Breath, Embodiment, and Technology

Designing for Human Awareness in Mixed Reality

Submitted for:

Masters Degree
Digital Experience Design

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Use of AI Declaration Statement

I used ChatGPT to help with organizing ideas, clarifying structure, and refining some of the language in this thesis—mainly to support clarity and flow. It was a tool I turned to for summarizing complex sections, but not for generating original content. All thinking, analysis, design decisions, and reflections are fully my own.

I also reflected on how AI fits (and doesn't) into this kind of embodied, philosophical work—it can support structure, but it can't replace insight. What surprised me most was how much I relied on my own rhythm and intuition, especially in the deeper writing stages.

If anything, this experience reinforced that AI can assist, but not lead, in research that's grounded in lived experience.

Nicole Dale

Abstract.

This thesis investigates how breath-based practices cultivate embodied awareness and inform the ethical design of virtual and mixed reality (MR) environments. Drawing from ancient breath traditions, phenomenology, and cognitive science, it reframes breath as a dynamic interface for sensing, regulating, and knowing.

Using a hybrid qualitative methodology—including interpretative phenomenological analysis, autoethnography, and practitioner interviews—the research identifies five key dimensions of embodied experience: sensory experience, cognitive self-regulation, context and facilitation, temporal design, and ethical attunement.

These insights culminate in the Embodiment Blueprint Matrix, a design framework that bridges embodied cognition theory with immersive technology. The matrix guided the development and prototyping of Respir.ai, a breath-centered digital tool designed to foster presence, emotional regulation, and inclusion in MR environments. Early user testing highlights the importance of simplicity, personalization, and emotional anchoring in supporting embodied engagement.

By positioning breath as both interface and intelligence, this study offers a grounded, relational, and ethically attuned approach to immersive design. It advocates for technologies that deepen inner awareness—not just external interaction—and invites a shift toward slower, more humane digital futures.

Word Count.

Literature Review: 6795
Research Methodology: 1249
Discourse Analysis: 4213
Blueprint and Protoype: 1082
Conclusion and Recommendations: 692
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Contents.

Study Foundation.

Research Objectives

To explore...

how embodiment
is defined and understood
in practice.

To identify...

methods used
to measure or assess
embodiment.

To examine...

the role of embodiment
within virtual environments.

To consider...

the ethical and accessibility
dimensions of embodied
experience in technologically
mediated contexts.

Problem Statement

How might we...

meaningfully **integrate embodiment awareness into virtual experiences** so that individuals can sense their way forward—not just think?

Research Aim

This research investigates **how breath-based practices cultivate embodied awareness**, and how these insights can inform the design of virtual and immersive environments. It aims to bridge ancient embodied wisdom with contemporary technologies, drawing on lived experience to guide ethical and inclusive innovation.

Literature Review.

Introduction

Breath as a Gateway to Embodied Cognition

Breathing is more than a biological necessity; it is a direct, embodied link between mind, body, and emotional life (Zelano et al. 2016; Johannknecht and Kayser 2022; Hydra Ng et al. 2024).

Its unique capacity to be both automatic and consciously regulated makes it a powerful tool for shaping attention, emotional states, and embodied awareness (Heck and Varga 2023; Chin et al. 2024).

Embodiment refers to the lived experience of sensing and responding through the whole body, grounded in physical sensation, movement, and internal awareness (Heck & Varga, 2023). A central mechanism in this process is interoception, this is, the ability to detect internal bodily signals such as heartbeat, breath, and temperature. Slow, intentional breathing enhances this sensitivity, allowing individuals to feel more present, grounded, and emotionally attuned (Goel et al. 2024).

Although no single theory addresses breath-based embodiment directly, breath sits at the intersection of embodied cognition, this is, the view that bodily processes shape how we think, feel, and act (Varga and Heck 2017).

Breathing patterns influence brain regions involved in attention, emotion, and decision-making (Ito et al. 2014; Johannknecht and Kayser 2022). In this way, the rhythm of the breath acts as both regulator and guide, reinforcing the central premise of embodiment: that our lived experience is co-created with and through body, brain, and environment.

This report explores how breath—rhythmic, sensory, and symbolic—offers a potent entry point for designing for embodied awareness in Mixed Reality (MR) environments (Chin et al. 2024; Goel et al. 2024).

Subtle Energy and Embodiment Across Traditions

Modern understandings of breath and embodiment echo ancient traditions, where breath was viewed not only as a physiological function but as a vital force uniting body, mind, and spirit (Manasa et al. 2020; Greenwood 2024).

Across cultures, concepts such as Qi, Prana, Pneuma, and Ruah reflect the shared belief that life energy flows through the body as a medium of consciousness and health (Rajesh et al. 2014).

Western thought, however, diverged with Descartes' dualist framework, which separated mind from body and treated the latter as mechanical (Veissière et al. 2020). This view sidelined embodied experience for centuries, reinforcing a brain-bound model of cognition.

In contrast, phenomenology—especially through Husserl and Merleau-Ponty—reasserts the primacy of the lived body. Husserl emphasized the intentionality of perception, while Merleau-Ponty proposed that we experience the world through the body itself (Thorburn and Stolz 2023). These perspectives align with emerging cognitive frameworks that treat mind and body as dynamically coupled.

Technology, Breath, and Embodiment

As MR becomes more integrated into how we live, work, and connect, embodiment becomes central to understanding cognition, presence, and emotional resilience. Rather than viewing cognition as computational or brain-bound, embodiment theory posits that it arises from the interactions between body, environment, and tools (Foglia and Wilson 2013; Ziemke 2016).

New technologies, including biofeedback and immersive environments, are beginning to leverage bodily rhythms like breathing to support attention, stress regulation, and presence (Hydra Ng et al. 2024). Breathing becomes not only a mechanism for self-regulation but also a design scaffold for creating more attuned and human-centered virtual experiences.

The integration of MR and breath-based tools marks a shift toward embodied technologies that engage users as sensing, feeling beings, rather than disembodied observers (Heck and Varga 2023).

Embodiment as a Guiding Paradigm

As technologies grow more immersive and emotionally impactful, they raise new questions about agency, inclusion, and psychological safety.

This research introduces embodiment not only as a cognitive framework but also as a design ethic—one that prioritizes lived experience, diversity, and affective resonance.

MR systems that promote interoceptive sensing, full-body interaction, and affective feedback offer opportunities to support emotional grounding and wellbeing. At the same time, if not designed with care, they risk intensifying disembodiment.

This study suggests embodiment as a guiding paradigm, calling for empathetic, participatory, and ethically attuned practices to shape more inclusive futures (Glenberg and Robertson 2000; Lindgren and Johnson-Glenberg 2013; Subin et al. 2025).

Methodological Approach

To investigate how breath-based practices cultivate embodied awareness—and how these insights can inform MR design—this study turns to those who work most closely with breath in practice.

Through semi-structured interviews with freedivers, yoga practitioners, and breathwork facilitators, as well as autoethnographic inquiry, the research explores how breath supports self-regulation, presence, and sensory awareness.

A hybrid qualitative methodology combining interpretative phenomenological analysis with ethnographic fieldwork allows for a comprehensive, first-person understanding of embodied experience.

Five dimensions structure the inquiry: sensory experience, cognitive self-regulation, context and facilitation, temporal design, and ethical attunement.

These serve as foundations for a design framework that helps individuals “sense their way forward”—not just think—within immersive, digitally mediated environments.

Research Contribution

This research makes five key contributions to the fields of cognitive science, immersive technology, and human-centered design:

1. It offers a conceptual redefinition of breath as both an interface and a form of embodied intelligence within digital environments.
2. It introduces the Embodied Cognition Blueprint, a design framework that bridges theoretical models of cognition with practical guidelines for MR systems.
3. It provides empirical insight into how breath-based practices shape sensory experience, cognitive self-regulation, and ethical awareness across physical and virtual contexts.
4. It distills design principles for crafting inclusive, affective, and ethically attuned immersive experiences that center embodied awareness.
5. It applies these findings through Respir.ai, a breath-centered prototype that demonstrates the translation of theory into practice for digital wellbeing.

In conclusion, this research advances our understanding of the intersection between breath, embodiment, and technology by redefining breath as a meaningful interface, proposing a practical design framework, and offering empirical and applied insights. Together, these contributions support the creation of immersive, ethical, and human-centered technologies that foster deeper embodied awareness and cognitive self-regulation.

Breathing and Embodiment

This section lays the foundation by defining embodied cognition and positions breath as a key rhythm for interoception, presence, and emotional regulation.

Breath as the Entry Point into Embodied Awareness

In cognitive science, the embodiment thesis challenges the view of cognition as abstract and brain-bound, proposing instead that it arises through the body's dynamic engagement with the world. As Foglia and Wilson (2013), Ziemke (2016), and Hellström et al. (2024) explain, cognition is not merely neural but emerges from the interplay between brain, body, and environment. Thought is grounded in perception and action, with sensory-motor systems shaping reasoning, memory, and meaning-making, even through metaphor (Foglia and Wilson 2013; Ziemke 2016; Hellström et al. 2024).

This view, now informing neuroscience, psychology, AI, and design, positions the mind as a relational process rooted in lived bodily experience (Hellström et al. 2024).

Breathing offers a uniquely direct route into the embodied process. As introduced earlier, breath plays a regulatory role bridging conscious and unconscious states, supporting perception, attention, and emotional balance (Chin et al. 2024; Goel et al. 2024).

It plays a central role in modulating the autonomic nervous system, balancing sympathetic and parasympathetic responses. Practices such as diaphragmatic and alternate-nostril breathing not only regulate arousal but also deepen interoceptive awareness and present-moment engagement (Hydra Ng et al. 2024).

Breath-based interoceptive cues draw attention inward, enhancing awareness of mood, tension, and coherence (Chin et al. 2024; Goel et al. 2024; Hydra Ng et al. 2024). Neuroscience supports this, showing that breath influences brain activity in regions linked to emotion, motor control, attention, and decision-making (Varga and Heck 2017; Heck and Varga 2023).

These findings underscore breath as more than a biological function, it is a powerful modulator of cognition and emotion, rooted in the lived, embodied experience of being in the world.

Grounding Breath in Embodied, Enactive, and Situated Cognition

This section traces the shift from dualist to embodied models of cognition, introducing theoretical frameworks that explain how breath-based practices are meaningful tools for embodied sense-making.

From Cartesian Dualism to Embodied Cognition

Ancient Traditions and Scientific Views

As stated in the introduction, ancient breath terms across cultures defined as Qi, Pneuma, Ruah, and Prana framed breath as a medium of life energy. Though culturally distinct, the concepts reflect a shared understanding of a dynamic life energy that animates and integrates our physiological and psychological functions.

From this perspective, embodiment is not merely physical presence, but a lived experience shaped by the flow of vital energy, one that reveals the deep interconnection of body, mind, and spirit (Manasa et al. 2020; Greenwood 2024).

The embodied worldview persisted for centuries until the 17th century, when René Descartes introduced mind-body dualism, a framework that split thinking (mind) from physical being (body), casting the latter as a passive, mechanical vessel (Veissière et al. 2020; Werner 2020). Understanding this shift is crucial to framing why breath was marginalized, and why it must now return as a central cognitive element (Heck and Varga 2023).

Descartes cartesian dualism shaped scientific thought for generations, reinforcing cognition as brain-bound and abstract, and largely neglecting the body's role in perception, emotion, and meaning-making (Veissière et al. 2020; Hellström et al. 2024).

In contrast, contemporary embodiment theory challenges this separation, returning to a more integrated perspective where cognition emerges from the dynamic interplay of body, mind, and environment (Veissière et al. 2020; Werner 2020). In doing so, it echoes the ancient insight that breath and bodily awareness are gateways to deeper knowledge, offering not just a physiological function, but a felt

connection to life energy and presence (Manasa et al. 2020; Greenwood 2024).

This shifts away from dualism and lays the groundwork for understanding why breath has become a key entry point into embodied cognitive processes. The return to embodied understanding is further developed in philosophical traditions such as phenomenology, which provides a conceptual foundation for exploring how lived, bodily experience shapes perception and meaning (Dowling 2007; Thorburn and Stolz 2023; Choi 2024).

Transcendental and Embodiment Phenomenology

Husserl's phenomenology offers a key philosophical framework for understanding embodiment. Central to Husserl's work is the concept of intentionality, which posits that consciousness is always directed toward something. This view challenges the Cartesian split between subject and object, arguing that meaning is not passively received but actively constituted through embodied engagement with the world (Dowling 2007; Thorburn and Stolz 2023; Choi 2024).

A key extension of Husserl's ideas is the concept of habituality. This idea emphasizes that repeated experiences shape how we perceive and act, creating a habitual body: the lived body that adapts to familiar environments and routines. Husserl's work, particularly his focus on the lived body, directly challenges the Cartesian notion of the body as an object and highlights the active, dynamic role the body plays in constituting experience (Dowling 2007; Thorburn and Stolz 2023; Choi 2024).

Merleau-Ponty built on Husserl's work but emphasized the pre-reflective nature of bodily experience. For Merleau-Ponty, perception is not a mental operation derived from abstract reasoning but the foundation through which we engage with the world. The body, for Merleau-Ponty, is an active subject, and meaning arises from the embodied interaction between the body and its environment (Thorburn and Stolz 2023).

His framework identifies four core dimensions of lived experience: spatiality (lived space), corporeality (lived body), temporality (lived time), and relationality (lived human relations). These dimensions underscore how embodiment shapes our perception of space, time, and social interactions (Thorburn and Stolz 2023).

Merleau-Ponty's emphasis on embodiment directly challenges Cartesian dualism by asserting that meaning and cognition emerge from embodied experience, rather than abstract mental processes. His philosophy informs contemporary fields like psychology, cognitive science, and human-computer interaction (Veissière et al. 2020). These insights contribute to understanding how deeply bodily rhythms like breath may structure our perception, attention, and sense of presence.

Theoretical Models

Conceptual Metaphor Theory and Ecological Psychology

Conceptual Metaphor Theory (CMT) highlights the embodied nature of cognition by showing how abstract thought is structured through bodily experience. Building on Merleau-Ponty's phenomenology, Lakoff and Johnson argue that metaphors such as "grasping an idea" or "feeling up" reflect underlying sensorimotor patterns that shape language and meaning (Lakoff and Johnson 1983; Hellström et al. 2024). This challenges disembodied models of mind, emphasizing that thought is fundamentally grounded in lived physical interaction (Lakoff and Johnson 1983).

Ecological Psychology complements this view by proposing that perception is direct, situated, and action-oriented—not reliant on internal representations (Szokolszky et al. 2019). Gibson's theory of affordances—possibilities for action shaped by an organism's abilities and context—frames perception as a dynamic relationship between body and environment (Glenberg and Robertson 2000; Szokolszky et al. 2019).

Key principles of Ecological Psychology include:

- **Direct Perception**
  Information is picked up directly from the environment.
- **Perception-Action Coupling**
  Perceiving and acting form an inseparable loop.
- **Affordances**
  Perception is attuned to possibilities for action offered by the environment.
- **Natural Contexts**
  Cognition is studied in real-world, dynamic environments.
- **Optic Flow and Surface Perception**
  Movement through space generates optical patterns that inform orientation.

This relational view aligns with Merleau-Ponty's idea of ontological reciprocity—where perception and meaning emerge through embodied engagement.

Within this ecological framework, breath becomes a real-time modulator of perception and readiness, anchoring

interoceptive awareness and emotional tone. As a rhythmic, adaptive process, it helps tune the body to its environment and supports situated sense-making.

Dynamical and Radical Embodied Cognitive Science

Radical Embodied Cognitive Science (RECS) builds on principles from Dynamical Systems Theory (DST), which views cognition as an emergent, self-organizing process shaped by continuous interactions between brain, body, and environment (Hotton and Yoshimi 2011; van der Schyff et al. 2018). DST's emphasis on sensorimotor coupling and feedback loops offers a useful basis for understanding how behavior adapts in real-time.

