the things I loved in order to become a better person and ultimately have a better life. The endless pursuit of more and better—reaching one goal after another—what's the meaning behind it? Am I doing it to satisfy myself, or am I just living up to the expectations of my parents and society?

It feels like no one ever taught us that we can stop, take a breath, and that while we should strive hard to have no regrets, do we truly know our limitations? How hard should we push? Where is the end of this pursuit? When people around me keep hustling—winning awards, getting promoted—can I truly stay detached and "lie flat" with a clear conscience? It is also interesting how many Chinese four-character idioms contain expressions that appreciate hard work and criticise laziness: 孜孜不倦、勤能補拙、好逸惡勞、遊手好閒、得過且過. A few idioms appreciate resting towards self-cultivation and a more productive future like 休養生息、養精蓄銳. Traditional Chinese culture emphasizes diligence, with relatively few idioms that purely celebrate rest or leisure. Asian kids can probably relate to this: when you want to go out, your parents say "all you ever do is hang out outside," but when you stay home, they say "you're just being lazy at home doing nothing all day."

I think my first real understanding of the "lying flat" concept—a social movement in which individuals reject excessive work pressure and material ambition (Zhang & Liu, 2024)—came not just from experiencing my physical limits, but also in high school when I worked on an art project about subdivided flats. I realized that no matter how hard many Hong Kong people work, they may never be able to afford a home. This made me start questioning the meaning of hard work. Later, when the 2019 pandemic began, life became more restricted, leading people to reevaluate what was excessive in their daily routines and simplify them as much as possible. My university final year was too intense, and my body once again sent warning signals, reminding me that pushing too hard leads to collapse, and it was time to reflect on the meaning of productivity. After graduation, I decided not to find a job immediately. Instead, I took a few months off, embracing what might be the last summer break of my life, doing things I love, and taking time to reflect before stepping into the workforce.

Productivity is tricky. As someone vulnerable to procrastination, I've tried all sorts of productivity tools—Pomodoro timers, rewarding myself after tasks, working with others—but when it comes to things I dislike or care too much about, I often end up doing them at the very last minute. This internal struggle is extremely painful and anxiety-inducing. But when I'm doing something I love—whether it's photography, painting, design, or 3D modelling—I enter a flow state and everything becomes effortless.

As described in *White Supremacy Culture in Organizations* (Centre for Community Organizations, 2019), perfectionism enforces unrealistic productivity standards by equating efficiency with worth, discouraging

reflection and learning, and fostering a culture of stress and burnout rather than sustainable, collective success. I remember my final university presentation—I procrastinated so much that even my professor asked where I was. While my classmates had already started presenting, I was standing at the classroom door, using tape to hold together my unfinished prototype. If I have spent my whole life achieving and producing, then does the version of me who procrastinates before deadlines, avoids tasks, and submits work that seems unfinished—does she have a place here too?

Every day, I oscillate between wanting to improve myself and wanting to "lie flat." This ongoing self-blame for not being productive traps me in a spiral of self-doubt and mental exhaustion. However, I felt liberated while learning what I describe later as the art of doing nothing (Odell, 2019). Lao Tzu knew this centuries ago. His writings remind us that we have limited life, and that to use that limited life to pursue something that is unlimited is not ideal. Zhuangzi stated, "There is a limit to our life, but to knowledge there is no limit. With what is limited to pursue after what is unlimited is a perilous thing" [吾生也有涯，而知也無涯。以有涯隨無涯，殆已。] (Sturgeon, n.d.).

Dr. Tao (健康嗎 Health Code, 2023) illustrates the importance of effortless action in modern times through the fear of missing out phenomenon and information overload. This brings to mind Heidegger's concept of "in order to" (Wrathall, 2025), where modern people seek to utilize everything deemed useful. While waiting for the bus, we fill every second scrolling or talking on our phones, refusing to let a moment go "wasted." We become exhausted chasing endless information we're afraid to miss—friends' latest updates, news, sales. Do we truly need all this information? Recognizing how phones hijack our attention, I turned off most notifications, unsubscribed from unread promotional emails, and kept only essential apps on my main screen. We live in a generation where technology uses clickbait and mindless content to encourage binge-watching and doom-scrolling, leading to mental fatigue. When we stop seeking more from the outside world, we reclaim moments of silence without our phones' constant interruption.

"Because of our phones, we may find ourselves incapable of sitting alone in a room with our own thoughts floating freely in our heads, daring to wander into the past and the future, allowing ourselves to feel pain, desire, regret and excitement." (Life, 2018)

Artist and writer Jenny Odell discusses non-productive pursuits in her book *How to Do Nothing: Resisting the Attention Economy* (2019). She emphasizes that it's not just about reducing screen time but questioning the entire framework of productivity. Odell explores how stepping back from modern life's constant demands can be a form of resistance in our attention-driven economy. Through examples like Zhuangzi's "Useless Tree", she questions whether productivity should be our ultimate pursuit and what our endless efforts truly achieve. Andreotti (2021) believes that modernity pushes us to always be productive. She thinks that stopping this constant need to produce value will give us room to let go of harmful wants and desires (Andreotti, 2021).

Vietnamese Zen monk Thich Nhat Hahn says it this way:

Many of us keep trying to do more and more. We do things because we think we need to, because we want to make money, accomplish something, take care of others, or make our lives and our world better. Often we do things without thinking, because we are in the habit of doing them, because someone asks

us to, or because we think we should. But if the foundation of our being is not strong enough, then the more we do, the more troubled our society becomes. (Thich Nhat Hanh, 2014).

Clearly the ability to slow down, and take the time to maintain our well-being is always very important. Why is non-action or effortless action important to designers specifically? To frame mindfulness as something useful to boost our creativity and productivity creates an ironic paradox. I experienced a clearer mind and flow of ideas during and after my retreat-like summer term (see next few paragraphs). I wanted to explore how slowing down develops our power of noticing as creatives, which reminds me of Harvard professor Jennifer Roberts's (2013) practice of patience. Roberts demonstrates that requiring students to spend three hours observing a single artwork teaches them that genuine understanding requires patience and deep attention—skills increasingly crucial in our era of instant digital access. I also wanted to explore why we have our best ideas in the shower and during walks, and how mindfulness and flow states work in tandem. However, I don't see mindfulness as merely a skill to acquire or a tool for creativity; instead, as I detail later, I see it as a gateway to question the very purpose of design and become a more conscious designer.

Alan Watts said, “A scholar tries to learn something every day; a student of Buddhism tries to unlearn something daily” (as cited in Goodreads, n.d.).

Learning consists in daily accumulating;
The practice of the Tao consists in daily diminishing.
Diminish and diminish again,
Until you reach the state of Non-Ado.
Non-Ado, and yet nothing is left undone.
To win the world, one must renounce all.
If one still has private ends to serve,
One will never be able to win the world.

為學日益，為道日損。
損之又損，以至於無為。
無為而無不為。
取天下常以無事，
及其有事，不足以取天下。

(Lao Tzu [老子], ca. late 4th century BCE/1996, trans. Wu, *Tao Te Ching* [道德經], Chapter 48)

To research mindfulness, I wanted to learn through practice, and I discovered that mindfulness involves two aspects—practicing and learning, practicing and unlearning. During my two years of Master's studies, I spent the summer term essentially doing nothing—sometimes reading and doing chores, sometimes simply living by drinking water, eating, and sleeping. I also nurtured sunflowers from seeds I got from the library, watching them grow inch by inch, day by day, observing their life unfold. When I was away from home for two days, I worried whether they would be blown over by winds or suffer from lack of water. Their drooping leaves would signal thirst, but since they couldn't speak, I could only observe and hope my choices were right. During blooming

season, spider mites appeared, and I anxiously wondered if they would render all my efforts futile. This summer was an unplanned retreat that I'll cherish forever.

As Odell (2019) describes, I embraced a passive, slow, contemplative, life as an act of maintenance. But *doing nothing* to me was not about resting or taking breaks from a productive life. It was not a planned retreat. It was simply about being—living naturally as a human being who takes care of themselves by sleeping, drinking, and eating, while also tending to family members and plants that need care just as naturally. It was about living in a minimal way, free from the pressure to optimize time or achieve something tangible. I feel that there was no goal to achieve, and it was not about fighting against or resisting anything. Although I was working hard to keep my plant alive—I later realized I should have simply let it grow naturally, since there were so many things beyond my control—I still see my summer life as *doing nothing* because, at its core, I was simply experiencing life.

That summer, I witnessed impermanence through the flowers' blooms and withering. I learned about what I could and couldn't control. I noticed my attachment to the sunflowers and became aware of my emotional responses. These attachments became windows into self-discovery. In serenity, I listened deeply to my body and mind, beginning to unlearn negative habits that had gone unexamined before. I worked on unlearning my anxiety about keeping pace with classmates on thesis work, and on accepting and observing my habitual responses toward myself and loved ones.

