

Breath of the Bow: an archery game on mindful breathing

Waded Oudhuis¹ , Diana Ban  ¹, Charlie Cia  ¹, Sahar Marossi¹ , Boris Pavi  ¹ , Maarten van der Weide¹ , Amir Zaidi¹ , Fengshi Zheng¹ , Tzu-Hsin Hsieh¹ , Wendy J. Sturrock², and Rafael Bidarra¹ 

¹ Delft University of Technology, Delft, Netherlands

R.Bidarra@tudelft.nl

² One Love Mindfulness, Delft, Netherlands

Abstract. Digital systems have become a ubiquitous convenience, but interconnectivity has led to a decline in users’ attention. This decline led to an increased interest in techniques that improve focus, such as mindfulness. However, early practitioners often struggle to form habits or lack incentives when practicing independently. We present Breath of the Bow, a mobile serious game designed to support mindful breathing practice. In the game, players control an archer whose breathing steadies their aim and allows them to shoot accurately, employing paced breathing techniques. The design emphasizes core principles that balance mindfulness with game mechanics. The game features varied breathing patterns across levels alongside active design elements such as target selection. The game uses microphone-based breath detection to facilitate a responsive feedback loop. Game levels are carefully structured for a 28-day practice schedule, around which an evaluation is proposed.

Keywords: Mindfulness · Mindful breathing · Attention focus · Serious games

1 Introduction

Our lives are filled with constant streams of information provided by digital systems. The influence of all these attention-attractors and information overload has led to a decrease in attention span amongst the users [23].

Scientists have examined various ways to enhance attention and focus, with mindfulness being one such technique [27]. Originating in Buddhism, mindfulness is a practice to increase one’s awareness of their mental and physical state with intentional and non-judgmental focus on the present moment. It has been proven effective in improving attention, especially among individuals with ADHD [12]. Mindfulness practice consists of many different aspects, including meditation, mindful eating, visualization, mindful breathing, and more.

One practice of mindfulness is mindful breathing, where the practitioner focuses on their breath, without judgment, and continuously brings attention back to it when their mind wanders [6]. Mindful breathing is particularly suitable for new practitioners because it can be easily guided through visual feedback.

While many existing tools help beginners learn mindfulness practice, the challenge of receiving little feedback hinders them. This may reduce their motivation to practice consistently.

Serious games, a type of digital game with a purpose beyond entertainment, are a medium that can incentivize building habits. For example, it is shown that games can help acquire productivity habits [15]. However, digital games and mindfulness are contrasting by nature. Digital games tend to be goal-driven, motivating players with rewards for their achievements [16], and stimulating external attention. Mindfulness practices aimlessness, emphasizing ‘being’ rather than ‘doing’ [25], and stirring attention inwards. This contradiction raises a design challenge: to encourage mindfulness practice while using game mechanics to build up habits progressively.

Integrating mindfulness into a serious game can leverage game-based interactivity and feedback, which, in turn, reinforces mindful practice. This is hypothesized to help combat the reduction in attention span caused by low-attention and short-form media that has become prevalent in the modern technological landscape. By combining the philosophies of both mindfulness and serious games, we present *Breath of the Bow*, a mobile game designed to introduce players to the practice of mindfulness and contribute to improving their attention span.

2 Related Work

Several studies suggest that our attention span can be improved over time. Posner et al. [14] investigate various attention-enhancing methods and found that mindfulness meditation is particularly useful.

Mindfulness has become increasingly popular due to its benefits in emotion regulation [5], stress and anxiety reduction, as well as attention control [24] through techniques such as focused breathing, mindful walking, or body scans. The development of mindfulness-based mobile applications (MBMAs) has made these practices more accessible by integrating features such as reminders, guided meditation, or progress tracking. Analysis of MBMAs reports improvements in well-being, attention regulation, and reduced negative thinking, but mixed results for domains such as awareness, positive affect, or psychological flexibility [10]. A review of studies evaluating *Headspace* and *Calm* [13], two of the most popular MBMAs, reports their positive effects on well-being and mindfulness.

Mindful breathing. Studies have shown the benefits of mindful breathing for mental well-being and attention. Semple et al. [20] report that practicing twice a day for four weeks leads to significant improvements in sustained attention. Compared to original mindful breathing, paced breathing aims at matching the inhalation, pausing, and exhalation to certain patterns. Both practices have shown improvements in attention and emotional regulation [26]. Different studies investigate the length, frequency, and effectiveness of mindful breathing sessions, showing the importance of habitual practice over single sessions [2].

Breathing games. Many serious games feature breathing input. Lukic et al. [9,8] present a game controlled by inhale, exhale, or non-breathing events detected by a microphone. Shih et al. [21] use a phone’s microphone for breathing detection.

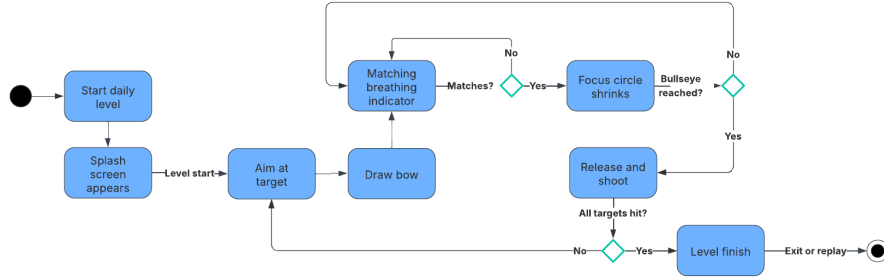


Fig. 1: Diagram depicting the core game loop

Miner et al. [11] design a VR breathing game driven by a respiration sensor. The breathing interaction in our game is inspired by these works.