RECS extends this foundation by integrating insights from Ecological Psychology and enactive cognition, which holds that cognition arises through active engagement with the world rather than internal computation, proposing that cognition does not reside solely in the brain but emerges through embodied interaction with the environment (Kiverstein and Miller 2015; Malinin 2019). It rejects internal representations, framing thought as a process enacted through doing, sensing, and adapting within dynamic contexts (Purvis 2021; Hellström et al. 2024).

Key principles of RECS include:

- **Beyond the Brain:**
  Cognition arises from brain–body–environment coupling.
- **Constitutive Bodily Involvement:**
  The body actively shapes thought, not just supports it.
- **Affordance Sensitivity:**
  Action possibilities are context-dependent.
- **Emotion–Cognition Unity:**
  Affective states modulate perception and decision-making.
- **Non-representational and Contextual:**
  Understanding is enacted, not symbolically computed.

This "radical" approach reframes cognition as lived, relational, and embedded—especially relevant in virtual environments, where bodily and environmental feedback shape perception and presence.

In this framework, respiration exemplifies embodied coupling: breath dynamically regulates emotional, attentional, and perceptual states, serving as a real-time interface for sense-making in both physical and digital contexts (Varga and Heck 2017).

4E Cognition and Breath as Embodied Interface

The 4E cognition framework—Embodied, Embedded, Enactive, and Extended—offers a relational view of the mind. Emerging from the work of Varela, Thompson, and Rosch (1991), it challenges brain-bound models by proposing that cognition arises through continuous interaction between the body, environment, and others (Gallagher 2013; Kiverstein and Miller 2015; van der Schyff et al. 2018; Werner 2020; McCaffrey 2024).

Key principles of 4E include:

- **Embodied:**
  Thought is shaped by bodily perception and movement.
- **Embedded:**
  Cognition is situated in cultural, material, and social contexts.
- **Enactive:**
  Meaning emerges through active engagement with the world.
- **Extended**:
  Tools and technologies participate in cognitive processes.

This framework is further enriched by:

- **Affective Cognition**
  It emphasizes how emotions—shaped by culture and experience—guide attention, learning, and decision-making (Veissière et al. 2020).
- **Grounded Cognition**
  It shows that abstract thinking stems from sensorimotor experience (Barsalou 2023).

Together, these perspectives form a unified, embodied understanding of mind—one that is emotional, physical, contextual, and socially shaped (Kiverstein and Miller 2015; Purvis 2021).

Viewed through this lens, breath is more than a physiological rhythm—it is a dynamic interface. Respiration synchronizes neural activity, modulates attention and emotion, and provides real-time sensory feedback that grounds perception and presence across physical and digital environments (Varga and Heck 2017; Heck and Varga 2023).

Brain–Breath Coupling in Embodied Cognition

Recent research describes brain–breath coupling—the influence of respiratory rhythms on brain activity and cognitive functions—as a key mechanism in embodied awareness (Varga and Heck 2017; Heck and Varga 2023).

Several studies support the importance of breath for cognitive and emotional processes:

- **Memory and breathing:** Arshamian et al. (2018) found that nasal breathing improves how we remember smells, showing a link between breath and memory.
- **Cognitive performance:** Johannknecht and Kayser (2022) showed that where we are in the breathing cycle can affect how quickly we react to tasks, linking breath to attention and mental focus.
- **Sensory processing:** Ito et al. (2014) discovered that breathing patterns affect brain activity in areas that process touch, suggesting that breath helps organize sensory input.
- **Emotional regulation:** Zelano et al. (2016) found that nasal breathing is connected to brain rhythms in emotional centers, which may help explain how breathing techniques support emotional control.

These findings reinforce that breathing is not merely biological, it is cognitive, emotional, and embodied. It shapes how we feel, sense, and respond, making it a potent tool for designing meaningful and human-centered virtual experiences.

Sense of Embodiment in Mixed Reality

Having established breath as a dynamic interface within embodied cognition frameworks, it is possible to understand how these insights apply in virtual and MR contexts. This section explores the Sense of Embodiment (SoE) framework, focusing on how presence, agency, and self-location can be modulated and anchored through breath in immersive environments.

The Sense of Embodiment Framework

As discussed earlier, breath modulates self awareness and anchors embodied cognition through dynamic regulation. Building on this understanding, particularly the role of bodily rhythms like breathing, it becomes increasingly important to explore how people actually experience being embodied (Heck and Varga 2023; Hellström et al. 2024; Hydra Ng et al. 2024).

While studies show how the body supports mental activity, research also points to the importance of subjective experience—how we feel and perceive ourselves as having and being a body (Heck and Varga 2023). This shift invites deeper exploration of how embodiment is not only physical but also emotional, relational, and influenced by context.

Technological developments take on and further expand this view. Today, embodiment extends beyond the physical body into virtual and MR environments, where people often experience a sense of presence, agency, or identity through avatars or digital interfaces (Dall Alba and Barnacle 2005; Barker 2023; Hansdotter 2023).

In this evolving landscape, the Sense of Embodiment (SoE) framework provides a helpful way to study how people feel and interpret their embodied experiences—both in real life and in virtual settings.

According to Roth and Latoschik (2020) and Guy et al. (2023), SoE includes three interrelated components:

» **Sense of Agency:**
The feeling of initiating and controlling one's own actions, grounded in movement and feedback from the environment.

» **Sense of Body Ownership:**
The experience that one's body (or avatar) belongs to oneself and is the source of sensory input.

» **Sense of Self-Location:**
The sense of being located somewhere in space, usually within the body, but potentially shifting in virtual contexts.

These three elements work together but can also vary independently. For example, someone might feel control over an avatar (agency) without fully identifying it as their own body (ownership).

Understanding how these dimensions relate helps researchers explore how embodiment is experienced differently across situations, especially as physical and digital boundaries blur (Costantini and Haggard 2007; Roth and Latoschik 2020; Guy et al. 2023).

Measuring Embodiment

In MR, measuring embodiment is crucial to understand how technology affects cognition, emotion, and behavior. Since embodiment and related constructs are inherently subjective, scholars suggest some methods that help quantifying them (Kiverstein and Miller 2015; Johansen 2020; Guy et al. 2023; Subin et al. 2025).

Assessing sense of embodiment include self-reports, physiological measures, behavioral and real time observations; all of which help understand user engagement and presence in MR environments.

These measures are key for designing immersive, ethical, and inclusive experiences that foster deeper cognitive and emotional engagement (Costantini and Haggard 2007; Kiverstein and Miller 2015; Johansen 2020; Barker 2023).

Self-Report Measures:
Surveys measure how much users feel connected to their avatars using categories like look, reactions, control, and senses.

Physiological Measures:
Embodiment occurs when sensory experiences (e.g., touch, sight, sound) align with user actions, creating a seamless connection between the physical and virtual worlds.

Behavioral Observations:
Behavioral tracking in virtual environments offers objective insights into user interaction, unlike subjective self-reports.

Real-Time Observations:
Real-time data like motion or gaze tracking is increasingly used to assess embodiment; higher movement-avatar synchrony signals stronger embodiment.

While no single metric captures embodiment, combining different methods gives a more complete picture—linking conscious experience with unconscious patterns. As the field evolves, neurophysiological tools may offer deeper insight into this complexity (Costantini and Haggard 2007; Lindgren and Johnson-Glenberg 2013; Roth and Latoschik 2020; Peck and Gonzalez-Franco 2021; Guy et al. 2023).

Breath-aware systems may enhance these metrics by offering a continuous, embodied signal that bridges physiological, behavioral, and experiential dimensions. Studies suggest that real-time breath sensing, for instance, can deepen presence and help calibrate emotional and attentional states in MR environments (Heck and Varga 2023; Hydra Ng et al. 2024).

Breath enhances presence, agency, and self-location in mixed reality by anchoring attention and regulating emotion. As a real-time signal, it offers a powerful tool for designing more embodied virtual experiences —especially where disconnection or fragmentation arises.

Virtuality, Sensation, and the Split Body

While the previous section outlined the theoretical basis of embodiment in MR via the Sense of Embodiment (SoE) framework, this section shifts to the emotional and experiential impact of disembodiment—when coherence between body, self, and virtual presence begins to fragment. As avatars mediate perception and action, users risk a disconnect between their felt self and digital representation.

This section examines how intense virtual experiences can unsettle bodily awareness, and how breath—both sensory and interoceptive—can restore coherence, presence, and emotional grounding. Drawing on Deleuze's Body without Organs, alongside phenomenological and empirical research, it proposes sensory-aware design strategies to foster psychological resilience in immersive environments.

Virtual Bodies and the Sensory Split

In MR environments, users often experience a split between their physical body and their virtual representation. While the physical body remains grounded in the real world, the avatar navigates a simulated environment. This separation can lead to a sense of disconnection between what the user physically feels and what they visually perceive or control virtually (Guy et al. 2023).

This gap disrupts the natural integration of perception, movement, and emotion. Philosopher Gilles Deleuze describes this fragmented, deterritorialized condition as the Body without Organs (BwO)—a body no longer defined by structure or identity, but instead composed of flows, intensities, and affective states (Cipresso et al. 2018; Guy et al. 2023).

Within this framework, sensation becomes the key to bridging subject and object, perception and action. In MR, this suggests that immersive, multisensory engagement may momentarily unify physical and virtual experience, blurring the boundaries between the two (Harris et al. 2019; Breuer 2020).

However, this merging is fragile. Research shows that abstract, incoherent, or mismatched sensory input can disrupt interoceptive awareness, leading to cognitive disorientation, emotional detachment, or physical discomfort (Harris et al. 2019; Guy et al. 2023).

These concerns echo findings from meditation and mindfulness studies: while virtual environments can support attention and stress relief—especially for beginners—they often lack key grounding elements such as tactile sensation, environmental coherence, and full-body awareness (Jo et al. 2024).

As a result, MR may amplify surface-level stimulation while struggling to foster deeper emotional integration (Breuer 2020; Cipresso et al. 2018).

Cognitive and Emotional Consequences of Disembodiment

Embodiment in MR is not just an aesthetic effect; it has measurable cognitive and emotional outcomes. When users experience a strong sense of body ownership, agency, and spatial presence, they report greater clarity, emotional resonance, and improved learning outcomes (Lindgren & Johnson-Glenberg 2013; Peck & Gonzalez-Franco 2021; Ahmedien 2024).

However, this illusion is delicate. Even minor disruptions—like an avatar's arm extending unnaturally or delayed visual feedback—can break the sense of coherence and reduce the user's feeling of control (Porssut et al. 2022).

These findings highlight the need for precise, consistent sensory feedback in MR. When the brain detects discrepancies between expected and actual movement or sensation, embodiment weakens. Users may feel confused, emotionally flattened, or dissociated (Porssut et al. 2022).

This is not merely an experiential concern—it affects interoceptive awareness, the ability to sense and interpret internal bodily signals like breath, heartbeat, or tension (Preiss et al. 2022; Barker 2023; Subin et al. 2025).

Encouragingly, research by Hydra Ng et al. (2024) demonstrates how breath-aware MR design can restore this lost coherence. In their study, participants engaged in various breathing techniques—mindful breathing, guided breathwork, and breath counting—within a tranquil virtual meadow.

Real-time physiological data, including EEG (a non-invasive method used to record electrical activity in the brain), heart rate, and respiration, was used to dynamically shape the virtual environment.

Results showed synchronized changes in brain and body rhythms, indicating that breath-responsive environments can restore interoceptive grounding and support emotional safety in MR contexts (Veissière et al. 2020; Hellström et al. 2024).

Breath, in this sense, becomes a vital design element—an embodied rhythm that links internal state with external experience, helping users stay anchored amid virtual intensity.

Phenomenological Design in Mixed Reality

While post-structural thinkers like Deleuze illuminate how fragmentation and intensity shape virtual experience, phenomenology offers a more grounded and user-centered approach to MR design.

As introduced earlier, Husserl's call to return "to the things themselves" places lived, first-person experience at the heart of inquiry (Husserl 2013).

In MR—where perception, agency, and presence are fluid and frequently disrupted—this orientation is essential (Dowling 2007; Choi 2024).

A core phenomenological concept is intentionality—the insight that consciousness is always directed toward something. In immersive design, maintaining this directed focus helps sustain users' sense of engagement and coherence.

When intentionality is lost—when actions feel disconnected from outcomes or avatars feel unfamiliar—the experience risks becoming alienating or emotionally destabilizing (du Toit 2020).

Phenomenology invites designers to go beyond technical functionality and instead consider how MR systems feel from within—how they support (or undermine) continuity, self-awareness, and meaningful interaction over time. This perspective helps shift design priorities from output to felt experience (du Toit 2020).

Neuroscience reinforces these principles. Slater and Sanchez-Vives (2016) show that immersive MR systems influence brain regions associated with spatial orientation and body ownership.

Their work supports the phenomenological premise: successful MR design must engage the brain–body system with care, avoiding sensory overload and supporting integration rather than fragmentation (Slater and Sanchez-Vives 2016).

In sum, designing for embodiment in MR is not simply a matter of aesthetics or usability. It requires close attention to sensation, coherence, and the subjective experience of being in a body.

Philosophical frameworks like Deleuze's Body without Organs and Husserl's phenomenology—when paired with empirical insights from cognitive science—offer essential tools for crafting immersive technologies that are not only engaging, but also emotionally supportive and psychologically coherent (Breuer 2020).

Toward Coherence Through Sensory-Aware Design

This section has examined the fragility of embodiment in MR environments, showing how intense virtual experiences can lead to disconnection between the self and the body.

Drawing on philosophical, psychological, and design research, it has argued that breath—rooted in interoception and lived sensation—can serve as a stabilizing force.

By integrating breath-aware features into MR systems, designers can help restore coherence between the physical and virtual, supporting presence, emotional grounding, and embodied integrity.

Whereas Deleuze alerts us to the risks of fragmentation and overstimulation, phenomenology and neuroscience offer practical and ethical insights for designing technologies that feel safe, meaningful, and alive.

This section invites a shift in MR design—from systems that prioritize control and output, to ones that prioritize coherence, rhythm, and the return to embodied experience.

Designing for Impact

The previous sections outlined a theoretical foundation for understanding breath through the lenses of embodied, enactive, and affective cognition.

Grounded in frameworks like 4E Cognition and Radical Embodied Cognitive Science, breath emerges not only as a physiological rhythm but as an interface for self-regulation, attention, and sensory meaning-making.

This section now applies those insights to the practical realm of immersive design. It explores how breath-based practices can be intentionally embedded into MR environments to foster presence, emotional safety, and user-centered engagement.

Design Implications and Practical Frameworks

Hansdotter (2023) framework, called VR4Impact, was designed to support the creation of highly immersive virtual reality (VR) experiences that promote prosocial behavior, specifically focusing on perspective-taking and self-transformation. Its overall aim is to provide guidelines and best practices for creating impactful and enjoyable VR experiences that encourage prosocial attitudes and behaviors (Hansdotter 2023).

Embodiment should be a central goal when designing immersive systems. A strong sense of presence, feeling inside, owning, and controlling a virtual body, enhances learning, emotional connection, and comfort (Barresi et al. 2021).

In alignment with these aims, the Technology Acceptance Model (TAM) offers a valuable lens for integrating user-centered criteria into immersive design. The extended TAM demonstrates that users, especially older adults, are more likely to adopt VR systems when they are easy to use, emotionally rewarding, socially engaging, and perceived as beneficial for their health and well-being (Chiang et al. 2024).

This has critical implications for design: emotional relevance and intuitive interaction are not just experiential enhancers but also adoption enablers. By attending to both experiential depth and perceived usability, designers can create VR and MR systems that are both impactful and accessible.

This dual concern is echoed in Hansdotter (2023) framework, which articulate best practices across the three areas shown in the table below.

These domains reinforce TAM's core insights: perceived ease of use and usefulness, especially when linked to emotional, social, and physical benefits, are key to acceptance and sustained engagement (Cipresso et al. 2018; Breuer 2020; du Toit 2020; Hansdotter 2023; Dopsaj et al. 2024; Jo et al. 2024).