This act of maintenance, both of myself and of the plants, was not separate from mindfulness; rather, it was a form of practice in itself. Odell (2019) sees maintenance as “maintenance of keeping ourselves and others alive and well” (p. 19) and “the mere experience of life as the highest goal” (p. 15). Just as mindfulness is not about achieving a fixed state but about being present. Through *doing nothing* and deep looking, I relearned how to respond to life rather than merely react, discovering that well-being is not about reaching a particular outcome but about sustaining a conscious way of being. This insight became the guiding philosophy for the development of the Walking Muse.

Figure 1

Growth Stages of the Sunflower.

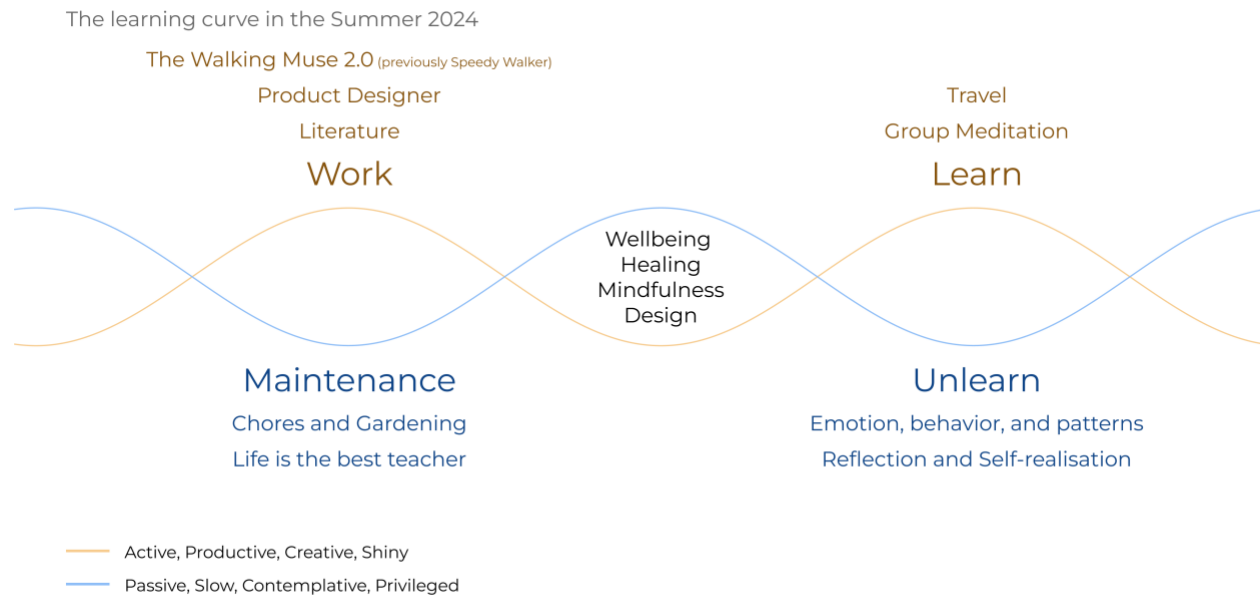


Note. The images depict the different life stages of the sunflower, from germination to full bloom, as observed during the study. Photograph taken by the author.

“Between stimulus and response there is a space. In that space is our power to choose our response. In our response lies our growth and our freedom.” (Pattakos, 2017)

Figure 2

The Learning Curve in Summer 2024.



Note. This visualization represents the cyclical balance between work, learning, maintenance, and unlearning, illustrating shifts between active, creative phases and passive, reflective periods. Diagram created by the author.

The Story of the Salmon

In October, I attended the *Annual Salmon Come Home* event at Hoy Creek Hatchery in Coquitlam (City of Coquitlam & Hoy-Scott Watershed Society, 2024). There, I spoke with an elderly gentleman who was displaying and handling deceased salmon. Among them was a female salmon that had died with her eggs still inside. I felt a pang of sadness for these salmon that couldn't complete their journey home, despite their valiant efforts and proximity to their destination. As I gazed at these lifeless creatures, I wondered if we could consume them or use their meat, making use of their four-year lifespan. I asked, "What happens to these dead salmon, and what will be their use?"

I learned that the deceased salmon become a source of nutrition for the life in and around the oceans and rivers. This revelation left me feeling both disappointed and enlightened.

I realized that my question stemmed from a human-centric perspective. Why should a salmon need a "use" in human terms? Salmon simply exist as salmon. They are part of nature and return to nature. It's we humans in modernity who constantly consider the usefulness of things and try to utilize our resources. What about the purpose of human life? Are we different from the salmon?

Figure 3

Showcasing salmon and roe.



Note. A person extracts salmon eggs from harvested fish as part of a demonstration on fish life cycles and reproduction. Photo taken by the author.

MINDFULNESS

Mindfulness has deep historical and philosophical roots, grounded in Eastern traditions, and recently spanning to Western acceptance (Kabat-Zinn, 1994). I am interested in its academic and practical dimensions, while drawing selectively from relevant philosophical and spiritual perspectives. I study through a first-person perspective, analysing personal inner embodied experiences.

Meditation serves as a means to mindfulness practice. Mindfulness is the practice of maintaining awareness and consciousness of the present moment. It can enhance wellness and collective enlightenment. Zen Master Thich Nhat Hanh described meditation as "washing the dishes to wash the dishes" (1999, p. 3). In *Why Buddhism is True*, Robert Wright explains that mindfulness involves paying close attention to the present moment and experiencing it clearly, without mental distortions (2017). Mindfulness meditation is presented as a practice of embodied and open-ended reflection, an effortless effort, and provides a counterpoint to disembodied reflections (Varela et al., 1991).

Mindfulness meditation is not simply sitting cross-legged or watching your breath. It is more than relieving stress and anxiety, lengthening your attention span, or calming your anger. And no, you do not need a week-long mountain retreat. Mindfulness is attention and awareness (Varela et al., 1991). Meditation helps align your body and mind through this practice of awareness. It often brings rise to self-reflection, empathy, acceptance, compassion, feeling, and sensing (Thich Nhat Hanh, 2012). It is living consciously, without judgment. It is seeing the world with clearer eyes and intention.

PERSONAL JOURNEY TOWARD MINDFULNESS

I began an intentional pursuit of mindfulness through a meditation practice that began in 2023 when I met the calmest and kindest people I have been fortunate to know including my bachelor's and master's studies

supervisors. Their special auras shared one common thread: mindfulness and meditation. I hoped to become a better person through meditation practice, but it proved more challenging than I imagined. Though I remember being amazed during one of my first sessions when tears streamed uncontrollably down my face, I initially approached the practice with rebellion and laziness, lying on my bed during guided meditation instead of sitting properly.

I feel fortunate for the serendipity in my learning journey and for my determination to resume practice after meeting Jess and Helen, my private meditation teachers in Vancouver. Our weekly group meditation sessions made it easier to maintain discipline than practising alone at home. The energy of like-minded people and a dedicated space motivated me more. Though finding quiet time and space in my living situation is challenging, I am proud of and grateful for my commitment to group practice. There is something special about connecting with like-minded people. We are, after all, social beings.

During this research, I went a month without sitting meditation due to work commitments. I noticed my eczema worsening and my breathing becoming unstable. I missed morning classes for sleep and longed for the routine of meditating with my fellows. My body honestly revealed that despite taking nature walks to reduce stress, it remained hyper-aware of pending work and deadlines.

EATING MEDITATION

The tea and snacks during eating meditation sessions tasted extraordinarily special. A simple mandarin, something I had eaten countless times, when consumed mindfully, revealed flavours and gratefulness I had never noticed before. When we attend to life's everyday moments, we develop a profound gratitude that helps us appreciate even the most ordinary people and objects. We can find wonder in the tiniest details, reminding us how fortunate we are as humans and how beautiful this world is.

THE BREATHING WORK

Most of us breathe unconsciously. While we can survive days without water, we cannot last minutes without air. Yet we only notice our breath when we are losing it while running or in moments of fury.

I remember managing my breath during early meetings with Louise, my supervisor, in her office. In that small room with its narrow window and slightly opened door, I felt my breath shortening as I tried to explain projects and ideas in my second language to someone I admired. In subsequent meetings, I discovered a simple solution: taking deeper breaths and observing them. This practice brought surprising ease to our later interactions.

Breath control proved equally vital when I first tried ping-pong and snowboarding in Vancouver. I realized I was not just battling the ball's trajectory or maintaining speed and height but managing my attitude and attention through breath control, or Qi. When focus wavers, breathing becomes erratic. But when you steady your breath, your body stabilizes, and suddenly you are gliding down slopes or playing ping-pong effortlessly, the equipment becoming an extension of your body and limbs.

WALKING

As someone born and raised in Hong Kong a place famous for its hustle and bustle, I am accustomed to a fast-paced culture where people sprint down streets, walk up escalators, and rush into trains. We have many ways to say "be fast" in Cantonese: "Do not stop the world from spinning," "The mosquitos have fallen asleep while I was waiting," or "Do not rush, but be quick." I love walking Hong Kong's streets. Most places are within walking distance, and public transport is so accessible that cars are unnecessary. Though downtown Vancouver's walking pace resembles Hong Kong's, the experience differs markedly. Vancouver's streets are less dense and quieter, with more noticeable seasonal changes. Winter walking is entirely new to me, the force needed to step through deep snow, the vigilance required for icy patches, and the unusual quiet of pedestrian-free streets as everyone drives. My most frequent walk is the twelve-minute journey between the train station and school. These walks ground me emotionally while providing perfect daily exercise. I cherish the fall foliage, the ginkgo leaves I shape into butterflies, the random items on grass, tree hollows, blue skies, and downtown skylines. This route has become a companion during my master's journey at Emily Carr University. Without a car, I spend considerable time exploring Vancouver on foot, seeing, noticing, watching, discovering, and feeling the ground, sky, flowers, people, and everything. Walking offers a way to actively slow down amid daily life. Walking heals.

As a creative person, I often find my best ideas emerge unexpectedly during relaxed walks. Walking requires less effort than running, yet offers much to daily life. It sparks creativity (Oppezzo & Schwartz, 2014) and reduces stress (Harvard Health Publishing, 2023). Beyond observing our surroundings, we might notice our wandering minds (St. Pierre, 2019). Our internal dialogue ranges from mundane concerns like lunch plans to deeper anxieties about upcoming presentations. While these mental conversations help us learn from the past and prepare for the future, excessive rumination can harm our health, as Kross explains in *Chatter* (2021). Rumination can activate a psychological response, which then can lead to physiological stress. This can have long term health effects. The ideal is to walk without rumination, but this often takes conscious effort.

Sometimes I walk alone with headphones, especially when seeking emotional release through music, whether to amplify positive feelings or soothe negative ones. The music energizes or comforts me, filling the silence. With part of my hearing blocked, I have noticed increased visual alertness to my surroundings. Other times, I walk without music, such as when I am feeling calm or needing a break from stimulation. Time seems to pass more slowly then. I find myself seeking sensory engagement noticing fancy cars, watching birds, and reading billboards to fill the quiet moments. Of course, there is also that endless internal monologue. Music might help quiet my inner voice by dividing my attention between sounds and surroundings. Though walking with music differs from formal walking meditation in its use of technology, sensory engagement, and pace, could it serve as an entry point for those who struggle with traditional walking meditation?

LESSONS FROM MINDFULNESS STUDIES AND MEDITATION PRACTICES

A key insight from my year of meditation practice is that we meditate to prevent our brain from hijacking our body. We free ourselves from automatic patterns and habits, regaining control of our lives (Thich Nhat Hanh, 2012). This leads to greater awareness of who we are and who we want to become. It is how body and mind

begin to synchronize. Meditation teaches us to focus on our breath and experience minimal sensations consciously, revealing our true nature. Through this practice, we become more fully embodied.

After all these meditations, I cannot say whether my brain has "advanced," but I know that the practice has built my resilience for life's ups and downs. I see myself and the world with greater clarity. I strive to live consciously, embracing what I cannot control while managing my breath and reactions. I stay attuned to my body and mind, remaining open to life's lessons. I feel grateful for all forms of existence. I am my thoughts. I am not my thoughts. I am. I am learning to let go of myself, allow things to unfold naturally, and find ease in life's flow.

THE PARADOX

"Tao can be talked about, but not the Eternal Tao. Names can be named, but not the Eternal Name."

「道可道，非常道。名可名，非常名。」

(Lao Tzu [老子], ca. late 4th century BCE/1996, trans. Wu, *Tao Te Ching* [道德經], Chapter 1)

Lao Tzu is referring here to how principles can be explained, but they're best understood through direct experience. Moreover, so-called principles are not eternal and unchanging. Here lies the power of product design—we transform knowledge from paper into tangible objects that can be experienced, "giving form to formlessness" as Akama describes (Akama et al., 2017). This is especially relevant when discussing mindfulness, which can only be truly understood through first-hand experience.

However, mindfulness doesn't need a design. "Ultimately, we don't need anything to become mindful" (Zhu et al., 2017). To practice mindfulness, one simply need to be present. Meditation takes many forms, including focused breathing, concentration, sitting meditation, walking meditation, loving-kindness meditation, and body scanning (Kabat-Zinn, 1994), and even everyday mindfulness—bringing complete awareness to routine activities like eating or washing dishes (Thich Nhat Hanh, 1991). Yet some people struggle to sit still for even 5 minutes, while others show no interest at all.

Designing for mindfulness presents a paradox. Mindfulness is the skill of being present. When we design with specific outcomes in mind, we inherently contradict mindfulness's fundamental nature. Akama and Light (2015) articulate this tension by noting that "designing for mindfulness [is] unachievable," suggesting instead that designers should recognize how their tools might invite mindful states rather than manufacture them. This highlights a distinction between technology that claims to induce mindfulness and artifacts that might serve as portals to awareness. The challenge lies in what Akama, Light, and Bowen (2017) describe as finding a "middle way", where technology neither dictates nor dismisses the mindful experience but potentially helps "disrupt mindlessness" in our everyday interactions. Rather than trying to enable mindfulness "with the push of a button," designers might consider how their work can support qualities that have been "designed-out because of inefficiency" in our productivity-focused digital landscape (Akama & Light, 2015). This connects directly to my research question about designing for, with, and through mindfulness. Instead of trying to create tools that promise to make people mindful, designers might focus on creating experiences that allow awareness to happen naturally. Mindful design could simply make room for people to pause and notice, and break free from automatic habits.

MOUNTAINS ARE MOUNTAINS: EXPLORING MINDFUL MOVEMENT THROUGH INTERACTION DESIGN

“First, mountains are mountains; then, mountains are not mountains; finally, mountains are mountains again.”

「見山是山、見山不是山、見山還是山。」

(Chan Master Ch'ing-yuan Wei-hsin [青原惟信禪師], n.d., as cited in *Pointing at the Moon Records* [指月錄])

I see the Chan quote as stages of spiritual growth. At first, "seeing mountains as mountains" means understanding things just as they appear. Then, "seeing mountains as not mountains" means realizing that things are more complex than we first thought. Finally, "seeing mountains as mountains again" means understanding and appreciating the true nature of things once more, but with deeper wisdom. This journey shows how I move from simple understanding to doubt and then to a clearer, wiser view in design, pace and mindfulness.

THE WALKING MUSE – A SUBTLE COMPANION FOR MINDFUL MOVEMENT

PROJECT INSPIRATION

My initial inspiration came from conducting ethnographic research where I observed activities in the Emily Carr campus cafeteria. This observation revealed two intriguing points: diverse walking paces among individuals, and the prevalent use of technology, like phones and music devices while walking or conversing. Observing people walking at different paces while engrossed in their music led to an interesting hypothesis: could slower music encourage a slower walking speed, thereby promoting mindfulness or even walking meditation?

Another source of inspiration was a mindfulness exercise involving a walk on campus. I divided our class into two groups: one group simply walked, and the other documented their observations using their phones and images. The feedback was positive from both groups because they felt relaxed, with some participants expressing a preference for walks without any tasks, allowing them to focus on simply being present.

Figure 4

Ethnographic Research in the School Cafeteria.



Note. The images capture cafeteria scenes, and the notebook entries show field notes recorded during the observation. Photograph taken by the author.

I further delved into the concept of walking meditation after a conversation with my supervisor, Louise. This idea intrigued me, prompting further exploration into the relationship between music, speed, and mindfulness. This reminded me of a concept known as the Melody Road (ONLY in JAPAN * John Daub, 2022). It is a playful intervention that encourages drivers to maintain a safe speed and encourage drivers to slow down. As a car drives over the road, a song plays due to grooves of varying widths cut into the pavement. The width of the grooves corresponds to musical notes, with narrow grooves producing high notes and wider grooves producing low notes, turning the road into a musical score. Could this same concept apply to the tempo of a person's walk? And what might be gained by slowing down someone's walking pace? Mindful walking is about linking the breath to the step, so that with each inbreath, we are focused on putting the foot down, and with each outbreath, the next foot (St. Pierre, 2019). There are many variations on this ratio. Sometimes we take three steps to an inbreath or four to an outbreath, and so on, so it is possible to walk mindfully at different speeds. It is not the specific pace that is important, it is the connection of the body to the moment, the awareness of the body in the moment. This is what I decided to tap into with the development of *The Walking Muse*.

THE WALKING MUSE

The Walking Muse is an everyday companion that helps to become more aware of your body through the act of walking. It is an application that is added to your favourite music streaming service, and can be in the on or off mode. In the on mode, as you walk, the music shifts to match your pace: walk faster, and the tempo picks up;

slow down, and the rhythm slows with you. Unlike instrumental mindfulness apps, *The Walking Muse* doesn't ask you to sit down, focus, or follow instructions. Instead, it offers subtle biofeedback experience that helps you notice your body naturally through sound.