Content Domain	Usability Domain	Technology Domain
Engage narrative, agents, self	**Emphasize ease of use**	**Ensure technical smoothness**
Scenario: Maintain emotional connection and relevance.	**Format:** Keep sessions short and engaging.	**User Tracking:** Enable natural body movement.
Social Presence: Include interactive and relatable agents.	**Interaction:** Ensure intuitive, inclusive actions.	**Sensory Quality:** Prevent motion sickness and visual lag.
Self-Representation: Allow personalized avatars or responses.		

Embodied Cognition and Biofeedback in Mixed Reality Environments

Embodiment in MR systems fundamentally reshapes how users experience and interact with technology, influencing cognitive, emotional, and physiological states (Horowitz et al. 2020).

When users feel physically present in a virtual environment, their learning, memory, and affective processing can be deeply impacted.

Measuring and refining embodiment enables more intuitive interaction, deeper immersion, and more emotionally resonant virtual experiences (Kiverstein and Miller 2015; Ahmedien 2024; Subin et al. 2025).

However, this depth of engagement also raises ethical concerns. Neuroscientific research shows that immersive VR and MR can significantly alter a person's internal state amplifying both therapeutic potential and risks, such as emotional overexposure, diminished autonomy, or behavioral manipulation (Slater and Sanchez-Vives 2016; Barker 2023).

This evolving interface between body and technology has sparked increased interest in the breath as a key regulatory tool.

As our understanding of breath's influence on brain and body deepens, technologies such as MR, VR and biofeedback (BF) are beginning to integrate breathing into immersive environments for therapeutic and educational purposes (Hydra Ng et al. 2024).

These tools translate internal physiological processes into real-time visual, auditory, or haptic feedback, making embodied experience more accessible and trainable.

In sum, the integration of biofeedback and breath into MR environments deepens embodiment and enhances emotional and cognitive engagement—while also demanding careful ethical consideration as internal states become increasingly externalized and influenced through technology (Hydra Ng et al. 2024).

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VR, MR and Biofeedback Applications:

Immersive Focus:
VR environments like swaying meadows or floating orbs visually mirror breath rhythms to anchor attention.

Gamified Engagement:
Progress tracking and achievement systems boost motivation and reduce dropout in breathwork training.

Distraction-Free Presence:
Immersive settings minimize external stimuli, helping users remain focused on internal regulation.

Real-Time Monitoring:
Sensors such as respiration belts, heart rate monitors, and EEGs track physiological signals during breathwork.

Feedback Visualization:
Data is mapped onto VR environments, giving users interactive cues to regulate their breath and emotional state.

Personalized Techniques:
Brainwave analysis (EEG) supports individually tailored breathing strategies based on real-time neural responses.

Clinical and Home Use:
These systems support stress relief, anxiety management, and interoceptive awareness in both therapeutic and at-home contexts.

Breath and body data in virtual environments open new ground in embodied design, making internal states visible and enhancing self-awareness. As these tools grow more immersive, concerns around consent, emotional safety, and equity become critical.

Designing for Emotional, Ethical, and Inclusive Mixed Reality

While the previous section explored how breath can support immersive engagement through frameworks like VR4Impact and TAM, this section takes a deeper look at the ethical stakes of such practices.

As breath-based technologies gain emotional and psychological influence, design must center inclusion, emotional safety, and consent—especially when working with vulnerable populations or altered states of awareness.

Emotionally Charged Mixed Reality

As MR technologies become more immersive and affectively powerful, their emotional impact is not just a design opportunity—it is an ethical imperative.

Breath-based experiences, in particular, require body-aware, participatory, and empathetic approaches that prioritize emotional safety and inclusion (Dall Alba and Barnacle 2005; Liu et al. 2022; Barker 2023; Hydra Ng et al. 2024).

Emotional Vulnerability
MR can provoke intense emotional responses, especially in therapeutic, grief, or trauma-related contexts—raising concerns about emotional overexposure and psychological risk (Dall Alba & Barnacle 2005; Liu et al. 2022).

Technophilia vs. Technophobia
Reactions to MR range from utopian enthusiasm to deep skepticism. Designers must navigate between these extremes, fostering balanced, grounded relationships with technology (Ahmedien 2024).

Agency and Consent
As affective influence grows, ethical design must safeguard autonomy. Emotional nudging or manipulation—especially without clear, ongoing consent—undermines trust. Consent should be layered, revisitable, and woven throughout the experience—not confined to a single click-through (Barker 2023).

In sum, MR design must center ethical sensitivity to protect users' emotional wellbeing and support agency in increasingly immersive environments.

Accessibility Barriers and Inclusive Design

Designing for breath-based embodiment in MR demands sensitivity to a wide range of physical, cognitive, and cultural differences. Inclusive design is not just a feature—it is foundational to emotional safety, usability, and ethical attunement (Glenberg & Robertson 2000; Lindgren & Johnson-Glenberg 2013; Subin et al. 2025).

The following principles synthesize best practices drawn from recent research and accessibility frameworks:

Adaptive Interfaces
Interfaces should be customizable to support diverse sensory, motor, and cognitive capacities—especially for users with disabilities or neurodivergence (Aflatoony & Kolaric 2022). This includes flexible layouts, font scaling, and breathing pace adjustments.

Multimodal Input
Incorporating diverse input methods—such as voice commands, eye-tracking, hand gestures, or co-pilot assistance—can enhance autonomy and comfort across user types (Cipresso et al. 2018; Subin et al. 2025).

Stimulus Regulation
To prevent sensory overload, systems should allow users to adjust motion speed, audio intensity, and visual complexity. Cipresso et al. (2018) emphasize how over-stimulation can lead to cognitive fatigue, especially in immersive environments.

Hardware Flexibility
Devices must accommodate assistive technologies like hearing aids and prescription glasses. Creed et al. (2023) highlight the importance of offering non-immersive alternatives or adjustable interfaces for users with mobility or visual impairments.

Despite best practices, several structural barriers remain:

Interaction Gaps
Haptic and gesture-based systems often lack the intuitive ease of visual interfaces, limiting engagement for some users (Creed et al. 2023).

Software–Hardware Fragmentation
Porssut et al. (2022) note that poorly synchronized systems—where hardware responsiveness lags behind software intention—can cause confusion and break user immersion.

Motion Discomfort and Latency
Issues like lag and latency can induce nausea, particularly for neurodiverse or vestibular-sensitive users. Dopsaj et al. (2024) propose new neurodigital interfaces to reduce these effects, but many commercial platforms still fall short.

Systemic and Economic Barriers
Finally, high costs, limited device availability, and a lack of culturally relevant content continue to restrict access—especially in emotionally sensitive or high-stakes contexts (Cipresso et al. 2018).

Embodied and Affective Interaction Frontiers

Emerging MR systems are extending interaction beyond the visual toward fully embodied, affective engagement, building on the interoceptive and emotional design practices discussed earlier in the literature review. This includes breath-aware inputs, haptic feedback, and emotion-responsive systems that deepen felt experience and relational presence (Cipresso et al. 2018; Creed et al. 2023; Dopsaj et al. 2024; Subin et al. 2025).

This signals a shift from purely visual immersion toward multisensory, emotionally attuned interaction, one that recognizes embodiment as central to cognition and user engagement.

Toward Participatory and Ethical Futures

To truly serve diverse communities, MR must be developed through participatory, ethical, and inclusive processes.

Community Involvement:
Marginalized, disabled, and neurodiverse users should be active co-designers, not passive end-users.

Representation:
Avatars and environments must reflect diverse bodies, skin tones, and assistive tools to promote belonging.

Ethical Standards:
Industry-wide frameworks are needed to ensure emotional safety and accessibility.

Education and Advocacy:
Developers and researchers must be trained in inclusive design and cultural competence.

As MR shapes how we feel and connect, its ethical stakes rise. Rooted in empathy, ethical design can guide MR toward more humane, relational futures

Embodiment Futures – Breath, Identity, and Design Beyond the Screen

This section envisions a future where embodiment becomes a central design paradigm. It considers how breath-aware technologies can shape not just interaction but identity, wellbeing, and relationality in digital life.

Embodiment in the Immersive Age

As immersive technologies like MR integrate into daily life, design must evolve to reflect how we think, feel, and relate through our bodies. Embodiment is not just about having a body—it's about sensing, moving, and experiencing the world in an integrated way.

Theories like 4E Cognition and Radical Embodied Cognitive Science position thinking as a whole-body process, embedded in lived action and context (Gallagher 2013; Kiverstein and Miller 2015; Veissière et al. 2020).

Technology increasingly shapes not only what we do, but how we feel and who we become. Designers must see it not just as a tool, but as a system that guides attention, emotion, and identity (Barker 2023; Creed et al. 2023).

Beyond Sight and Sound

Most immersive systems prioritize vision and sound, but real-life experience involves touch, balance, smell, and internal rhythms like breath and heartbeat. Over-reliance on visual channels can cause disorientation and disconnection (Peck and Gonzalez-Franco 2021).

As previously stated, breath, influences attention, emotion, and memory (Heck and Varga 2023; Goel et al. 2024). New systems now respond to breath in real time, modulating physiological states and brain activity to foster calm and focus (Hydra Ng et al. 2024).

As discussed earlier, breath modulates interoceptive awareness and anchors embodied cognition through dynamic regulation. This marks a shift toward technologies that respond not just to input—but to internal experience.

Embodiment, Identity, and Adaptation

Taking on virtual bodies can shift one's sense of self—offering empowerment but also risk. When virtual embodiment feels disconnected, it can lead to confusion or emotional strain (Horowitz et al. 2020; Hansdotter 2023).

Internal signals like breath, heartbeat, and body temperature help anchor users, supporting embodied presence and emotional regulation (Varga and Heck 2017; Guy et al. 2023; Heck and Varga 2023).

Embodiment as Social Practice

Embodiment also plays a role in relationality. In shared virtual spaces, breathing or moving together can enhance group connection, trust, and empathy (Creed et al. 2023).

Some MR systems already use breath-based biofeedback to support collaborative awareness in therapy or learning contexts (Hydra Ng et al. 2024), framing embodiment as a social technology.

Ethical Concerns

As immersive tech becomes more emotionally powerful, ethical risks rise—particularly in therapy or education. Systems must adapt to users' states, include ongoing consent, and reflect diverse bodies, cultures, and needs. (Creed et al. 2023; Subin et al. 2025).

Embodiment as a Design Paradigm

Centering embodiment in design supports well-being, learning, and agency—not just function. It respects the intelligence of the body as a guide for attention, emotion, and connection (Heck and Varga 2023).

Breath, as a core anchor of presence, enables systems to tune into users' needs—not just their commands—creating more humane, emotionally attuned environments (Heck and Varga 2023; Hydra Ng et al. 2024).

Embodied design asks us to slow down, to feel, and to question how technology shapes us. When guided by empathy and ethics, it offers the potential for immersive experiences that are not only intelligent but alive (Hydra Ng et al. 2024).

Framing breath as both interface and intelligence, this section calls for technologies that attune to the rhythms of the body, inviting a more ethical, inclusive, and emotionally grounded digital future.

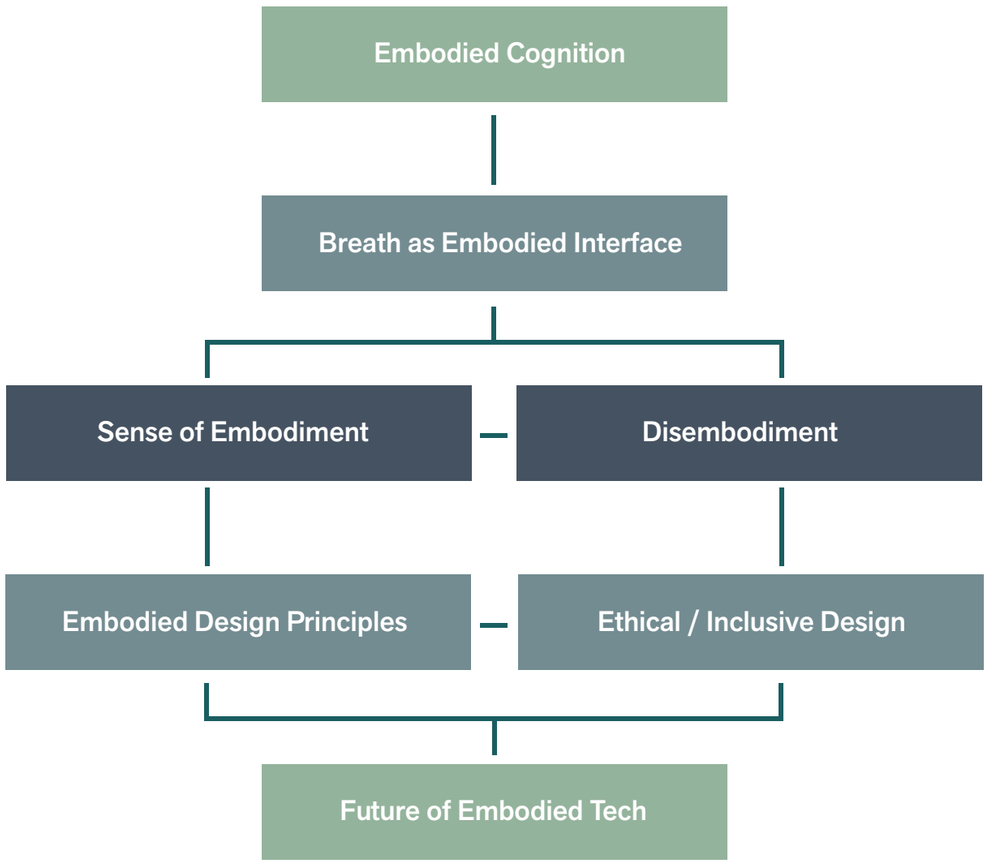
Literature Review Synthesis

The conceptual framework below shows how breath is woven throughout cognitive theory, experiential design, and ethical practice.

It reveals breath as:

- **A bridge between inner awareness and outer action**
- **A stabilizer in fragmented virtual spaces**
- **A guide for ethical, inclusive, and emotional tech design**

Taken together, the study propose a shift toward technologies that place breath as the bridge between mind & body, self & environment, and design & meaning.



Research Methodology.

Central Research Question and Objectives

How might we meaningfully integrate embodiment awareness into virtual experiences so that individuals can sense their way forward—not just think?

Rooted in this inquiry, the research explores how breath-based practices cultivate embodied awareness and how these insights can inform the design of mixed reality (MR) environments. Specifically, it investigates how the subjective, sensory, and affective dimensions of breath support presence, emotional regulation, and ethical inclusion in technologically mediated settings.

The research addresses four core objectives:

- **To explore how embodiment is defined and understood in practice**
- **To identify methods used to measure or assess embodiment**
- **To examine the role of embodiment within virtual environments**
- **To consider the ethical and accessibility dimensions of embodied experience in technologically mediated contexts**

Theoretical Frameworks

To investigate these objectives, the study draws on five interrelated theoretical models that inform both research design and analysis:

Radical Embodied Cognitive Science (RECS): Emphasizes that cognition emerges from brain–body–environment coupling and foregrounds action-based, situated interaction.

4E Cognition (Embodied, Embedded, Enactive, Extended): Views the mind as shaped by bodily experience, environmental context, and social interaction.

Sense of Embodiment (SoE): Focuses on body ownership, agency, and self-location—key components in both physical and virtual embodiment.

Phenomenology: Prioritizes first-person lived experience and emphasizes how meaning arises through embodied perception.

Conceptual Metaphor Theory (CMT): Explores how abstract concepts (e.g., grounding, flow, expansion) are shaped through bodily metaphor and sensorimotor experience.

Together, these frameworks offer an interdisciplinary foundation for understanding how embodiment is experienced, practiced, and interpreted in both physical and virtual environments

Methodological Approach

Hybrid Qualitative Methodology

This study uses a hybrid qualitative methodology combining Interpretative Phenomenological Analysis (IPA) with Ethnographic and Autoethnographic methods. This approach is designed to explore how embodied awareness can be meaningfully integrated into virtual experiences—helping individuals prioritize feeling over thinking.

IPA, rooted in the study of lived bodily experience, emphasizes how individuals make sense of their sensory and emotional worlds through a double hermeneutic: participants interpret their own experiences, and the researcher interprets those interpretations. This is especially well suited to uncovering the subtle, affective, and embodied dimensions at the core of this inquiry.