The Walking Muse helps you become more mindful of your walking pace naturally. There's no need for formal meditation or focusing hard, it's about being present with your movement, almost without realizing it. It is designed to create an experience of mindfulness in movement, connecting your walking pace with music, and inspiring awareness of the present moment. As you walk, the music shifts according to your speed, inviting you to notice the relationship between your body, mind, and sound. In this case, the act of walking becomes a mindful practice, enhanced by the music's response to your movement. Whether you're walking slowly or speeding up, you might notice how your body and mind react to the shifting tempo.

Rather than being a tool you need to use at specific times, *The Walking Muse* integrates seamlessly into your daily life. It's designed to be an option on your standard music player, to operate any time you put your music play in *Muse Mode*. It's a light addition to your routine that helps you connect with your body and become more aware.

Thich Nhat Hanh's description of walking meditation highlights the simplicity and accessibility of mindfulness in movement:

Walking meditation is a way to practice moving without a goal or intention. Mindful walking simply means walking while being aware of each step and of our breathing. We can even practice mindful breathing and walking meditation in between business appointments or in the parking lot of the supermarket. We can keep our steps slow, relaxed, and calm. There's no rush, no place to get to, no hurry. Mindful walking can release our sorrows and our worries and help bring peace into body and mind. (2015, p. 76)

I wanted to see how digital tools could support mindfulness—not as structured guides, but as gentle facilitators of awareness. I realized that music, when dynamically connected to walking, might create an experience of presence without requiring conscious effort. This idea became central to *The Walking Muse*. This approach led me to explore non-instrumental design—where technology does not serve as a means to an end, but instead fosters a state of being. It was within this framework that I began considering symbolic devices, tools that operate at an intuitive and experiential level rather than through explicit interaction.

NON-INSTRUMENTAL DESIGN

While much of the research or current digital application on mindfulness and design focus on pragmatic and instrumental solutions to certain goals such as reducing stress or increasing productivity, *The Walking Muse* seeks to be a non-instrumental design that incorporates biofeedback qualities to evoke awareness of one's presence. Research by Zhu et al., (2017), suggests that engaging with the digital artifact should naturally evoke a state of mindfulness through the interaction itself, without the artifact being an instrumental tool to practice mindfulness exercises. To describe different ways digital technology can support mindfulness, Zhu et al. (2017) propose a four-level framework for digital mindfulness. This framework distinguishes between instrumental approaches (Levels 1.0-3.0), where applications serve as tools for achieving mindfulness, and non-instrumental designs (Level 4.0), which enable *presence-in* and *presence-with* experiences.

1. Level 1.0 – Digitalized Mindfulness: Apps that provide basic guided mindfulness, such as Headspace or Calm.
2. Level 2.0 – Personalized Mindfulness: Apps that adapt content based on user data, such as Buddhify, which offers meditation exercises tailored to different daily activities.
3. Level 3.0 – Quantified Mindfulness: Apps that integrate biofeedback from wearable sensors to provide real-time mindfulness coaching, such as Muse, a brain-sensing headband that quantifies meditation performance based on EEG readings.
4. Level 4.0 – Presence-in and Presence-with: Instead of acting as a tool for achieving mindfulness, artifacts at this level create an environment that naturally fosters mindfulness. Examples include interactive installations that respond to users' presence in subtle ways, such as a digital koi pond that moves in sync with a user's breathing, or ambient visual displays that change with the time of day to encourage reflection.

Level 4.0 emphasizes mindful presence as an emergent, non-instrumental state. The three design qualities that characterize Level 4.0 are:

1. Bare attention to the present – Encouraging direct, non-judgmental awareness.
2. Integration with daily life – Embedding mindfulness into routine moments rather than requiring dedicated practice.
3. Aesthetics for non-judgmental acceptance – Fostering open-ended reflection instead of goal-driven self-improvement.

In this sense, *The Walking Muse* functions as a symbolic device, resonating with Akama & Light (2015) framework for designing technologies that invite mindfulness through everyday interactions. They outline five key qualities that characterize a symbolic device:

1. It accompanies the user – Portable or present at hand, available whenever mindfulness arises.
2. It holds personal meaning – Resonates with individual experiences, emotions, or cultural background.
3. It appears on occasions – Emerges at specific moments rather than constantly, preventing habituation.
4. It disrupts routine – Breaks habitual, mindless behaviours, prompting awareness.
5. It prompts a detour in time or space – Briefly interrupts daily activities, shifting movement, action, or focus.

MINDFULNESS IN THE WALKING MUSE: EMBODIMENT/ BODY AND MIND SYNCHRONISATION

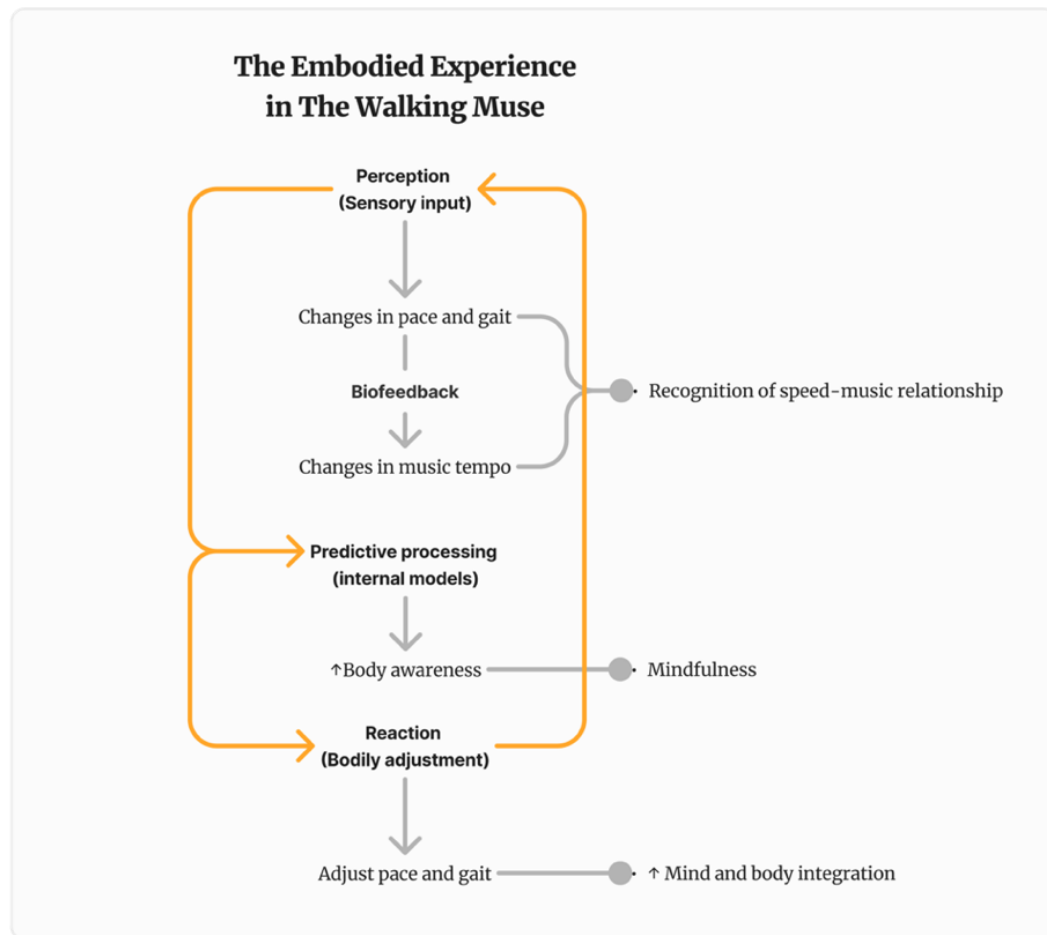
The design of this study used the key principles from cognitive science and embodied cognition. Embodied cognition (Varela et al., 1991) suggests that thinking and awareness are shaped by the body's interactions with the world, rather than being purely mental processes. "By embodied, we mean reflection in which body and mind have been brought together" (Varela et al., 1991, p. 27). Friston's Free Energy Principle (2010) posits that the brain minimizes prediction errors, which is the gap between expectations and sensory input, by continuously integrating perception and action. *The Walking Muse* acts as an adaptive music system that

leverages this principle by subtly changing the music's tempo, creating “surprises” (prediction errors) when the tempo diverges from the user's walking rhythm. To resolve these discrepancies, users naturally adjust their walking speed or reinterpret the relationship between their movement and the music. The design enhances users' body awareness by adjusting their perceptions and predictions in response to subtle mismatches between their movement and the music. Through the cycles of perception, adjustment, reflection, and reaction, the user may develop a deeper sense of awareness of their bodily movements, sensory environment, and mental state. *The Walking Muse* builds on these ideas by serving as a “technological scaffold”—a designed system that supports and amplifies mindful awareness by structuring the conditions for self-reflection. Rather than explicitly guiding users toward mindfulness, it provides subtle cues that invite exploration.

This aligns with Akama & Light (2015) concept of symbolic devices, which are designed to gently prompt awareness rather than impose structured actions. One example they discuss is the torii gate at the entrance of Shinto shrines, which visitors may become more aware of their movements and their state of mind by simply passing it, which subtly marks a transition into a reflective state. Similarly, *The Walking Muse* encourages mindfulness through sensory shifts. Rather than prescribing structured mindfulness exercises, *The Walking Muse* creates a space where technology becomes a scaffold for self-reflection, allowing users to discover mindfulness through embodied interaction. This intersection of mindfulness, technology, and design underscores the potential of interaction design in fostering awareness. This approach redefines the designer's role, moving beyond interface design or functionality optimization, to crafting experiential space where mindfulness can naturally emerge.

Figure 5

The Embodied Experience in The Walking Muse.



Note. Diagram created by the author.

MOUNTAINS ARE NOT MOUNTAINS: I MAY BE WRONG

The aim of *The Walking Muse* is to bring people to that first place of awareness of self and body in the moment. This project went through a series of three different user tests, on various iterations of the design and the testing instrument. Here is where I learned where I may be wrong. Thankfully, I also learned that I was sometimes right.

The Walking Muse showed how differently people interact with the system. Some tested its limits by running or changing their walking speed often. Others were more contemplative, making small speed changes to see how the music responded. Many found that walking slowly with slower music helped them notice more around and within them. Each experience is valid and valuable. This flexibility seems to be a strength of the design, letting people find their own preferred way to engage with the music, walking, and mindfulness experience.

TESTING EVOLUTION AND FINDINGS: *THE WALKING MUSE* V3

Earlier versions (V1-V2) documented in appendix.

The Walking Muse V3 used smartphone accelerometer data to detect walking patterns, which were then translated into musical tempo changes through a Max/MSP implementation. This allowed for real-time biofeedback where music speed responded to walking pace. Testing involved a structured protocol with pre and post surveys and three walking sessions under different conditions. Each participant experienced variations in tempo, biofeedback, prompts, and sensitivity.

Full technical details, methodology, and complete findings are in the appendix.

KEY FINDINGS

1. Expertise Effect

An interesting finding was the contrasting response between experienced meditators and novices:

- Meditation practitioners often experienced music as a competing attentional focus that interfered with their established mindful walking practice.
- Mindfulness novices typically found the music thought-provoking and reported increased awareness of both their walking patterns and surroundings.
- Some beginners, however, struggled to recognize their own thought patterns during the experience, while others found that they were able to observe thoughts arising, acknowledge judgments, and step back from them, aligning with mindfulness principles.
- The experience also revealed varying definitions of mindfulness among participants—some associated it with a complete absence of thought, while others viewed consistency in movement and rhythm as a mindful state.

This suggests *The Walking Muse* may be more valuable as an onboarding tool for beginners than as an enhancement for experienced practitioners. Design integration to different levels of practice could be considered in future directions.

2. Biofeedback Awareness and Adaptation

Participants showed varying levels of engagement with the biofeedback element:

- Some reported a "threshold effect" where specific walking speeds triggered abrupt tempo changes in the music, rather than gradual transitions, which they found unexpected and jarring.
- Some actively adapted their walking to explore or control the music.
- Others maintained awareness of the relationship without intentionally modifying behaviour.
- Some noted that the system encouraged consistency in movement, which they saw as a form of mindfulness: "Yes, it felt almost like an exercise in how to walk very consistently, which I see as a way to be mindful—being aware of how you walk."
- For some, the biofeedback-driven tempo changes felt restrictive rather than supportive, creating a sense of being "punished" for deviating from a specific pace. Others, however, reacted minimally to these changes, instead adopting a mindset of non-resistance, allowing the system to function without attempting to control or respond to it.
- Interestingly, several participants reported the highest mindfulness during conditions without biofeedback, suggesting that external modulation of movement may not always enhance mindful awareness.

3. Environmental and Social Context

- Participants reported different comfort levels with slow walking depending on location and the presence of others.
- Environmental elements became part of the mindful experience, including sounds and temperature changes.
- Some described heightened awareness of surroundings, noticing details they had never observed before: "I don't think I have ever had that moment of walking that slowly next to that building and actually seeing what's inside."
- Some participants found that reducing visual distractions made it easier to engage with the experience, highlighting how external environmental conditions can significantly influence attention and immersion.

These findings highlight how mindfulness technologies used in public spaces must account for social dynamics and environmental contexts.

4. Attentional Oscillation

Rather than sustained single-pointed focus, many participants described a fluid attention pattern between the music, their body, the environment, and their thoughts.

- Some noted that walking at a consistent pace created a unique sense of stillness, making changes in the environment more noticeable. "When you walk at a consistent speed, it's similar to being still—you'll see the things changing around you. Relativity becomes more apparent."
- The way participants engaged with mindfulness varied—some emphasized structured awareness of thoughts, while others approached it as a state of effortless presence, simply allowing the experience to unfold without interference.

5. Music Tempo and Mindful States

- Slow songs generally encouraged slower walking, which some participants associated with heightened awareness due to the 'fear of being punished' by the change in tempo.
- Some found that maintaining a consistent rhythm fostered mindfulness, suggesting the idea that predictability and flow play a role in sustaining attention.
- Personal connection to music appeared as important as tempo in shaping the mindfulness experience.

6. Prompt Effectiveness

The prompt: "Before starting, set an intention to walk mindfully. Focus on your steps, breathing, and the rhythm of the music. Watch any thoughts come and go without judgment."

- Novices found the prompts helpful in educating them on how to direct their attention. However, they also noted that juggling multiple focal points sometimes felt overwhelming.
- Experienced meditators, already familiar with walking mindfully, found the multiple focuses in the intention-setting process contradictory. They noted that even without a specific prompt, they would naturally engage in mindful walking as part of their usual practice, if they are just asked to walk without specific destination.
- Both groups found that the music often became the dominant attention-catcher, making it difficult to focus equally on steps and breathing.
- Both groups found that setting an intention at the start of the walk helped them stay anchored throughout the experience: "Intentions are helpful at the start to keep in mind and help me anchor at the end."

7. Spectrum of Attention and Mindfulness

Testing revealed competing attentional frameworks, with participants reporting various types of awareness:

- Focus on song lyrics, meaning, story, or melody
- Body awareness (footsteps, breathing, posture)
- Situational awareness (surroundings, other people)
- Emotional awareness (feelings evoked by music or environment)

This spectrum of attention types echoes the definitional ambiguity around mindfulness, suggesting different experiences may or may not all qualify as "mindful" despite focusing on different aspects of awareness.

- Some participants were able to observe thoughts arising, recognize judgments, and step back from them, aligning with traditional mindfulness principles.
- Others, however, found it difficult to recognize their own thought patterns, instead adopting a more passive form of mindfulness, where they let stimuli come and go without engaging in analysis.
- Several novice participants experienced moments of insight during testing, with one noting, "I now understand what it means to 'let go'" after experiencing how attention naturally flows between different focuses.

- Others described discovering "a completely new way of experiencing music" that continued beyond the testing session, with one participant reporting, "Even now, I'm still aware of my body" minutes after their walk.

These findings indicate that *The Walking Muse* has the potential to introduce mindfulness to beginners by fostering awareness of movement, thoughts, and surroundings. However, the varied responses to biofeedback and music integration suggest that mindfulness engagement is highly individual. Future iterations of mindfulness technologies should consider adaptive systems that accommodate different attentional styles and levels of experience.

MOUNTAINS ARE MOUNTAINS AGAIN: REFLECTIONS ON DESIGN AND MINDFULNESS

“Reflection, as undertaken as mindfulness, is not just to reflect on experience but to experience reflection itself.” (Akama & Light, 2015).

Modern design often prioritizes active intervention and innovation while neglecting reflection and complexity (Akama, 2017). This raises a question: What if design were not just about solving problems, but about deepening awareness? One of the struggles I found myself facing in this thesis journey was questioning the value and meaning of design and my work, to the point where I failed to motivate myself to create and write. I was drawn to inaction. I couldn't see my self-worth and doubted whether this paper or design would ever see the light of day. Even though my supervisor, family, friends, and I all shared the same message, assuring me I was doing valuable work, I still couldn't find the purpose in continuing. I reached a point where I didn't want to continue, despite really enjoying learning about mind, body, and spirit this past year and a half.

It all came back to deep looking. I allowed myself to let go of the urge to do something. I was fortunate to be inspired by the Bodhisattva Path in Mahayana Buddhism, the idea of seeking enlightenment not only for oneself but for the benefit of all beings. The life wisdom I've gained, dealing with internal conflicts and finding courage when facing authority, seeking help instead of facing challenges alone, balancing historical wisdom with personal experience and collective needs, experiencing autonomy and peace while embracing slow living, being aware of the body, learning to breathe, sharing these life experiences regardless of their utility or reception. These are the large lessons for me. At its core, this thesis transcends mindfulness. While mindfulness remains a component, I see that this thesis contributes to a broader spiritual exploration and a shift in design practice—one that values presence, openness, and attunement. This journey shows me that our fundamental intentions behind design matter more than the form of the design. Why am I designing this? Who am I to design this?