To contextualize IPA's idiographic focus, an ethnographic lens was added through participant observation, fieldwork, and researcher reflexivity. The researcher's

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own embodied experience further contributed an autoethnographic layer consistent with embodied inquiry traditions (Creswell, 2007).

Data collection included semi-structured interviews, conducted in a conversational style to allow emergent themes. A deductive thematic analysis was used, with codes and questions shaped by existing literature on embodiment and virtual interaction (Saunders et al., 2023). While theory-driven, the analysis remained open to emergent, experience-based insights.

Together, IPA and ethnography supported a rich, situated understanding of how individuals interpret and reshape their embodied presence in digital environments.

Sample and Participant Characteristics

Given that breath is a powerful entry point into embodied experience (as explored in the literature review), this study used criterion-based sampling to select individuals who work with breath-based practices in their daily professional lives.

In line with IPA's emphasis on small, homogenous samples, participants were deliberately chosen for their deep experiential knowledge of breath-based embodiment through practices like freediving, yoga, embodiment practices and breathwork facilitation. These individuals were considered well-positioned to offer nuanced insights into how breathing supports interoception, emotional regulation, and presence (Creswell, 2007; Wagstaff & Williams, 2014).

Since not all breathing approaches are equal, the sample was intentionally diverse in background and modality to reflect a broader spectrum of embodied practice. All interviews were conducted remotely via Google Meet and recorded for transcription and analysis.

Participant characteristics are presented in the following table.

Freediver Professional	Sweden
Freediver Professional	Sweden
Freediver Professional	US
Yoga Teacher	US
Yoga Teacher	India
Breathwork Facilitator	Australia
Breathwork Facilitator	Germany
Breathwork Facilitator	Brazil
Embodiment Practitioner	Mexico
Embodiment Practitioner	US
Embodiment Practitioner	UK

Interview Questions

The study employed semi-structured interviews to explore participants' first-person experiences of breath-based embodiment.

Interview questions were theory-informed, drawing from RECS, 4E Cognition, SoE, Phenomenology, and Conceptual Metaphor Theory. These frameworks shaped the interview guide to align with the study's four core objectives: how embodiment is defined, measured, practiced, and ethically facilitated—especially in digital contexts.

Given the emergent nature of qualitative inquiry, the guide was used flexibly. While question topics and sequence remained consistent across interviews, phrasing was adapted to suit each participant's background, allowing for a more relational and embodied dialogue (Creswell, 2007). View interview questions on Appendix B.

Data Analysis

Interviews were transcribed and selectively analyzed to focus on content relevant to the study's core aims. Thematic analysis followed Creswell's (2007) guidelines, with key themes identified and coded into broader patterns aligned with the four research objectives. Ethnographic observations—including contextual notes on participants' embodied engagement—were used to complement and enrich the interview data. This allowed for a more holistic interpretation, grounded in both verbal and non-verbal dimensions of experience.

The analysis integrated insights from the literature (Saunders et al., 2023), enabling a critical reflection on how participants' lived experiences relate to existing theories of embodiment, presence, and ethical design in virtual contexts. View analysis tables & themes on Appendix C.

Trustworthiness and Rigor

To ensure qualitative rigor, the study followed established criteria (Shenton, 2004; Saunders et al., 2023):

Credibility: Themes were cross-validated through both interviews and ethnographic field notes.

Dependability: Data collection procedures and coding decisions were carefully documented.

Transferability: Detailed descriptions of methods and participant backgrounds support comparison in future research.

Confirmability: All interviews were recorded and transcribed with accuracy to maintain objectivity.

Ethical Considerations

Participation was fully voluntary, with the right to withdraw at any time. Data were anonymized, securely stored, and used solely for research and design purposes. Informed consent was obtained, and participants were given space to reflect on their comfort levels throughout the process. The researcher maintained a reflexive stance, prioritizing fairness, emotional safety, and confidentiality at every stage.View participant information sheet on Appendix A.

Research Autoethnography

By engaging in daily breath-based exercises, the researcher positioned her own body as a source of knowledge. This approach reflects the values of embodied inquiry, where first-person experience is essential for understanding subtle, internal phenomena like breath.

The self-study complements participant perspectives and strengthens the research by offering a direct, experiential view of how breath can shape presence, perception, and self-awareness.

Autoethnography Through Breath

A One-Month Self-Study Using Ethnographic Dimensions

Over 30 days, the researcher committed to a daily breath ritual—20 minutes of kapalabhati followed by Anuloma Viloma (8:32:16 ratio), practiced each morning in the same quiet setting. View daily meditation on Appendix D.

The researcher also completed a 60-minute guided breathwork session and a level 1 Molchanovs Freediving course.

Throughout, the responses were tracked through the lens of interoceptive awareness—sustained attention to inner bodily sensations across physical, emotional, and mental states.

The study was structured using nine ethnographic dimensions - presented in the following page - adapted from Reeves and Hodges (2008).

Space	The researcher reflected on shifts in behavior, state, and awareness.
Actor	A consistent indoor setting helped sustain habitual rhythm and internal focus.
Activity	The repeated breath practice sequence provided structure for comparing change over time.
Act	The researcher tracked micro-events for somatic insight.
Event	Each session was treated as a complete experience with a beginning, middle, and end.
Time	The researcher noted not just practice duration but changes in breath rhythm and time perception.
Goal	The primary aim was to observe the embodied impact of breath.
Feeling	Emotional and physical sensations were tracked, noting how they shifted across practices.

By applying these dimensions, the study offers a structured yet personal account of how breath can deepen presence and embodied self-awareness.

This method bridges subjective experience with ethnographic insight, revealing breath as both a physiological technique and a meaningful, culturally situated practice.

Participant Discourse Analysis.

Answering Objective 1

To explore how embodiment is defined and understood in practice.

The questions that addressed this topic were:

- **What does it feel like to be fully in your body during breathing exercises?**
- **What sensations help anchor people during breathing exercises?**
- **How do breathing exercises change body awareness over time?**

Participant quote:

”Some days it feels peaceful and some days it feels really swirly and chaotic and some days it just feels”

What does it feel like to be fully in your body during breathing exercises?

Based on the answers in the interviews:

Being fully in your body during breathing exercises is a deeply perceptual experience, marked by heightened self-awareness and internal presence. You may feel peaceful and grounded —or at times, encounter swirling, haotic, or anxious sensations. Bodily awareness sharpens: heart rate, skin temperature, and sensory perception become vivid, anchoring you in the moment. Clarity often emerges—both in sound and sight—as if perception itself intensifies. There's a strong sense of physical and emotional presence, with feelings of happiness, belonging, integrity, or expansion. Many describe this state as being “in the now” or even “in their cells”—a visceral, embodied aliveness. Ultimately, breath brings you into contact with your inner world, anchoring perception and deepening presence.

”It's just being with what's there.”

From the researcher's autoethnographic study

Being fully in my body means entering a timeless state—realizing the session has ended and I've lost track of time. It's sensing both silence and noise, holding space for whatever arises. I notice subtle shifts: a racing heart, heat building in breath retention, or tension surfacing as tremors or tightness. I observe pain and ease as they coexist. I begin to question hidden patterns in how I treat my body. To be fully embodied is not just to feel, but to listen deeply—to stay present with what's real, moment by moment.

Section Theme: Perception

What sensations help anchor people during breathing exercises?

Based on the answers in the interviews:

During breathing exercises, a range of sensory anchors help individuals stay grounded. Tactile cues like feeling the feet on the floor or maintaining a steady posture provide physical stability. Visual focus—either fixed on a central point or softly defocused—supports concentration. Internal sensations, such as diaphragm expansion or belly movement, deepen body awareness.

Rhythmic elements like counting the breath or using fingertips engage attention, while auditory anchors—mantras or repeated sounds—reinforce presence. Kinesthetic tools like body scans and visualization expand awareness across the whole body, enhancing sensorimotor coupling. These layered practices, often guided, support intentional focus and embodied presence across multiple sensory channels.

Section Theme: Intentionality

”The breath is always with you. So that is a very natural way to use as an anchor, as a refuge from all the mindstorm that can get created”

From the researcher's autoethnographic study

I shift between anchor points depending on the day. Sometimes I begin with visualization—like a light blue dissolving into black—to ease into the practice. When my mind is scattered, I repeat a mantra, often Hooponopono, whose rhythm brings me back. If anxious, I follow the pulse of my heartbeat inward; if calm, I anchor at the Muladhara (Root) chakra. Other times, I do a full body scan. Each anchor offers a distinct kind of support, depending on how I arrive.

How do breathing exercises change body awareness over time?

Based on the answers in the interviews:

Breathing exercises gradually deepen body awareness by fostering habit and shifting from conscious to intuitive practice. Repeated engagement builds a continuity of attention, helping individuals notice subtle bodily cues—like shifting between comfort, challenge, or stress zones. Breath becomes a tool for recovery, allowing the body to restore balance. Recognizing the body as intelligent and responsive enhances presence and self-regulation.

Over time, this attentiveness expands mental clarity and anchors intention in daily life—where even a single mindful breath can influence behavior. This awareness is layered and kinesthetic, involving posture, movement, and internal signals. Some participants described moments of subtle, intuitive awareness—what process-oriented psychology calls “quantum flirts”, brief, meaningful cues from the body or environment that guide deeper presence and attunement.

Section Theme: Habituality

”What really changes is just your ability to notice when you’re not present”

From the researcher's autoethnographic study

My body awareness changed markedly from week 1 to week 4. Early on, I struggled with retention during anuloma viloma and noticed signs of anxiety I didn’t act on. With daily practice, I became more attuned to internal signals and steadier in technique. I also experimented with shifting my anchor points to better focus attention.

As awareness deepened, my days felt more balanced. I began responding to signals like a racing heart or restlessness—pausing to breathe and reset. Noticing and honoring these cues became a vital part of my rhythm, contributing to a greater sense of ease and well-being.

Answering Objective 1

Embodiment in the context of breathing exercises refers to the direct, felt experience of being fully present in one's body, where awareness of internal and external sensory input is heightened. This includes a conscious perception of body presence, skin temperature, heart rate, and the five senses, which become reliable anchors in guiding one's awareness.

Participants report sensations such as silence, peace, or even swirliness and anxiety, demonstrating that embodiment is not about achieving a fixed emotional state, but rather about cultivating the capacity to feel deeply and directly.

Through clear sight, clear sound, and connection to internal states like integrity, belonging, and expansion, individuals deepen their sense of self-awareness —not merely conceptually, but as an ongoing perceptual and physiological process.

The implications of embodiment go beyond momentary awareness—it involves sensorimotor coupling (e.g., feeling your feet grounded, aligning breath with bodily sensations) and builds through habitual practice.

Tools like body scans, visualization, mantras, and focal points help participants tune in to subtle changes in breath and bodily rhythms.

Over time, this practice shapes cellular memory, allowing individuals to move from conscious competence to unconscious competence, and to maintain presence with less effort.

Embodiment becomes a way of navigating life—guided by attention, practice, and moments of spontaneous insight ('quantum flirts') that deepen alignment and presence.

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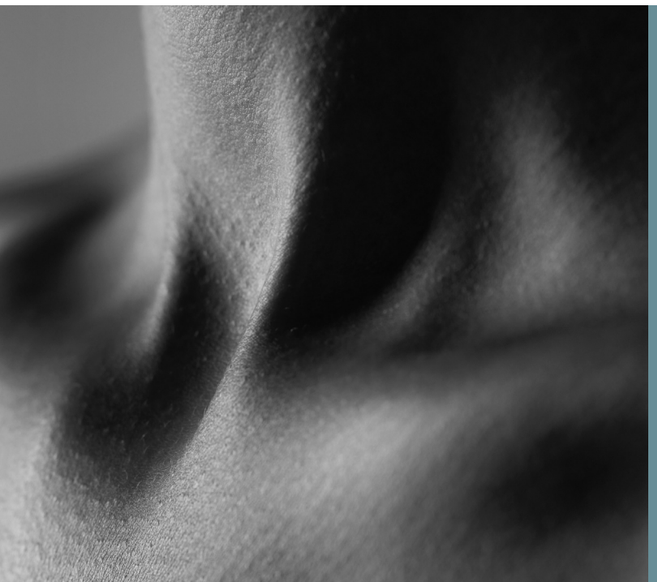
Answering Objective 2

To identify methds used to measure or assess embodiment

The questions that addressed this topic were:

- **How can breathing exercises help people feel more in control of themselves?**
- **How do breathing exercises support emotional balance?**
- **What disrupts someones connection to breath or body?**



General theme Objective 1

Sensory Experience

Participant quote:

"I'm just like, truly operating from a more peaceful place inside of myself."

How can breathing exercises help people feel more in control of themselves?

Based on the answers in the interviews:

Breathing exercises help individuals cultivate a sense of agency—the feeling that they can influence their internal state. Over time, breathwork becomes a skill, like a muscle, that strengthens relaxation and self-trust.

This growing familiarity allows people to feel more at ease in their bodies, even in difficult situations—“if you are comfortable with your breath, you are comfortable anywhere.” As breath slows, so do thoughts, creating space for clarity, intuition, and responsiveness.

Participants report becoming more grounded and emotionally aware. Breathwork supports emotional labeling, helping reduce reactivity by allowing people to recognize tension or identify where they are—comfort, challenge, or panic. Ultimately, it fosters the belief that “you are the most qualified person to deal with yourself,” supporting stability, self-guidance, and calm—even in chaos.

Section Theme: Agency

”It helps me so much to tune into what I’m feeling, what I need, what I want...”

From the researcher’s autoethnographic study

Regular breathwork deepened my awareness of subtle bodily cues—signals I once overlooked or ignored. I realized that avoiding them didn’t erase them; it amplified their impact. For me, awareness isn’t about control—it’s about choice. These sensations are invitations. In each moment, I can either listen or gently let them go.

How do breathing exercises support emotional balance?

Based on the answers in the interviews:

Breathing exercises support emotional balance by offering a structured, embodied way to regulate stress—physically, emotionally, and mentally.

Techniques like inhaling for 3–4 seconds and exhaling for 6–8 activate the parasympathetic nervous system, calming the body and lowering heart rate. With consistent practice, breathwork builds awareness of stress patterns and fosters perspective shifts and emotional clarity.

Though it requires commitment—“breath work is work”—the result is greater resilience and inner stability. Over time, this practice embeds a kind of cellular memory, making emotional regulation more accessible.

Breath becomes a form of self-care and a way to reclaim the “ability to be,” integrating individual and cultural expressions of embodiment.

Section Theme: Emotional Regulation

”when you become more aware of your breathing, you’re also telling your body that, - I’m fine, even if I’m sitting in a stressful environment -”

From the researcher’s autoethnographic study

Subtle cues from my body help me understand where I am emotionally. Some days, I can barely retain my breath; other days, it flows effortlessly, and time seems to disappear. These shifts show me how breath can serve as an emotional barometer—gently reflecting my inner state and helping me adjust how I move through the day.

What disrupts someone's connection to breath or body?

Based on the answers in the interviews:

Disconnection from breath or body can stem from psychological, emotional, or physical factors. Mental distractions—like a "monkey mind," impatience, or anticipation—pull focus from the present.

Ego-driven expectations, such as seeking quick fixes, create tension between intention and experience. Fear or resistance can surface as deeper sensations arise, blocking access to embodied awareness.

Physical disruptions—like illness, imbalance (e.g., excess Vata), or inexperience—may leave individuals feeling scattered or unready.

At its core, these disruptions reflect a split between mind and body, making it harder to access the grounding benefits of breath.

Section Theme: Distraction

"It would be me expecting to get a quick fix."

From the researcher's autoethnographic study

Over time, I've realized the main disruption is often myself—my own thoughts, emotions, and resistance.

Answering Objective 2

Embodiment can be measured by assessing how individuals subjectively report their felt sense of self-awareness and emotional regulation over time.