We can design consciously, reminding ourselves that our creations' impact outlasts us. As designers, we wear many hats, scientists, psychologists, marketers, and project managers. Perhaps our most fundamental role and competence is in fostering empathetic living and inspiring self-discovery. Design needn't always be functional or commercially viable; sometimes its value lies in the questions it raises and the reflections it inspires.

The journey has taught me crucial lessons about design and intention. While my design might seem playful rather than consciousness-raising, I believe one of its biggest impacts is in creating mind-body synchronization and awareness. In my work on *The Walking Muse*, I sought to evoke acceptance. Radical acceptance is the deep recognition of things as they are, without resistance or avoidance. In design, this means accepting uncertainty, ambiguity, and the limits of control. It means creating with openness rather than rigid intent. It's about being present, about breathing, about those moments when life's challenges ask us to look inward.

“As all these habits are cut through and one learns an attitude of letting go, the mind's natural characteristic of knowing itself and reflecting its own experience can shine forth. This is the beginning of wisdom or maturity (prajñā).” (Varela et al., 1991). As designers, we face common challenges: balancing voices, understanding our capabilities, and handling opposition. The key isn't necessarily slowing down, it's learning to question and

understand ourselves. This self-reflection is essential for mindfulness and meaningful design. Without it, we risk creating without purpose or impact. My design offers a gentle step toward conscious living, prioritizing this journey over pure functionality. But is this thesis only about mindfulness? Or is it something more?

Perhaps this journey is about openness and surrender, about seeing beyond dualities and embracing complexity. Design, like life, is not about controlling outcomes but about cultivating presence within them. Rather than offering solutions, design can become a practice of questioning, one that invites us to engage with uncertainty, reflect deeply, and remain open to the unknown. Perhaps, then, the true value of design lies not in what it produces, but in how it shapes our ways of being in a conscious and mindful way.

Elizabeth Sanders (2015) describes design wisdom as a fabric that connects two sides of design: analysing the present and creating the future. It is a process that moves smoothly between these two ways of thinking. This idea aligns with Escobar's (2018) concept of the pluriverse, which challenges the belief that there is only one "right" way to design. Instead, the pluriverse encourages many ways of designing and understanding the world, embracing different perspectives and possibilities rather than following a single, universal approach.

Design, then, is not just about what we create, but about how we cultivate and share wisdom. We should take our time and use our designer's eyes to appreciate the wisdom in every corner of the world. Like planting a seed, our role is not to control how it grows. Plant the seed and share it, then every second and hour that follows, through blossom and end of life, we are nourishing the lives on earth with our wisdom.

"Are you massaging our Mother Earth every time your foot touches her? Are you planting seeds of joy and peace?" (Thich Nhat Hanh, 1991)

AFTERWORD

THE PARADOX IN THE PARADOX

In Zhuangzi's "The Tree on the Mountain" story, we learn about a tree that lives because it is useless. It's odd shape makes woodcutters ignore it. But the story goes on—Zhuangzi then tells his friends to kill a goose that can't make noise. This confuses his students, they ask "What position would you take, Master?"

Zhuangzi explains with a laugh: "I would probably take a position somewhere between worthiness and worthlessness. But though that might look right, it turns out not to be—it still leads to entanglements. It would be another thing entirely to float and drift along, mounted on only the intrinsic powers of the Course—untouched by both praise and blame, now a dragon, now a snake, changing with the times, unwilling to keep to any exclusive course of action." (Zhuangzi & Ziporyn, 2020)

Kwong, as a speaker on Zhuangzi in a lecture (HKBU Department of Religion and Philosophy, 2024), used the example of a stroll to support his interpretation of Zhuangzi's philosophy: "If life is like taking a walk with no fixed destination, then there are no limitations, no wrong paths, and thus, freedom."

REFLECTION

Reflecting after the defence, I have come to recognize the deep tension between the desire for a polished design outcome and the often-overlooked value of the design process itself. As designers, we are trained to measure success through results, but this project reminded me that the process, with all its uncertainties, surprises, and personal impact, is equally meaningful. I learned to give credit not only to what I created, but to how the act of designing shaped me. I began to see that design is not truly about having full control, but about creating the conditions for something meaningful to happen. The unexpected responses from users were not failures; they were reminders that design is a shared process, and we cannot always predict where it will go. This experience helped me understand design as something reflective and relational, something that calls for intention but also for openness. It also reminded me of how important it is to pay attention to the pace at which we are moving. In a culture that often pushes us to go faster, it is easy to lose sight of why we are doing what we are doing. Being aware of our pace, whether fast or slow, helps us stay connected to the work, to the people and things it impacts, and to ourselves. Going forward, I want to continue practicing design in a way that is thoughtful and conscious.

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APPENDICES

A: PROTOTYPE TEST PLAN FROM RESEARCH ETHICS APPLICATION – EVALUATING MINDFULNESS DURING WALKING WITH BIOFEEDBACK

OBJECTIVES

- Examine how music tempo (fast vs. slow) impacts mindfulness during walking.
- Evaluate the effect of biofeedback (responsive music speed adjustment) on walking behavior, bodily awareness, and synchronization.
- Assess whether setting a mindful intention (prompt) enhances mindfulness during walking.
- Understand the role of feedback sensitivity (more vs. less responsive biofeedback) in improving user experience and body-mind connection.

HYPOTHESES

- Fast songs may enhance mindfulness by energizing participants and encouraging awareness of dynamic movements.
- Slow songs may promote mindfulness by fostering calmness and focus on music and walking.
- Biofeedback increases awareness of walking pace and rhythm.
- Setting a mindful intention will enhance focus, encourage practice motivation and self- reflection.
- A moderate level of feedback sensitivity is preferred by participants, with overly sensitive feedback potentially feeling distracting.

PARTICIPANTS

Selection Criteria

- Recruit 8-16 participants
- Participants should be:
 - Adults 19+
 - Physically comfortable with walking, listening to music with headphones and carrying a laptop and a phone.
 - Open to mindfulness-related activities, whether or not they have prior experience.

Recruitment

- University peers, friends, or colleagues. Inform participants that the study will involve walking with music and reflecting on their experience.
- I will recruit participants randomly on campus (e.g., in the cafeteria) or directly invite people I know who haven't tested my prototype yet.

STUDY DESIGN

Type of Study

A within-subjects design.

Testing Variables

I will test 4 variables, each with 2 levels:

1. Music Tempo
 - Fast Songs (e.g., 120-140 BPM)
 - Slow Songs (e.g., 60-80 BPM)
2. Biofeedback Presence
 - With Biofeedback
 - Without Biofeedback
3. Mindful Intention Prompt
 - With Prompt
 - Without Prompt
4. Feedback Sensitivity
 - More Sensitive: Music tempo changes quickly and noticeably with small changes in walking speed.
 - Less Sensitive: Music tempo changes more gradually and subtly.

Session Structure

Each participant attends a 60 to 90 min session, structured as follows:

Introduction and Consent (2 minutes)

- Explain the study's purpose and provide instructions on how to use the prototype.
- Obtain informed consent.
- The invitation script: "Hi! I'm conducting a thesis study on mindful walking and music at Emily Carr University. The study involves walking around campus while listening to music with headphones. You will carry a phone and laptop that act as sensors, and the session takes about 60-90 minutes. There are short questionnaires before and after. If you're interested, I can provide a consent form now, and you can decide whether you'd like to participate immediately or schedule a session for later. Let me know if you'd like more details!"

Pre-Test Survey (5 minutes)

- Gather baseline data on:
 - Current mindfulness level using a mindfulness scale (i.e. [Mindful Attention Awareness Scale](#)).
 - Emotional state (e.g., calmness, focus, stress).
- Gather 3 fast and slow song suggestions from the participant.

The script:

- "How are you feeling right now?"
- "Can you think of three slow (or fast) songs that you would like to listen to?"
- "Could you please fill in this printed Mindful Attention Awareness Scale for me? While you do that, I'll import the songs to my laptop."