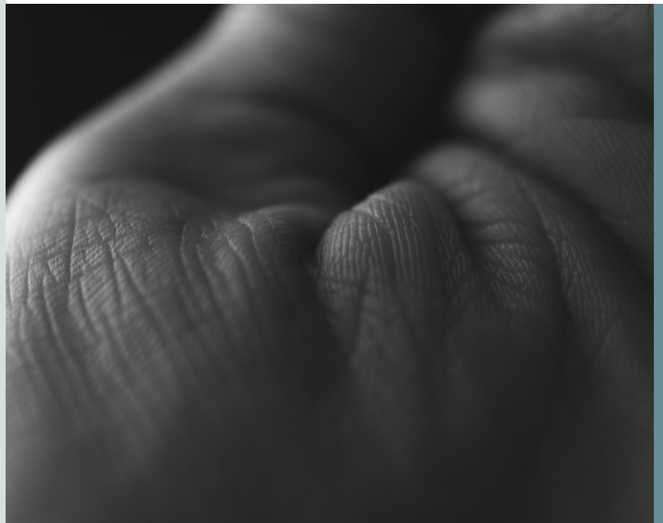
Participants describe indicators such as the ability to recognize physical stress, emotional stress, and mental stress, which are often tracked through breathing exercises.

Reports of slowed thoughts, reduced tension, or being able to name sensations in the body (e.g., "tension in your body? name it!") show increased somatic awareness.

Further, consistency in practice and the expression of an "ability to be" suggest developing embodied presence. These are often accompanied by introspective reflections such as "I feel it in my day-to-day" or "You are the most qualified person to deal with yourself," which point to agency and integration—both key markers of embodiment.

On the other hand, disruptions to embodiment can also be informative markers. Experiences like ego inflation, monkey mind, impatience, fear, or a drifting mind reflect a disconnect from embodied awareness. Physiological signs—like shallow breath or difficulty trusting the exhale—can be measured as bio-indicators of embodied disruption. Additionally, observing how individuals describe feeling ungrounded, not ready to go deep, or physically distracted offers insight into the loss of body-mind coherence.

Therefore, combining subjective self-report, psychophysiological cues, and behavioral consistency (like "breathwork is work; relax is a consequence") provides a robust, experience-driven approach to evaluating embodiment in breath-based practices.



General theme Objective 2:

Cognitive Self-Regulation

Answering Objective 3

To examine the role of embodiment within virtual environments

The questions that addressed this topic were:

- **What in the space helps deepen the breath experience?**
- **Do you use metaphors in your practice, if so, can you share an example?**
- **What makes breath session feel real or authentic to you?**

What in the space helps deepen the breath experience?

Based on the answers in the interviews:

The setting of a breathing practice can shape its depth, but not in a fixed way.

Some find that a calm, consistent space—a designated “safe place”—supports habit and presence. Familiar environments signal the body it’s safe to relax. Others thrive in less controlled settings, showing that effective breathwork can also happen in noisy or crowded spaces if attention is managed.

What matters most is context-awareness—how the environment influences perception and regulation. Ultimately, the power of breath lies in the ability to find inner stability, regardless of location.

”it’s nice for me to not be reliant on one specific location. So all I need is just myself”

From the researcher’s autoethnographic study

For me, returning to the same space—physically or symbolically—has been key. When I couldn’t be in the same room, familiar elements like a guided voice, object, or ritual helped ground me. That repetition formed a rhythm—a thread I could follow back to myself.

Participant quote:

”learn to be in the crowd and find the peace within you”

Section Theme: Environment

Do you use metaphors in your practice, if so, can you share an example??

Based on the answers in the interviews:

Metaphors are commonly used in breathwork to support internal guidance and meaning-making.

Practitioners describe the mind as a lake—choppy on the surface, calm below—or refer to the “monkey mind” or being a “rock in the river,” highlighting stability amid mental turbulence. Breath is often imagined as waves, windows opening inward, or a dance between the conscious and unconscious.

These images aid emotional processing and make sessions more intuitive and embodied, especially when transitioning into or out of practice.

”a rock that’s not swept away by the winds… that’s the metaphor for equanimity and groundedness”

From the researcher’s autoethnographic study

Some metaphors I used:
Out of the matrix
Spinning in the wind
Floating leaf
Rolling stone
Running out of breath
Rock in the river
Dripping off like water

Section Theme: Metaphor

What makes a breath session feel real or authentic to you?

Based on the answers in the interviews:

A breath session feels authentic when grounded in direct sensory awareness and embodied presence.

Participants often describe losing track of time, fully immersed in the moment. This authenticity arises not from trying to force a state, but from letting go—allowing sensations and thoughts to come and go.

Ritual or structured flow can help anchor attention and deepen presence. Ultimately, intention—simply sitting down and beginning with purpose—transforms the experience into something real and embodied.

”one of the most important things about pranayama is that you’re not trying to make something happen”

From the researcher’s autoethnographic study

This morning, I had a 60-minute virtual breathwork session with Allison Pellaers in Australia. Lying down, I followed the rhythm, music, and her gentle guidance: two-stop inhale, one-stop exhale through the mouth. Within minutes, the outside world faded. My body took over. I felt heat, tingling, lightness, pressure—no thoughts, just breath. Time disappeared.
Afterward, I was calm, open, and deeply aware. I remembered how powerful breathwork really is. It reminded me how essential it is to return to the body. We talk about rest all the time, but giving yourself permission to stop—and truly feel—is something else.
Embodiment means showing up for yourself. Every session is different. A new feeling, sensation, or insight. Conscious breathing offers a direct experience of impermanence—and a chance to simply be.

Section Theme: Reflection

»

Answering Objective 3 (continued)

To examine the role of embodiment within virtual environments

The questions that addressed this topic were:

» **What do you think of breath-based practices in VR, MR settings?**

» **How long does it typically take for breathing exercises to create a shift in awareness, and does duration matter?**

What do you think of breath-based practices VR, MR settings?

Based on the answers in the interviews:

Virtual breath-based practices offer both possibilities and challenges. Participants appreciate the accessibility and continuity of well-guided online sessions, especially when features like sound cues or haptic feedback help establish rhythm and presence. However, some find screens less satisfying, and digital distractions can reduce depth.

Many prefer practicing alone, valuing autonomy and internal focus. While VR holds promise, it must include post-session care, clear guidance, and respect for individual limits. Overall, virtual breathwork can be effective—when approached with skill, safety, and user awareness.

”I don’t want to have to rely on anything or anybody to access this place inside of myself”

From the researcher’s autoethnographic study

I often use a guided virtual voice in my practice. In a recent session, though my coach was remote, she was fully present—watching, guiding, holding space. Virtual sessions can be just as effective, especially with simple, safe techniques. For beginners, they're a useful entry point. Still, safety is essential. Clear health information and awareness of personal limits matter. Breathwork is powerful—it must be approached with care and respect for the body.

Participant quote:

”what I’ve realized is, both, online and in-person sessions definitely work, but they work for different type of people ”

Section Theme: Design

How long does it typically take for breathing exercises to create a shift in awareness —and does duration matter?

Based on the answers in the interviews:

The time it takes to shift awareness through breathwork varies.

Some feel it within 5–15 minutes; others may need longer. But duration isn't the determining factor—presence and mental letting go are more important.

Shifts often happen when effort softens and trust deepens. With practice, the threshold shortens, and individuals can explore new depths as familiarity grows.

Ultimately, it's less about time and more about attunement to the moment.

”for me, every day is different.”

From the researcher's autoethnographic study

It usually takes me 5 to 10 minutes.
It depends on the day.

Section Theme: Time

Answering Objective 3

Embodiment in virtual environments is fostered when users maintain an internal locus of control and contextual adaptability, allowing them to anchor awareness in the body despite external distractions.

Participant remarks that “all I need is just myself” and that practice is “location-nonspecific” indicate that physical setting is secondary to one's capacity for self-directed attention. Although spatial cues such as “context-awareness,” “your safe place,” and “environmental continuity” matter, their effectiveness depends on how intentionally the environment is perceived and engaged.

Metaphoric anchors—“mind like a lake,” “rock in a river”—further support embodied experience by linking abstract states to felt sensations, while sensory inputs like “clear sight” and “clear sound,” together with emotional cues such as “letting go” and “returning to simplicity,” deepen embodiment when the virtual context offers focused multisensory integration, ritual structure, and personal meaning-making.

Temporal dynamics and media choices add essential nuance. Embodiment is shaped not only by spatial features but also by the continuity and rhythm of engagement.

Some practitioners prefer solitary practice, even in virtual settings, whereas others find that virtual guidance—especially through sound or haptic feedback—enhances focus and embodiment, particularly for novices. Screens, however, are often described as less satisfying, underscoring the need for MR designs that prioritize body–mind integration.

Embodied states tend to arise when mental effort subsides and practitioners “let go” or “trust,” typically within 5–15 minutes, though timing varies with individual readiness. Thus, embodiment in MR emerges from a constellation of temporal tuning, personal agency, and environments that reliably foster self-directed attention and a sense of safety, rather than from technical affordances alone.

General theme Objective 3:

Context & Facilitation and Temporal Design

Answering Objective 4

To consider the ethical and accessibility dimensions of embodied experience in technology mediated contexts

The questions that addressed this topic were:

- **What ethical responsibilities do facilitators have when guiding breathing exercise sessions?**
- **How do you ensure psychological safety in your breathing exercise sessions?**

Participant quote:

”you inhale three to four seconds and you exhale six to eight seconds, nothing can go wrong there. It’s the best way to regulate yourself”

What ethical responsibilities do facilitators have when guiding breathing exercise sessions?

&

How do you ensure psychological safety in your breathing exercise sessions?

Based on the answers in the interviews:

Facilitators play a key role in ensuring psychological safety during breathwork, especially when guiding participants through vulnerable emotional states. This starts with clear agreements—health disclosures, and check-ins before, during, and after sessions. Facilitators must be attentive to distress, offer choices, and adapt to individual needs, including disabilities or emotional sensitivities. Fast or shallow breathing can signal imbalance or distress, making sensitive monitoring essential. Ultimately, creating space for expression—grounded in embodied awareness—supports emotional safety and healing.

Section Theme: Ethics & Care

”I don’t give sessions to people I don’t know their health, their health background...”

From the researcher's autoethnographic study

When practicing breathwork online, I’m always asked to agree to a health advisory—and I see why. Breathwork can have real emotional and physiological effects. That’s why informed consent and awareness of personal limits are so important, especially when practicing alone.

Answering Objective 4

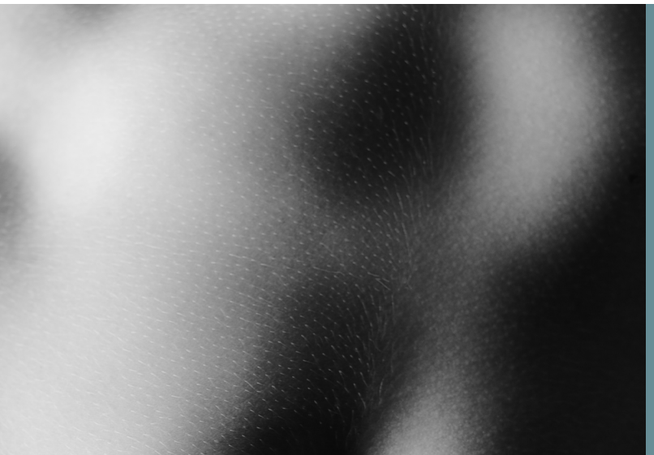
Facilitating breathing exercises in virtual settings requires rigorous ethical consideration and inclusive design. Ethical responsibilities include ensuring participants complete health agreements, receive pre- and post-session support, and are checked in with before, during, and after practice.

Facilitators must understand participants' health histories and encourage them to take responsibility for their experience, while being available for guidance if needed.

Online settings add complexity—participants may face physiological changes (like rapid breathing or shallow inhales/exhales) without on-site support, requiring MR experiences to include cues for self-regulation, such as "listen and accept your sensations." Because MR breathing exercises directly manipulates bodily states to influence emotion and cognition, constant reflection prompts (e.g., "what are you feeling?") become crucial to psychological safety.

Accessibility is equally vital. MR environments must provide various options—verbal cues, flexible pacing, adaptable visuals/sounds—to accommodate differing sensory and emotional needs. Facilitators should recognize that not everyone experiences presence in the same way online, and should give participants autonomy: "everyone knows what is good for them."

Accessibility also means being mindful of disabilities and designing multiple entry points to the practice. Ultimately, ethical and accessible MR breathing exercises should foster embodied autonomy, emotional safety, and meaningful inclusion.



General theme Objective 4:

Ethical Attunement

Analysis Synthesis

Attuned to sensation, agency, emotion, context, and care, we discover embodiment not just as a concept, but as a relational, temporal, and ethically grounded experience of being here and now.

General Theme	Section Themes	Insight
Sensory Experience	Perception. Habituality. Intentionality.	Embodiment arises through grounded sensory perception.
Agency & Regulation	Agency. Emotional Regulation. Distraction.	Breath enhances self-guidance and stress management.
Context & Temporality	Environment. Metaphor. Reflection. Design. Time.	Safety, ritual, and flow shape presence in virtual settings.
Ethical Attunement	Ethics. Care.	Consent, guidance, and accessibility are vital in breath sessions.

Analysis Conclusion

To conclude the analysis, embodiment, particularly through breath-based practices, is a dynamic interplay of perception, agency, context, and care.

Drawing on participant interviews, autoethnographic insights, and interpretive analysis, four key dimensions of embodied experience emerge—sensory experience (Objective 1), cognitive self-regulation (Objective 2), context & facilitation and temporal design (Objective 3), and ethical attunement (Objective 4)—**each contributing to a richer understanding of what it means to feel "in the body" in both physical and technologically mediated environments.**

First, embodiment is fundamentally a sensory experience. Participants describe heightened perceptual clarity, deep presence, and moment-by-moment awareness of breath, heartbeat, tension, and temperature. This capacity to feel and respond emerges not as a static state, but as a fluid, unfolding relationship with the body—sometimes peaceful, sometimes chaotic, but always real.

Through repeated practice and intentional attention, embodiment becomes a skill honed over time, supported by tactile anchors, visual focus, mantras, and bodily rhythms that create coherence between mind and body (Objective 1).

Second, embodiment is also a means of self-regulation and agency. Participants report feeling more in control of their inner states—able to recognize, name, and modulate emotional and physical responses through breath. Here, the breath becomes a tool of self-guidance, helping individuals manage stress, clarify thought, and maintain equilibrium even in destabilizing environments.
This process of tuning in—especially through practices like retention, slowed exhalation, and body scanning—marks a transition from automatic reactivity to intentional responsiveness (Objective 2).

Disruption, too, is diagnostic: when the connection to breath falters, it reveals how mind–body misalignment, fear, or distraction impairs embodied presence.

Third, embodiment in virtual and MR settings depends less on technical features and more on the capacity to sustain attention, rhythm, and internal coherence. While environmental continuity and metaphoric cues (e.g., "lake mind," "rock in the river") help create immersive experiences, what matters most is how users perceive, adapt to, and inhabit the space.

Temporal design—not just the duration but the flow, pacing, and symbolic framing, such as the tempo of breath cycles—plays a critical role in supporting the shift from effortful focus to felt presence. In this way, virtual practices don't replace physical embodiment but rather extend and reflect it when designed with sensitivity to inner rhythms and personal meaning-making (Objective 3).

Finally, the ethics of facilitating breathing practices—particularly in virtual environments—are inseparable from its embodied nature. Facilitators must create conditions for psychological safety, informed consent, and user autonomy, especially when guiding vulnerable emotional states.

Practices must be inclusive and accessible, allowing for a wide range of physical abilities, cultural interpretations, and emotional responses. Ethical embodiment in technology-mediated spaces means supporting agency without assumption, presence without pressure, and inclusion without erasure (Objective 4).

Together, these findings suggest that embodiment is not a single event or outcome, but a continual process—a practice of returning to the body, again and again, across different states, environments, and intentions.

Whether alone or guided, in person or online, in silence or sound, the breath offers a gateway into a deeper knowing of oneself.

Embodied Cognition Blueprint.

Breath-based interventions help anchor users in virtual spaces by enhancing self-location, body ownership, and emotional regulation.

This creates more self-aware, human-aligned immersive experiences.

Designing Breath-Based Experiences for Immersive Environments

Drawing from the empirical findings—including user experiences, breath practitioner reflections, and autoethnographic inquiry—this section introduces a design blueprint for breath-based immersive experiences.

Grounded in the theoretical frameworks of embodied cognition and enriched by practice-based insight, the Blueprint Matrix offers a tool for designing ethically attuned, emotionally resonant, and interoceptively grounded MR systems.

Blueprint for Breath-Based Practices in Virtual Immersive Environments

To support embodied awareness and emotional regulation in immersive technologies, a design blueprint was developed. Rooted in empirical data and cognitive theory, it aligns core design considerations with embodied principles, bridging theory and application.

The Blueprint Matrix cross-aligns five thematic pillars with immersive design dimensions (adapted from Hansdotter 2023), creating a holistic framework spanning content, usability, and technology.

View Embodied Cognition Blueprint Matrix on the next page.

From the matrix, several emerging design principles can be distilled:

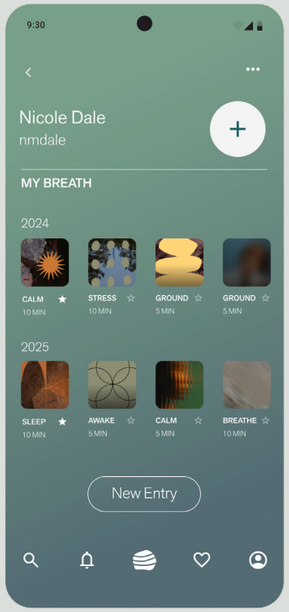
- **Design for interoceptive depth, not just presence.**
- **Prioritize slow, low-saturation pacing over sensory overload.**
- **Autonomy is embodiment: let users lead from the inside out.**
- **Don't start with visual design—start with rhythm and felt state.**

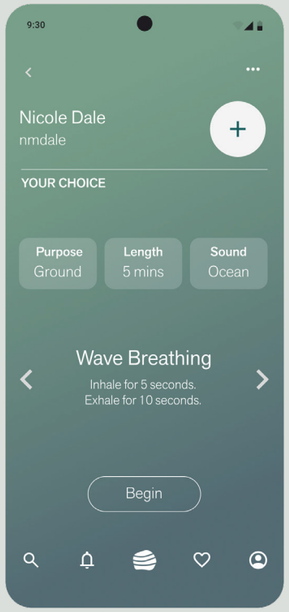
Embodied Cognition Blueprint Matrix

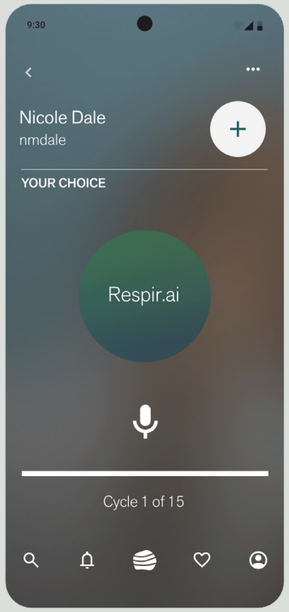
Blueprint Pillar	Content (what)	Usability (why)	Technology (how)
Sensory Experience	Multi sensory inputs (sound, visuals haptics)	Supports grounding and presence	Biofeedback, haptic cues, ambient design
Cognitive Self-Regulation	Breath as attention, and emotional regulation tool	Enhances cognitive clarity	Personalized breath rhythm, real-time tracking
Context & Facilitation	Ritual, guidance, tone for safe practice	Creates meaningful practice environments	Customizable UI, personal reflection prompts
Temporal Design	Breath pacing, rhythm, narrative flow	Shapes user experience over time	Flexible session timing, intuitive flow
Ethical Attunement	Accessibility, consent, emotional safety	Designs for inclusive and safety	Consent layers, trauma informed defaults

Blueprint in use: Respir.ai

To demonstrate how the blueprint can be applied in practice, a prototype app—Respir.ai—was conceptualized. It is designed as a digital breath hub, helping users reconnect with their inner rhythm, emotional state, and embodied presence.







	PHASE	FEATURE	BLUEPRINT
1	**Onboarding**	Consent & safety prompts Session customization (duration, goal, audio mode)	Ethical Attunement Context & Facilitation
2	**Live Breath Session**	Animated pacing visuals, optional voice or sound guidance, haptic cues	Sensory Experience Cognitive Self-Regulation Temporal Design
3	**My Breath Anchor**	Saved breath recordings tagged with emotional states, journaling options	Cognitive Self-Regulation Ethical Attunement
4	**Profile Page**	Access to favorites, emotional state archive, revisit past breath anchors	Temporal Design Context & Facilitation
5	**Community Page**	Breath shares by facilitators or peers, filter by type or intention	Ethical Attunement Context & Facilitation
6	**Quote & Inspiration**	Daily quotes with optional soft audio	Sensory Experience Temporal Design
7	**Journaling**	Prompted or free-form journaling with voice-to-text support	Cognitive Self-Regulation Ethical Attunement

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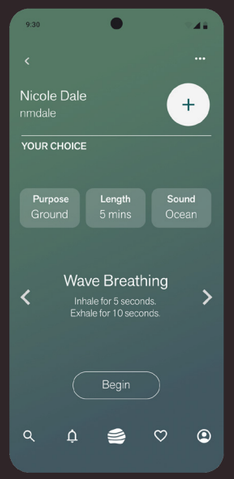

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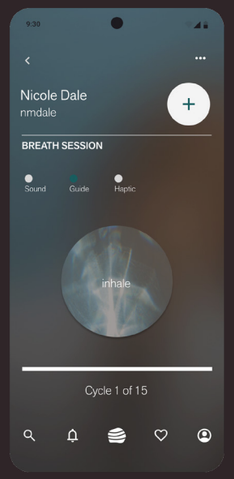

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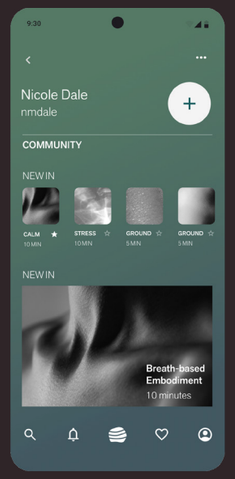

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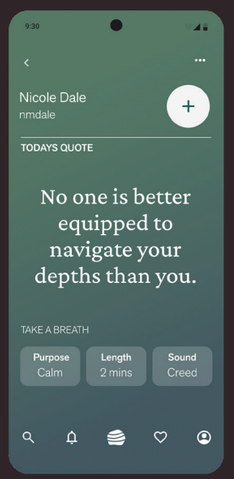

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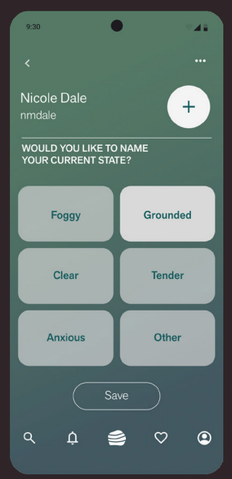

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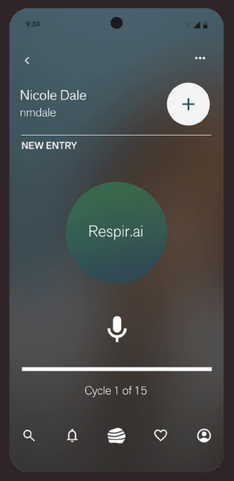

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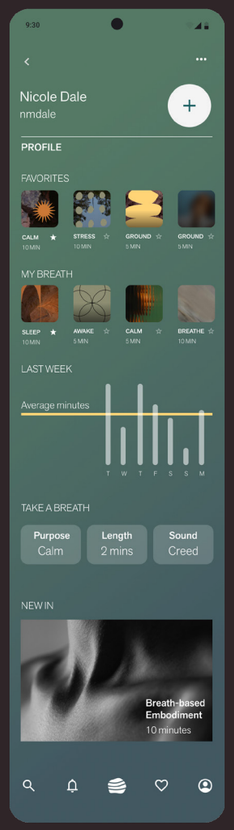


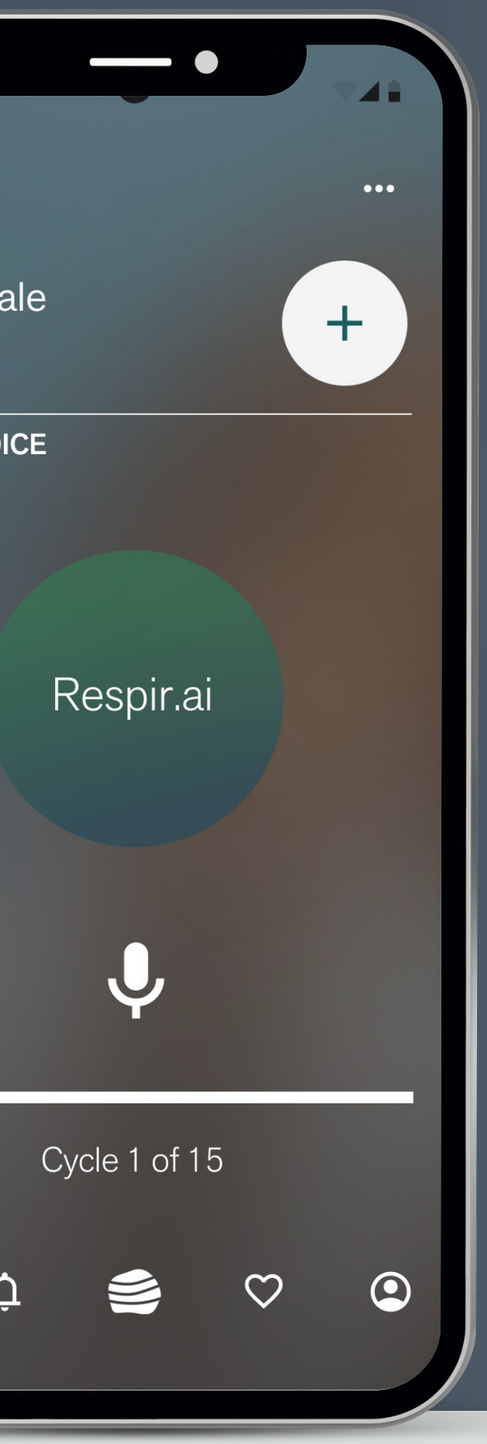
»

When breath slows down, thoughts slow down.

A unique breath-based experience made for you.

When you give your breath full attention, you step out of thinking and into the present moment.

Eckhart Tolle



Unique Design Values

» **Breath as Memory**
Create an emotional library of past breath states.

» **Self-Guided, Not Optimized**
No performance pressure or gamification.

» **Embodied by Design**
Grounded in RECS, 4E cognition, and interoceptive learning.

» **Emotion + Sensory Tagging**
Track your body's signals over time.

» **Safety First**
Includes disclaimers, safety checks, and non-triggering defaults.

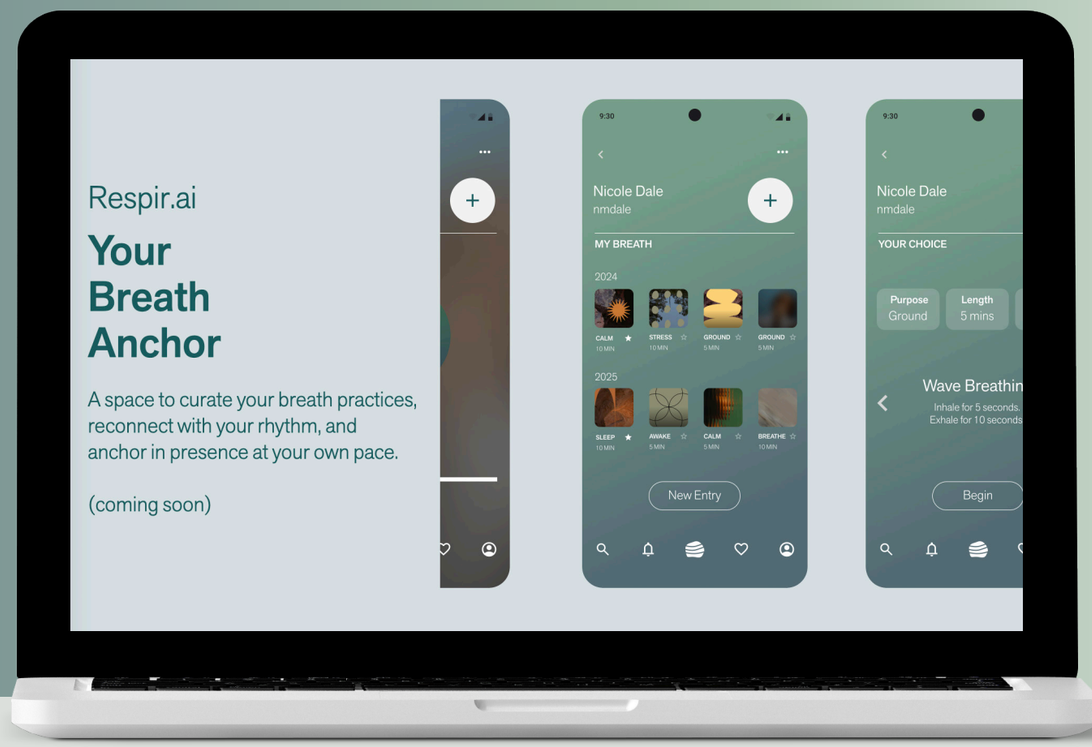
Holding space for your breath, your rhythm, your becoming.

Why This Matters

In a world of overstimulation, Respir.ai offers a space to slow down with intention. It shifts from distraction to presence, helping users reconnect with breath as a bridge between digital space and inner awareness.

This section demonstrates how theory-informed design can translate lived experience into responsive, inclusive, and emotionally attuned technologies.

By grounding immersive breathing practices in the blueprint matrix and prototyping it through Respir.ai, it invites new possibilities for designing technologies that not only inform or entertain—but help users inhabit themselves more fully.



From Design Principles to User Feedback

Having conceptualized Respir.ai prototype using the Embodiment Blueprint Matrix, the next step was to test its assumptions and features in practice.

This section presents expert feedback from early prototype testing, offering insight into how the design principles performed and what refinements emerged. It marks the shift from theoretical application to real-world iteration.

To evaluate the Respir.ai prototype and refine its design, feedback was gathered from three expert testers: a developer, a psychologist, and a professional sailor.

Their responses emphasized visual clarity, emotional anchoring, simplicity, and contextual relevance.

This section summarizes their insights and outlines how the feedback is shaping the next design phase.

Tester 1: Developer

Visual Simplicity & Personalization

"Have only one visual focus point.
Let users choose a circle, square,
or object that changes color
with inhale, hold, exhale."

Response:

» Default to one dynamic visual cue (e.g., a breathing circle).
» Offer shape and color customization for personalization.
» Animation adapts to the chosen breathing pattern.

Tester 2: Psychologist

Emotional Anchoring & Trends

"Let users record their calm breath.
When anxious, they can return to it.
Track trends—less anxious months vs. more anxious ones."

Response:

» Add a “My Calm Breath” feature to record and revisit personalized calm states.
» Implement a mood-linked trend dash-board for emotional tracking over time.
» Develop a future therapist-facing mode for guided use in clinical settings.

Tester 3: Athlete

Simplicity & Training Integration

"Keep it simple.
Add an easy start page with time,
sound, and purpose.
Link it to training schedules."

Response:

» Simplified start screen: select duration, sound, and intent.
» Sync with calendars for pre/post training breath sessions.
» Include templates (e.g., Pre-Training Focus, Post-Training Recovery) to guide timing and purpose.

Key Design Principles Emerging from Testing

» **Visual Simplicity**
Single animated anchor, customizable by user
» **Personalization**
Shape/color options, rhythm selection
» **Emotional Memory**
“My Calm Breath” recordings
» **Behavioral Insight**
Mood-tagged breath trends over time
» **Ease of Access**
Quick-start options: time, sound, purpose
» **Routine Integration**
Calendar sync for daily use or training blocks

Wrap up

This testing phase confirmed that clarity, rhythm, and emotional relevance are central to designing for embodied awareness.