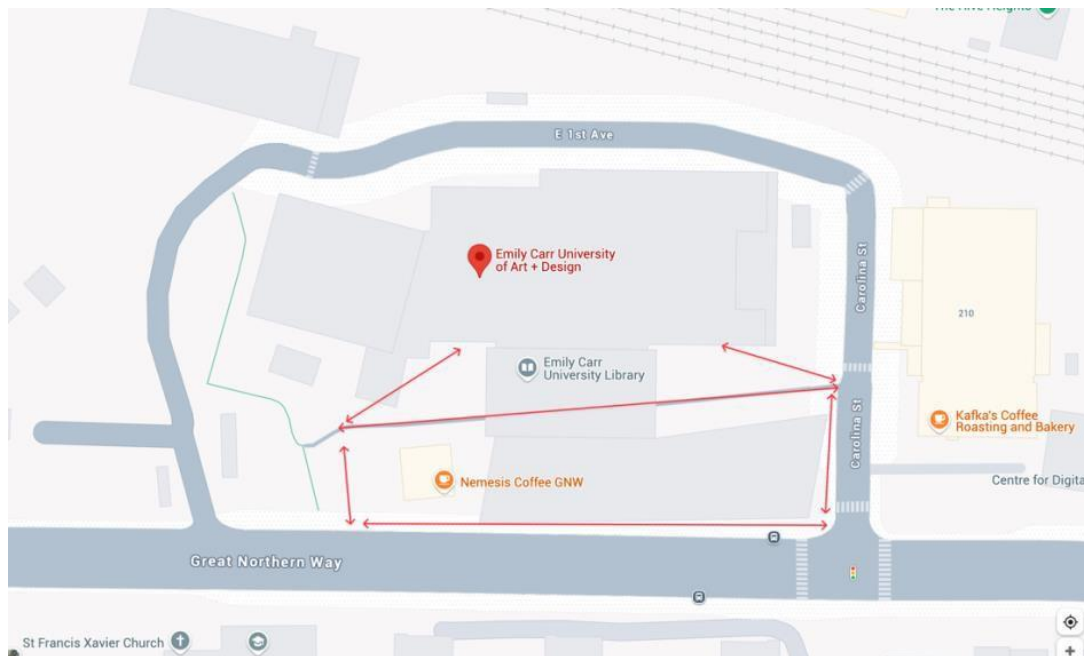
Three Walking Sessions (3 songs = ~15 minutes)

- **Setup:** Adjust the prototype to the appropriate combination of variables (tempo, biofeedback, prompt, sensitivity).
- **Mindful Intention Prompt (if applicable):**

Read a short script: "Before starting, set an intention to walk mindfully. Focus on your steps, breathing, and the rhythm of the music. Watch any thoughts come and go without judgment."
- **Walking:** Participants walk with the prototype for 8-10 minutes
- **Location:** Campus indoor hallways or outdoor pathways. If weather permits, participants may walk outside the campus buildings, though they must avoid crossing driveways for safety reasons. I will show participants this map to indicate the permitted outdoor walking routes:

Figure 6

Map of Permitted Outdoor Walking Routes.



Note. This map is shown to participants to indicate the permitted outdoor walking routes.

The script:

"Feel free to walk around campus and return here after the songs finish. It's completely fine if you want to come back earlier. If you prefer walking outdoors, avoid crossing driveways for safety reasons. Please stay on the same floor and don't use the elevator or stairs, as the device will lose internet connection."

Post-Session Survey (2 minutes per session)

- Please check this e-form here: <https://pepper-smash-91d.notion.site/1845eec78a788073a01de53b3af5f6f9?pvs=105>

Post-Test Interview (5-10 minutes)

- Post mindfulness level using a mindfulness scale i.e. The [Toronto Mindfulness Scale](#)
- Which session felt the most mindful, and why?
- Did the experience make you more aware of your body or your walking pace? If so, in what ways?
- How did fast and slow songs affect your experience?
- Did the biofeedback help or distract you? How would you describe the connection between the music and your walking pace? Did it feel natural or intentional?
- What changes would you suggest for the feedback sensitivity?
- How did Speedy Walker compare to a traditional mindfulness or meditation experience for you?
- Overall, how did you feel—physically, emotionally, or mentally—while using Speedy Walker?
- What changes or improvements would you suggest for Speedy Walker to enhance mindfulness or engagement?

Metrics

Quantitative Metrics

1. Walking Speed Variability:
 - Measure the standard deviation of walking speed for each session.
2. Frequency of Speed Adjustments:
 - Count how often participants adjust their walking speed in response to the music (biofeedback).
 - Hypothesis: More sensitive feedback leads to more frequent adjustments but may feel less natural.

Qualitative Metric

1. Self-Reported Mindfulness
2. Emotional State
3. User Preferences
 - Music tempo preferences (fast vs. slow).
 - Biofeedback presence (useful vs. distracting).
 - Feedback sensitivity (too subtle vs. too reactive).

Success Criteria

1. Music Tempo: Fast songs promote dynamic mindfulness (e.g. awareness of inner state or body movement), while slow songs foster calm, steady awareness.
2. Biofeedback: Participants synchronize better and feel more aware of their body with biofeedback.
3. Mindful Prompt: Participants report higher mindfulness and focus with the intention-setting prompt.
4. Feedback Sensitivity: Participants prefer a sensitivity level that enhances awareness without feeling distracting.

B. TECHNICAL ARCHITECTURE OF *THE WALKING MUSE*

Sensing Layer

- **Hardware:** A smartphone (typically in pants pocket) contains an accelerometer that detects leg movement patterns.
- **Data collection:** ZIG SIM mobile application captures and transmits motion data to the processing system.
- **Metrics captured:** Walking intensity, measured through peak acceleration data within specific time periods.

Processing Layer

- **Peak detection:** The system identifies peaks in accelerometer data that correspond to steps.
- **Threshold mechanism:** When a user exceeds a certain threshold, the system triggers tempo adjustments.
- **Buffer system:** A brief delay between detected movement changes and musical response prevents erratic tempo shifts.
- **Baseline speed:** The system establishes a baseline playback speed of 1.0, with adjustments made relative to this value.

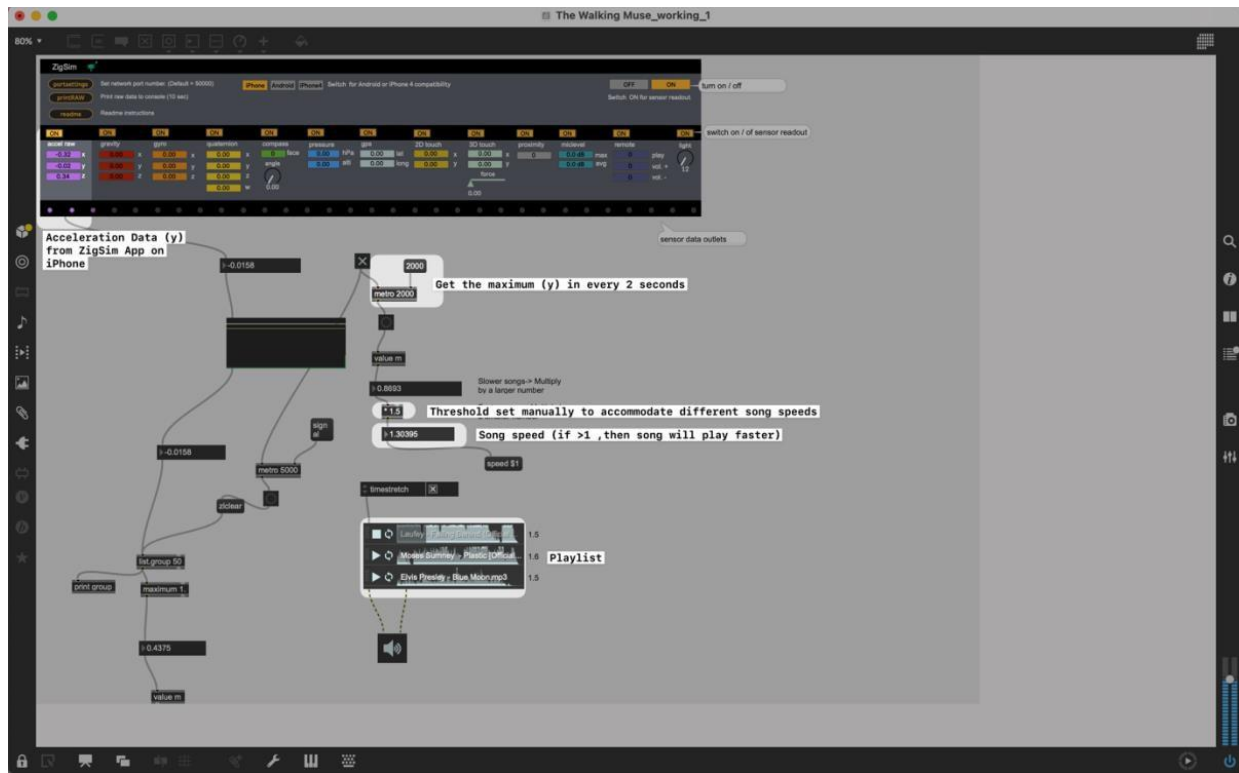
Audio Layer

- **Time-stretching engine:** Max/MSP implementation enables tempo adjustments while maintaining the original pitch.
- **User-selected music:** Allows participants to select familiar or preferred music.

The final implementation runs on a laptop carried by the participant, with communication established between the smartphone and the processing/audio system.

Figure 7

Max/MSP Prototype for Collecting Pace Data.



Note. This image shows the Max/MSP prototype used to collect pace data on a laptop. The interface was screen recorded during each walking session.

C. V1, V2 AND V3 TESTS PARTICIPANT FINDINGS

V1 Test (previously titled: Speedy Walker 1.0)

Technical Implementation

- Built using TouchDesigner
- Used gravity data from ZIG SIM iOS app
- Limited time-stretching capabilities
- Implemented isomorphic mapping where music tempo increased with walking speed

Key Findings

- Initial positive responses from classmates
- Interest in potential connections to biometric data
- Questions about ambient sound and its calming effects
- Highlighted potential for exploring various mapping approaches
- Identified limitations in audio processing capabilities

V2 Test (previously titled: Speedy Walker 2.0)

Technical Improvements

- Migrated from TouchDesigner to Max/MSP for better time-stretching
- Removed speed limitations
- Enhanced data input sensitivity
- Tested phone placement options (pocket, handheld, arm strap), with pants pocket proving most effective
- Introduced custom song selection

Variables Tested

- Positive vs. negative symmetry (isomorphic vs. counter-isomorphic mapping)
- Various music genres and tempos
- Familiar vs. unfamiliar music

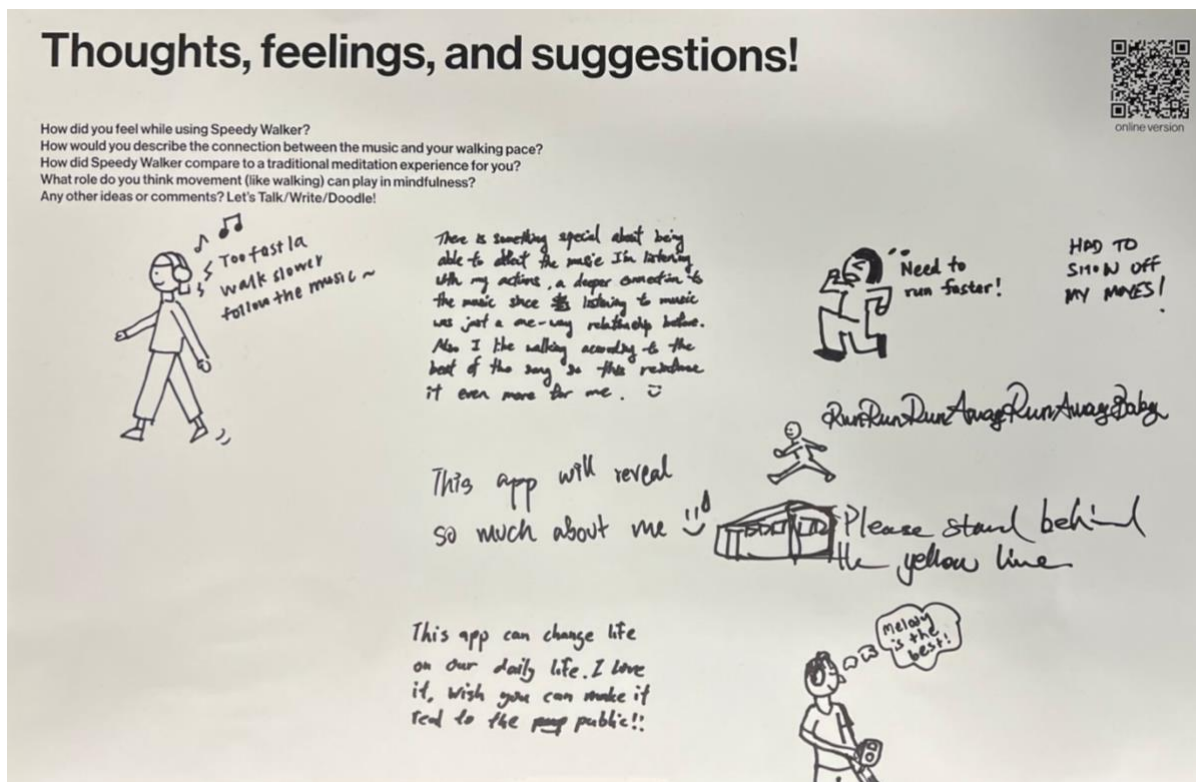
Key Findings from Try-out 1

- Early testing contrasted two feedback approaches: speed adjustment (changing the tempo of the current song) and song transitions (switching to a different song with a faster tempo when walking pace increased)
- Speed-adjusted music promoted better flow states than song transitions
- Users engaged more with familiar songs and preferred genres
- Users expressed uncertainty about causation: whether music influenced walking or vice versa
- Repetitive musical patterns adapted more smoothly to speed changes
- Users enjoyed experimenting with different walking speeds

- Counter-isomorphic mapping was found confusing, leading to a focus on isomorphic mapping in subsequent testing

Figure 8

Written Comments on Engagement Experience with V2.



Key Findings from Try-out 2

- All participants reported moments of mind-wandering but noted that music and walking helped redirect attention
- Participants reported increased awareness of their body and walking pace
- The connection between walking pace and music felt mostly natural, though sometimes intentional
- Participants found Speedy Walker more accessible than traditional mindfulness practices
- Emotional responses included feelings of calm, relaxation, and presence

Figure 9

Classmates Trying Out V2 on Campus.



Note. Photograph taken by classmates, used with permission.

V3 Test (*The Walking Muse*)

Participant M (new to mindfulness practice)

- Felt most mindful when there was no feedback
- Became conscious of walking slowly, with awareness of others' perceptions
- Described a learning process in responding to the system
- Found high sensitivity more mindful than low sensitivity
- Felt anxious about sudden tempo changes, which effectively "forced" slower walking to maintain comfortable listening
- Listened to songs more attentively than during normal activities
- Reported increased awareness of surroundings and previously unnoticed sounds

Participant H (meditation practitioner)

- Noticed the speed influence but didn't actively control walking speed
- Found it difficult to be mindful while listening to music due to being drawn into the rhythm
- Preferred traditional walking meditation for focusing on footsteps
- Music demanded attention, pulling focus away from breath and footsteps
- Didn't feel the need to deliberately walk slower

Participant J (meditation teacher)

- Experienced strong emotional responses to familiar songs
- Questioned the multitasking required: "I don't know what to focus on—walking, listening to music, or finding my way?"
- Believed walking itself is already an uplifting activity without added music
- Acknowledged sound's significant influence on attention and mindfulness but preferred non-musical sounds (e.g., temple bells, singing bowls)

Collective Insights from H and J

- Both experienced practitioners believed results would differ significantly between those with and without mindfulness practice
- Experienced practitioners would automatically walk mindfully with or without prompts
- The prototype created different experiences based on prior meditation experience, suggesting different optimal designs for different user groups

Participant F (meditation practitioner)

- Experienced a shift in perspective, embracing uncertainty and presence. "Instead of me using music, I feel like music is going through me more."
- Questioned whether the system was making them more mindful, calm, or just more consistent in movement.
- Found that walking consistently helped cultivate mindfulness. "The sense of mindfulness here is like trying not to spill the coffee."
- Became more attuned to surroundings, noticing details they had previously overlooked.
- Described walking at a steady pace as similar to being still, increasing awareness of environmental changes.
- Found intention-setting helpful for anchoring focus.
- Reflected on how walking consistently created a sense of relativity, making movement in the world more apparent. "When you walk at a consistent speed, it's similar to being still—you'll see the things changing around you."
- Felt more aware of others and their place within a larger ecosystem. "It also made me more aware of others, in some ways—like human beings as part of this ecosystem."

Participant S (New to Mindfulness Practice)

- Perceived tempo changes as a form of punishment rather than guidance.
- Noticed thoughts and judgments, stepping back from them in a mindful way.
- Preferred the experience without biofeedback, finding it more enjoyable.
- Believed that prompts, rather than the software itself, determined whether the experience felt like mindfulness.

Participant C (New to Mindfulness Practice)

- Did not react much to biofeedback, believing that non-resistance was the most mindful approach.

- Struggled to understand how to observe their own thoughts.
- Viewed mindfulness as either "not thinking at all" or entering a flow state.
- Initially disliked walking with music but later adjusted by choosing a route with fewer visual distractions to help focus.
- Had a habit of rationally analysing environmental sounds but found that blocking external noise with music might helped them enter mindfulness more easily.

LIMITATIONS

Technical Limitations

1. **Hardware constraints:** The requirement for participants to carry both a smartphone and laptop limited ecological validity and natural movement.
2. **Detection accuracy:** The system occasionally misinterpreted certain movements (stopping, turning, stair climbing) as pace changes, creating unintended musical responses.

Methodological Limitations

1. **Sample size and diversity:** The limited number of participants (8-16) and convenience sampling approach restricts the generalizability of findings.
2. **Short exposure duration:** Each walking session lasted only 8-10 minutes, which may be insufficient to fully experience and adapt to the biofeedback system.
3. **Artificial setting:** The campus environment and awareness of being observed may have influenced participants' behaviour and experience.
4. **Individual preference:** Individual differences in musical taste, walking habits, and multitasking abilities may have influenced results.

FUTURE DIRECTIONS: RESEARCH AND TECHNICAL ENHANCEMENTS

- Integrate as a feature within existing music apps rather than developing standalone applications
- Develop smarter motion detection algorithms that distinguish intentional pace changes from incidental movements
- Explore additional musical parameters beyond tempo that might respond to movement qualities
- Test with playlists and shuffle modes to understand how variety affects the experience
- Develop personalization algorithms that learn individual preferences over time
- Create different modes optimized for varying levels of mindfulness experience
- Explore collective implementations that build on the initial classroom testing with shared speakers
- Design context-aware versions tailored to specific environments