Breath-centered technologies succeed not through complexity, but by helping users return to simplicity, presence, and trust in their own internal signals.

Respir.ai Implementation Roadmap

To build on the initial prototype and move toward real-world application, the following roadmap outlines the phased development of Respir.ai—from MVP refinement to inclusive deployment.

Each phase is designed to deepen embodied interaction, ensure ethical safeguards, and expand accessibility across diverse user groups and contexts.

This roadmap extends the core insight of the thesis: that designing from the breath outwards fosters embodied, inclusive, and emotionally grounded digital experiences.

Respir.ai is not just a tool—it is a practice of returning to the body through intentional, ethical design.

With care, co-creation, and continued iteration, it can become a model for technology that helps people feel more—not less—alive. View Appendix F for Go-To-Market Considerations.

1

MVP Finalization

Refine core features: breath pacing visuals, emotional tagging, journaling, and safety prompts.

Simplify UI for intuitive navigation.

Customize visual anchors (shape, rhythm, color).

Focus: emotional anchoring and personalization.

2

Small-Scale User Testing

Conduct in-depth testing with 10–20+ users.

Gather feedback from diverse demographics (including neurodivergent and disabled users).

Evaluate accessibility, emotional safety, and perceived value.

Iteratively refine based on insights.

3

Biometric Integration

Integrate additional biometric inputs (e.g. HRV, EEG, skin conductance).

Develop real-time biofeedback loops.

Explore adaptive breath pattern guidance based on physiological state.

Collaborate with developers and healthcare advisors.

4

Contextual Deployment

Pilot use in clinical, educational, and wellness settings.

Co-create with therapists, educators, and coaches.

Develop therapist mode with calm-state playback and trend dashboards.

Include templates e.g. anxiety reduction, focus, trauma-sensitive entry points).

5

Inclusive Co-Design & Open Beta

Launch participatory design cycles.

Host co-creation sessions to adapt for different cultural, sensory, and relational contexts.

Prepare for open beta launch with safety measures, onboarding sequences, and reflective prompts.

Establish ethical design standards aligned with care, autonomy, and lived experience.

Critical Considerations and Design Limits

While this study advocates for breath-based immersive design, it is important to critically reflect on its limitations.

First, not all users may experience interoceptive signals in the same way—trauma survivors, neurodivergent individuals, or those with dissociative tendencies might find such introspective interfaces overwhelming or inaccessible.

Additionally, the framing of breath as a universal tool risks erasing cultural and historical differences in how breath is practiced or interpreted.

Technologically, relying on biometric data (e.g., breath sensors) introduces issues of privacy, data ownership, and bio-surveillance. Emotionally responsive MR systems—especially those used in therapeutic or learning contexts—should be designed with explicit consent layers and opt-out paths to avoid manipulation or unintentional harm.

Finally, breath-based embodiment is not a shortcut to wellbeing. It is a practice that requires time, readiness, and personal context.

As MR tools scale, ethical design must avoid commodifying presence or reducing complex internal states to quantifiable feedback.

Conclusion.

This study advances a comprehensive and practice-informed understanding of embodiment by positioning breath as a central modality through which cognitive, emotional, and interoceptive awareness can be cultivated, both in physical and technologically mediated environments.

Drawing on theoretical frameworks such as 4E Cognition, Radical Embodied Cognitive Science, and phenomenology, the research establishes that embodiment is not merely a theoretical abstraction but a lived, relational, and temporally unfolding process.

Breath, as both a physiological rhythm and symbolic act, emerges as a uniquely accessible entry point into this process.

The empirical findings—derived from interviews, autoethnographic inquiry, and interpretive analysis—demonstrate that embodied awareness unfolds across four key dimensions: sensory experience, cognitive self-regulation, contextual and temporal design, and ethical attunement. Each dimension reflects the dynamic interplay between intention, attention, and environment, shaping how individuals come to sense, regulate, and locate themselves within both physical and virtual spaces.

Importantly, the study goes beyond description to offer an applied framework—the Embodied Cognition Blueprint—which operationalizes these insights into concrete design principles for immersive systems.

Through the prototyping of Respir.ai, the research exemplifies how breath-centered interactions can support presence, emotional resilience, and inclusive engagement when guided by rhythms of the body rather than external performance metrics.

This design philosophy reorients immersive technology development toward attunement, slowness, and lived relationality.

In sum, this work argues that designing for embodiment is not only a methodological or aesthetic choice, but an ethical imperative.

As digital environments increasingly mediate how individuals relate to themselves and others, grounding these experiences in embodied practices such as breath practices offers a means of restoring coherence, autonomy, and care.

Rather than amplifying disconnection, technology—when designed with embodied intelligence—can become a site of remembering: a way back into the felt immediacy of presence.

”Let us design systems that help us feel more - not less - alive”

Summary of Contributions

This thesis contributes to advancing a relational, embodied, and ethically grounded approach to immersive technology design:

» **Reframes breath as both interface and intelligence, repositioning it as central to digital interaction and self-awareness;**

» **Develops the Embodied Cognition Blueprint, aligning embodied cognitive theory with design application;**

» **Illuminates how breath-based practices inform the sensory, regulatory, and ethical dimensions of embodied experience in virtual environments;**

» **Proposes inclusive, human-centered design principles for MR systems that foster presence, autonomy, and care;**

» **Demonstrates theory-to-practice translation through Respir.ai, a prototype that centers breath in immersive experience design.**

Limitations and Scope

While this study offers a rich and layered understanding of breath-based embodiment in MR, its scope is intentionally exploratory and qualitative.

The sample size, though appropriate for interpretative phenomenological analysis, limits generalizability.

The autoethnographic dimension, while offering depth, also carries subjective bias.

Moreover, the Respir.ai prototype remains in early stages of testing, with user feedback drawn from a small, expert group rather than a diverse, real-world population.

Future research should include larger, more demographically varied samples and long-term usage studies to assess impact, accessibility, and emotional safety over time.

Future Directions

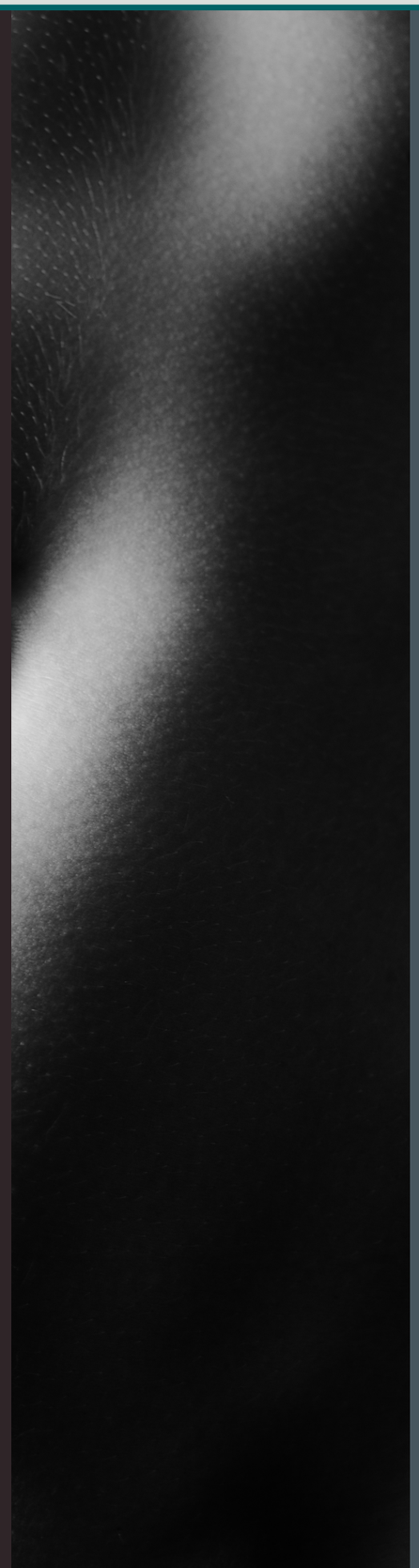
Building on these findings, future work could explore how breath-aware MR systems perform across different cultural, clinical, or educational contexts.

Longitudinal studies could assess the sustained effects of breath-based interaction on emotional regulation, cognitive performance, and digital wellbeing.

Technologically, there is potential to integrate more advanced biometric sensing (e.g., HRV, EEG) for deeper biofeedback personalization.

Design-wise, future iterations of Respir.ai could test how shared breath-based environments influence group dynamics, empathy, or therapeutic outcomes.

Finally, there's a critical need for co-design processes that include neurodivergent, disabled, and marginalized voices to ensure that embodied technologies remain inclusive, safe, and relevant to all.



Reflection Journal.

At the start of this project, I struggled to find the right topic. I knew I didn't want to stay only in the digital or academic space—I wanted something that felt real and human. That's what led me to focus on the breath. It's something simple, always with us, and yet deeply powerful. I wanted to explore how breathing connects us to ourselves, especially in a world where technology often pulls us away from our bodies.

The journey wasn't always easy. Turning something as personal as breath and embodiment into a research project took time and reflection. But it also helped me grow. Through daily breath practices—especially kapalabhati and anuloma viloma—I started to feel more in tune with my body and emotions. I also did breathwork sessions and began a freediving course, which pushed me to develop a deeper relationship with breath in a whole new way.

What stood out the most were the long breath retentions—moments of total silence and deep presence where time seemed to disappear. Another thing that really surprised me was how much my body temperature rises during breath holds. I could actually feel the heat spreading through my body. That physical intensity became a big part of the experience too.

Interviewing breath practitioners and yoga teachers showed me how many others also use breath to find calm, clarity, and connection. It helped me feel more confident in the direction I had chosen—bringing together lived experience with a more mindful approach to tech.

One of the biggest challenges was making the project both meaningful and practical. I wanted to design something that could help others too, which led to the prototype of

Respir.ai—a breath-based digital tool for presence and self-regulation. It was exciting to see how personal insights could actually turn into something useful for others.

Looking back, I've learned a lot—not just about research, but about myself. I've become more aware of my patterns, steadier in how I deal with stress, and more confident in trusting my own rhythm. I've also gained skills in listening, designing, and turning complex ideas into something more human and grounded.

Most importantly, I don't want this to stay just as a thesis. I'm committed to making Respir.ai happen—to create a space where people can reconnect with their breath, their bodies, and their own sense of calm in a fast-moving world.

In the end, this project taught me that breath is more than a tool—it's a way of coming back to yourself. And that's something I want to keep carrying forward.

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Appendices.

Appendix A
Participant Information Sheet

Title of Project:
Breath, Embodiment, and Technology

Designing for Human
Awareness in Mixed Reality

Researcher:
Nicole Dale
nmd.dale@gmail.com

Introduction
You are being invited to take part in a research project exploring how breathwork practices can be meaningfully integrated into virtual reality,, with a focus on embodied experience and awareness. Before you decide whether to participate, it is important you understand why the research is being done and what your involvement will entail. Please read this information carefully. You are free to ask questions and take time to decide.

Purpose of the Study
This research investigates **how breath-based practices cultivate embodied awareness**, and how these insights can inform the design of virtual and immersive environments. It aims to bridge ancient embodied wisdom with contemporary technologies, drawing on lived experience to guide ethical and inclusive innovation.

Why Have I Been Invited?
You have been invited because you use breath-based embodiment as practice. The aim is to include diverse participants that use breath-based practice in different ways.
What Kind of Questions Will Be Asked?
Questions will invite you to explore your bodily sensations, emotional states, and intuitive
▪ How do you guide people to sense their breath and body in space during your sessions?
▪ What is lost or changed when there's no real co-presence in a session?

Is the Study Confidential?
Yes. All data collected will be anonymised. No personal identifiers will be shared, and your responses will be stored securely and used only for research and design development purposes.

Are There Any Risks or Benefits?
There are no known risks associated with this study. Some people may find the reflective process calming, insightful, or even therapeutic. However, if at any time you feel discomfort, you are free to stop.

Do I Have to Take Part?
No. Participation is entirely voluntary. If you decide to take part, you are free to withdraw at any time without giving a reason and without consequence.

What Will Happen to the Results?
The findings may be used in academic research, creative design development, or educational contexts. Any publication will preserve your anonymity.

Contact for More Information
If you have questions or would like to know more about the study, please contact:
Nicole Dale
Email: nmd.dale@gmail.com

Appendix B
Interview Questions

» What does it feel like to be fully in your body during breathing exercises?
» What sensations help anchor people during breathing exercises?
» How do breathing exercises change body awareness over time?
» How can breathing exercises help people feel more in control of themselves?
» How do breathing exercises support emotional balance?
» What disrupts someones connection to breath or body?
» What in the space helps deepen the breath experience?
» Do you use metaphors in your practice, if so, can you share an example?
» What makes breath session feel real or authentic to you?
» What do you think of breath-based practices in VR, MR settings?
» How long does it typically take for breathing exercises to create a shift in awareness, and does duration matter?
» What ethical responsibilities do facilitators have when guiding breathing exercise sessions?
» How do you ensure psychological safety in your breathing exercise sessions?

Appendix C
Analysis Tables and Themes

Section Theme: Perception

Experience/Theme	RECS	4E Cognition	SoE	Phenomenology	Conceptual Metaphor Theory
Silence	✓	✓	–	✓	–
Peaceful	✓	✓	✓	✓	–
Chaotic	✓	✓	✓	✓	–
Swirly	✓	✓	–	✓	–
Happy	✓	✓	✓	✓	–
Belonging	–	✓	✓	✓	✓
Integrity	–	✓	✓	✓	✓
Expansion	✓	✓	✓	✓	✓
Anxious	✓	✓	✓	✓	–
Feel it, sense it, have it in my cell	✓	✓	✓	✓	✓
Body presence	✓	✓	✓	✓	–
Skin temperature	✓	✓	–	✓	–
Heart rate	✓	✓	✓	✓	–
5 senses	✓	✓	–	✓	–
Clear sound	✓	✓	–	✓	–
Clear sight	✓	✓	–	✓	–
In the now, expansive and free	✓	✓	✓	✓	✓

Section Theme: Intentionality

Experience/Anchor	RECS	4E Cognition	SoE	Phenomenology	Conceptual Metaphor Theory
Visualization	✓	✓	–	✓	–
Body scan	✓	✓	✓	✓	–
Count with your breath	✓	✓	✓	✓	–
Count in your head or using fingertips	✓	✓	✓	✓	–
Focusing on the gaze	✓	✓	✓	✓	–
CENTER OF MY EYES	✓	✓	✓	✓	–
Defocus	✓	✓	–	✓	–
M Focal point	✓	✓	✓	✓	–
Connect through breath	✓	✓	✓	✓	–
Belly breathing	✓	✓	✓	✓	–
Diaphragm and core	✓	✓	✓	✓	–
Guided support sometimes	✓	✓	–	✓	–
Comfortable and steady position	✓	✓	✓	✓	–
Feel your feet on the ground	✓	✓	✓	✓	–
Mantras	✓	✓	–	✓	✓
Repetition of sounds	✓	✓	–	✓	✓

Section Theme: Habituality

Theme or Phrase	RECS	4E Cognition	SoE	Phenomenology	Conceptual Metaphor Theory
Habit formation	✓	✓	✓	✓	–
Conscious competence to unconscious competence	✓	✓	✓	✓	–
Cultivating continuity of awareness	✓	✓	✓	✓	–
You get used to listening to your body	✓	✓	✓	✓	–
Listen, subtle sensations are meaningful	✓	✓	✓	✓	–
Understand zones in breath (comfort/challenge/fight)	✓	✓	✓	✓	–
It becomes easier to maintain presence over time	✓	✓	✓	✓	–
Know how to breathe in different situations	✓	✓	✓	✓	–
Making it easier for your body to recover	✓	✓	✓	✓	–
Discovering greater mental capacity	✓	✓	✓	✓	–
Intentional consciousness - body awareness	✓	✓	✓	✓	–
Intentionally take a breath	✓	✓	✓	✓	–
Intention brings attention - NOT LINEAR	✓	✓	✓	✓	✓
Quantum flirts?	✓	✓	–	✓	✓
Kinesthetically	✓	✓	✓	✓	–
Importance of respecting the body	✓	✓	✓	✓	–

Section Theme: Agency

Theme or Phrase	RECS	4E Cognition	SoE	Phenomenology	Conceptual Metaphor Theory
Relaxation is a skill, like a muscle	✓	✓	✓	✓	✓
Be in the crowd and find peace within	✓	✓	✓	✓	–
If you are comfortable with your breath, you are comfortable anywhere	✓	✓	✓	✓	–
You learn to get out of your own way	✓	✓	✓	✓	–
Allows intuition to emerge	✓	✓	–	✓	–
Prana is essential for health	✓	✓	✓	✓	–
Consistency	✓	✓	✓	✓	–
Tension in your body? Name it!	✓	✓	✓	✓	–
Naming emotions reduces reactivity	✓	✓	–	✓	–
Comfort zone / Learning zone / Panic zone	✓	✓	✓	✓	✓
I feel it in my day-to-day	✓	✓	✓	✓	–
Breath slows down; thoughts slow down	✓	✓	✓	✓	–
You are the most qualified person to deal with yourself	✓	✓	✓	✓	–
Letting intuition guide your way	✓	✓	✓	✓	–

Section Theme: Emotional Regulation

Theme or Phrase	RECS	4E Cognition	SoE	Phenomenology	Conceptual Metaphor Theory
Breathwork supports overall fitness	✓	✓	✓	✓	–
Inhale for 3-4 seconds and exhale for 6-8 seconds	✓	✓	–	✓	–
It gives you a chance to look at things in a different way	✓	✓	✓	✓	✓
Consistency	✓	✓	✓	✓	–
Ability to be	✓	✓	✓	✓	–
Embodiment - individual or cultural expression	✓	✓	✓	✓	–
A cellular learning and cellular memory	✓	✓	✓	✓	✓
Take care of yourself	✓	✓	✓	✓	–
It helps understand physical, emotional, and mental stress	✓	✓	✓	✓	–
Becoming aware of diaphragm breathing lowers heart rate	✓	✓	✓	✓	–
Breath work is work. Relax is a consequence.	✓	✓	✓	✓	✓

Section Theme: Distraction

Disruptive Factor	RECS	4E Cognition	SoE	Phenomenology	Conceptual Metaphor Theory
Ego	✓	✓	✓	✓	–
Drifting mind	✓	✓	✓	✓	–
Anticipation	✓	✓	–	✓	✓
Health	✓	✓	✓	✓	–
Fear	✓	✓	✓	✓	✓
Physical distraction	✓	✓	✓	✓	–
Excess Vata	✓	✓	–	✓	✓
Me, expecting a quick fix	✓	✓	✓	✓	✓
Monkey Mind	✓	✓	✓	✓	–
Anxiety	✓	✓	✓	✓	✓
Misalignment	✓	✓	✓	✓	–
Resistance	✓	✓	✓	✓	–
Physiological insights	✓	✓	–	✓	–
Impatience	✓	✓	✓	✓	✓
Disconnection	✓	✓	✓	✓	–
Not ready to go deep	✓	✓	✓	✓	–
Ungroundedness / being scattered	✓	✓	✓	✓	✓

Section Theme: Environment

Environmental or Spatial Element	RECS	4E Cognition	SoE	Phenomenology	Conceptual Metaphor Theory
All I need is just myself	✓	✓	✓	✓	–
I can practice anywhere, anytime	✓	✓	✓	✓	–
No location-specific	✓	✓	✓	✓	–
Any circumstance	✓	✓	–	✓	–
Be in the crowd and find peace within	✓	✓	✓	✓	–
Embodiment in noisy environments	✓	✓	✓	✓	–
Extremely stressful environments help	✓	✓	✓	✓	–
Just focus on what I can control	✓	✓	✓	✓	–
Flexibility is key	✓	✓	–	✓	–
Environment continuity is important	✓	✓	–	✓	–
Practicing in the same space helps build good habit	✓	✓	✓	✓	–
Your safe place	✓	✓	✓	✓	✓
Make it cozy for you	✓	✓	✓	✓	✓
Clean space	✓	✓	✓	✓	✓
Safe places are co-created	✓	✓	✓	✓	✓
Context-awareness	✓	✓	✓	✓	✓

Section Theme: Metaphor

Metaphorical Expression	RECS	4E Cognition	SoE	Phenomenology	Conceptual Metaphor Theory
Mind is like a lake	–	✓	–	✓	✓
Monkey mind	–	✓	–	✓	✓
Thoughts can snowball into a big story	–	✓	–	✓	✓
Breathing gives you an internal wave-like sensation	✓	✓	✓	✓	✓
Breath allows doors to open inside of you	✓	✓	✓	✓	✓
Empty your stress container	✓	✓	✓	✓	✓
A dance between conscious and unconscious	✓	✓	–	✓	✓
Thoughts can be choppy and busy; deeper levels are peaceful	–	✓	–	✓	✓
A rock not swept away by the wind	✓	✓	✓	✓	✓
Thoughts are like waves at the top of the surface	–	✓	–	✓	✓
I feel like a rock inside a river	✓	✓	✓	✓	✓
It feels like opening windows	✓	✓	✓	✓	✓

Section Theme: Reflection

What Makes It Feel Real	RECS	4E Cognition	SoE	Phenomenology	Conceptual Metaphor Theory
It is real when I sit down and do it	✓	✓	✓	✓	–
Lose your connection to time	✓	✓	✓	✓	–
Sensory awareness	✓	✓	✓	✓	–
Real physical experience	✓	✓	✓	✓	–
Returning to simplicity - sensations and thoughts	✓	✓	✓	✓	–
Live emotions without losing alignment	✓	✓	✓	✓	–
Full awareness and focus	✓	✓	✓	✓	–
M Purpose and flow	✓	✓	–	✓	–
Activities done in specific order	✓	✓	–	✓	–
Letting go, rather than trying to make something happen	✓	✓	✓	✓	✓

Section Theme: Reflection

Digital/VR Breath Practice Experience	RECS	4E Cognition	SoE	Phenomenology	Conceptual Metaphor Theory
I don't want to have to rely on anything or anybody	✓	✓	✓	✓	–
I prefer to do this alone	✓	✓	✓	✓	–
Screens are just not as satisfying	–	✓	–	✓	✓
Potential for distractions in digital environments	✓	✓	✓	✓	–
In VR I'm not available to help if needed	–	✓	✓	✓	–
Ok to do it online, important to have continuity	✓	✓	–	✓	–
It's ok to do alone if you have know how	✓	✓	✓	✓	–
Online and in-person sessions cater to different people	✓	✓	✓	✓	–
Adequate post-session care is important	✓	✓	✓	✓	–
Virtually you can do it anywhere	✓	✓	✓	✓	–
Important to be aware of your body and limitations online	✓	✓	✓	✓	–
Importance of safety when practicing alone or online	✓	✓	✓	✓	–
More verbal explanation is needed in digital settings	–	✓	✓	✓	✓
Sound cues or haptic feedback can be valuable	✓	✓	✓	✓	–
Virtual guidance is good	✓	✓	✓	✓	–
VR potential for beginners especially	–	✓	–	✓	–
Inhale for 3/4 exhale for 6/8 nothing can go wrong	–	✓	–	✓	–

Section Theme: Time

Time or Shift Indicator	RECS	4E Cognition	SoE	Phenomenology	Conceptual Metaphor Theory
Everyday is different	✓	✓	✓	✓	–
Around 15 minutes	–	✓	–	✓	–
When mental effort lessens	✓	✓	✓	✓	–
It varies from individual to individual	✓	✓	✓	✓	–
When it becomes easy, give different exercises	✓	✓	✓	✓	–
No specific time	✓	✓	✓	✓	–
10–15 minutes	–	✓	–	✓	–
5 minutes	–	✓	–	✓	–
When you let go	✓	✓	✓	✓	✓
When you trust	✓	✓	✓	✓	✓
Challenge your mental capabilities	✓	✓	✓	✓	✓

Section Theme: Time

Time or Shift Indicator	RECS	4E Cognition	SoE	Phenomenology	Conceptual Metaphor Theory
Everyday is different	✓	✓	✓	✓	–
Around 15 minutes	–	✓	–	✓	–
When mental effort lessens	✓	✓	✓	✓	–
It varies from individual to individual	✓	✓	✓	✓	–
When it becomes easy, give different exercises	✓	✓	✓	✓	–
No specific time	✓	✓	✓	✓	–
10–15 minutes	–	✓	–	✓	–
5 minutes	–	✓	–	✓	–
When you let go	✓	✓	✓	✓	✓
When you trust	✓	✓	✓	✓	✓
Challenge your mental capabilities	✓	✓	✓	✓	✓

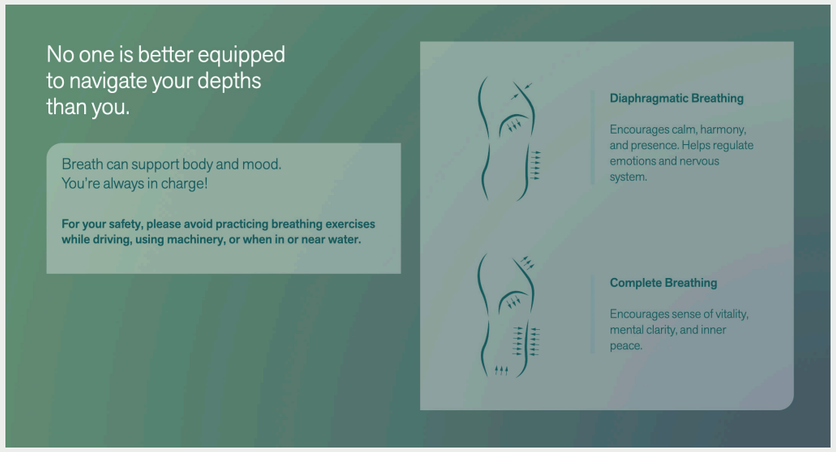
Section Theme: Ethics & Care

Ethical Responsibility	RECS	4E Cognition	SoE	Phenomenology	Conceptual Metaphor Theory
Sign a health agreement	–	✓	–	✓	–
Adequate pre & post-session care is important	✓	✓	✓	✓	–
Check-ins before, during and after	✓	✓	✓	✓	–
Adults need to be responsible for themselves	–	✓	–	✓	–
Ask questions if there is a problem	✓	✓	–	✓	–
Understand participant's health background	✓	✓	✓	✓	–
Online: Everybody has a body... presence matters	✓	✓	✓	✓	–
Give choice. Everyone knows what is good for them	✓	✓	✓	✓	–
Mindful of disabilities – provide different choices	✓	✓	✓	✓	–

Appendix D
Daily 20 Minute Meditation Link

Click here
for 20 Minutes Pranayama with Yogi Ji

Other breath-based practices:



For Calm & Recovery

Diaphragmatic Baseline Breathing

Sit tall, place one hand on your belly and one on your chest.
Inhale slowly through the nose (4 seconds), letting the belly rise.
Exhale gently (8 seconds), letting the belly fall.

Repeat for 3-5 minutes.

For Emotional Regulation

Triangle Breathing

Inhale through the nose for 5 seconds.
Hold for 5 seconds.
Exhale for 10 seconds.

Repeat for 3-5 minutes.

For Grounding

Wave Breathing

Inhale for 5 seconds, visualizing breath flowing in the body.

Exhale for 10 seconds, visualizing breath flowing out the body.

Repeat for 3-5 minutes.

For Reset

Physiological Sigh

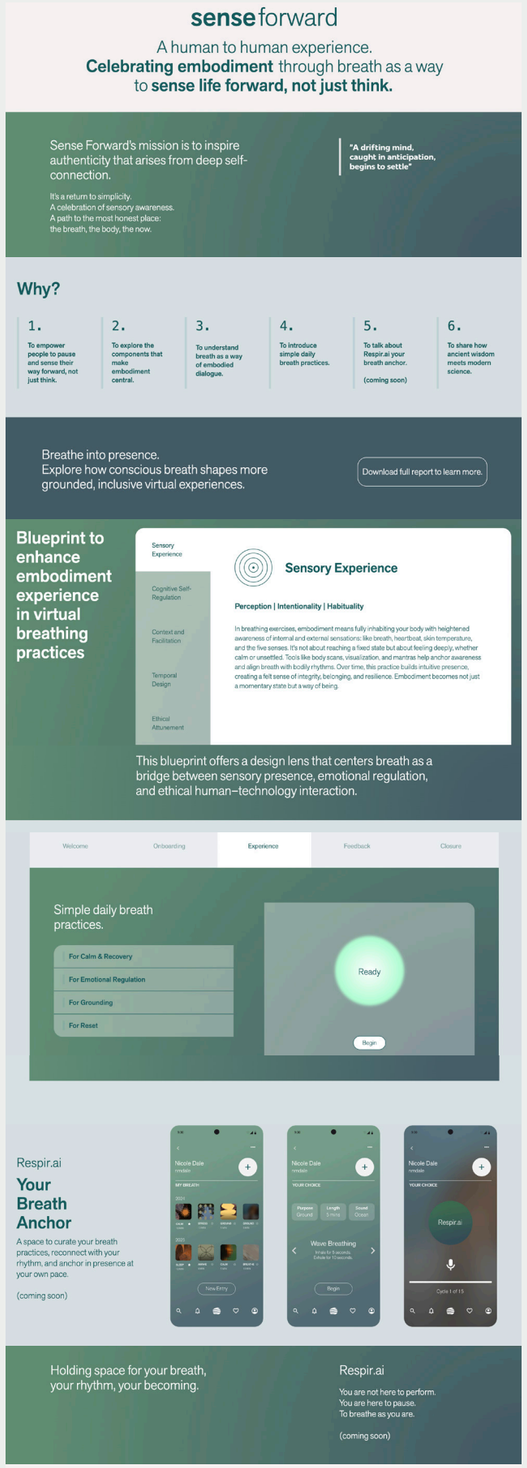
Take one deep inhale through the nose.
Take a second small inhale on top of the first.
Exhale slowly and fully through the mouth.

Do 2–3 rounds.

Appendix E

Project Web Page and Thesis Host:

Click here to navigate page.



To be fully in your body is all about tuning out external stimuli, sinking into a peaceful **internal experience**, where even the chaotic and the swirly settle into a **sense of alignment.** There's a rising self-awareness, a feeling of being connected, **completely present**, and wrapped in total silence. In the stillness and quiet of no thoughts, you find inner focus, **deeply involved within yourself.** You feel **aware**, and attuned to all senses, heart rate, skin temperature, the **rhythm of your breath**, and the grounded sense of body presence. It's a return to home, a state between wakefulness and sleep, where you are fully into the experience, connected with body and breath, **resting in the intimate truth of embodiment.**

Appendix F

Go-to-Market Considerations:

Go-to-Market Considerations

To complement the Respir.ai implementation roadmap, a go-to-market (GTM) strategy has been outlined to explore how the prototype might transition from experimental prototype to real-world application. The primary target users include individuals engaged in mindfulness, breathwork, and mixed-reality wellness practices—especially those seeking embodied, trauma-sensitive digital experiences. Secondary audiences include therapists, educators, and neurodivergent individuals for whom traditional wellness platforms may feel disembodied or inaccessible. The GTM approach positions Respir.ai within a unique niche that bridges cognitive science, ethical design, and MR technology—offering a value proposition centered on emotional anchoring, personalization, and interoceptive awareness.

Initial distribution would focus on app stores and MR platforms (e.g., Meta Quest, SteamVR), supported by partnerships with clinical, educational, and wellness institutions. A freemium pricing model with optional therapist dashboards or training templates could enable broader access while supporting ethical monetization. Marketing would center on storytelling, breath challenges, and educational content across platforms like Instagram, LinkedIn, and TikTok, emphasizing the embodied and inclusive nature of the tool. Key performance indicators include session completion, emotional self-tagging, and user retention, measured through in-app reflections and trend dashboards. Importantly, all design and deployment strategies are grounded in ethical attunement—ensuring emotional safety, accessibility, and informed consent are prioritized as the system scales. This GTM vision reinforces the thesis's core aim: to design technologies that help people feel more—not less—alive.