Mindfulness games. *Flowborne VR* [17] is a meditative breathing VR game aiming to alleviate stress and promote deep relaxation through breathing. Progression in the game is driven by the synchronicity of the players’ paced breaths. Sliwinski et al. [22] propose a framework for designing games that improve mindfulness. Asati et al. [1] present a VR mindfulness training environment including an archery game to improve attention. Our game instead integrates breathing with archery and runs on mobile phones.

3 Game Design

This section outlines the main design goals and principles behind *Breath of the Bow*. This includes the game synopsis, core principles, target audience, game environment, game mechanics, level design, sound design, and art style.

3.1 Game Synopsis

Research on mindfulness and serious games suggests a lack of games specifically designed for practicing mindful breathing. *Breath of the Bow* addresses this gap as a single-player, breath-controlled target shooting game, set in a calming forest environment where players steady their arrow using slow and measured breaths while aiming at different targets.

A central design challenge is balancing engagement and mindfulness. The game must be engaging enough to keep the players interested and returning to the game, but not so much that it takes away from the mindfulness aspect. All design decisions are guided by this balance.

3.2 Core Principles

The design is guided by four core principles, derived from different challenges and principles of mindfulness:

- **Mindfulness**

Every element of the game reinforces the main purpose of mindfulness.



Fig. 2: A session of Breath of the Bow (from left to right): start screen, target selection, start matching breathing, finish matching breathing, shoot the target, level complete

– Engagement

Adding feedback and engagement to the game makes it easier for players to maintain motivation.

– Repeated practice

Short, daily sessions support habit building over time.

– Willingness to accept

Players can succeed without perfection, emphasizing a willingness to be with the pleasant or unpleasant, accepting things as they are in this moment.

3.3 Target Audience and Play Context

The target audience is adults looking to improve their attention through mindful breathing, but find traditional mindfulness practice challenging. Players are encouraged to play for 5-10 minutes every day for 28 days to support habit building. Game sessions are intended to take place in a calm, quiet environment with headphones on. Before the player starts the game, a splash screen is shown, encouraging the player to sit down comfortably and use headphones.

3.4 Game World and Environment

The game's world is a 2D circular scrolling environment with parallax perspectives to create depth and visual interest without overwhelming the player's focus. By using distinct background regions the game preserves player's spatial orientation.

3.5 Core Game Mechanics

A diagram of the core game loop can be seen in Figure 1, a typical game session depicted with screenshots can be seen in Figure 2.

Breath indicator A bubble indicator guides the player's breathing by expanding for inhale, shrinking for exhale and pausing for breath holds. The bubble is similar to indicators used by some meditation apps, and early playtesting showed players finding it intuitive to follow. To make it easier for the player to follow the length of the breath, a circle is displayed at the maximum size of the bubble.

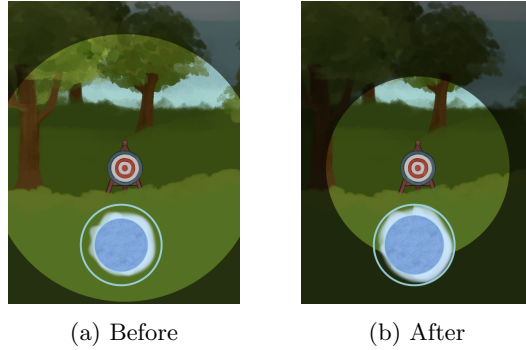


Fig. 3: Progression of the focus circle.

Breath control The arrow’s steadiness is directly tied to the player’s ability to follow the breathing pace of the game. The focus circle begins large and shrinks when the player matches the breathing pattern, darkening the screen, as can be seen in Figure 3. When the breathing is successfully matched long enough that the focus circle is the size of the bullseye, the player can release the arrow. Breathing matching from detected audio is done by using a pre-trained YAMNet to create embeddings, which are then classified as ‘inhale’, ‘exhale’ or ‘non-breathing’ using a dense neural network [19]. To ensure that imperfect but mindful breathing still reduces the circle, the mechanic is lenient. This ensures effort and attention are rewarded without judgment, making mindful breathing the true skill. The player does not receive a score as direct feedback on how well they match the pattern in terms of correctness or failure. Additionally, to avoid a noisy environment from deterring players’ success, the player can also turn off the breathing detection, making the focus circle shrink slowly automatically.

Target Selection Target selection is a toggleable feature, configurable through a slider in the game settings. When disabled, the game omits player-aiming and automatically focuses on the targets of the levels. When enabled, players scroll left and right to the targets, using an aiming indicator that automatically adjusts vertically. To avoid the player’s dexterity affecting the outcome of the game, the camera automatically locks onto a target when close enough to the target’s center. This design ensures that the challenge lies in mindful breathing, not in technical accuracy, consistent with the principle of acceptance.

Shooting Mechanics To ensure player engagement, at least one finger has to be on the screen while drawing back the bow. This way, they are encouraged to focus only on the game. When the player releases to shoot, a random position within the focus circle is sampled. If the player hits a target, they will hear an audio cue, the target will be greyed out, and the arrow will stay inside the target. This makes it easy for the player to distinguish what targets still have to be hit. If no target is found, the arrow instead flops from the bow, falling downwards and disappearing from the screen, indicating an ineffective shot.



Fig. 4: A collection of level landscapes.

3.6 Level Design

As the player progresses, game levels evolve in three regards: breathing patterns, environment, and targets.

28-day Structured Progression The game promotes repeated practice through a 28-day progression. Each day introduces slightly more advanced breathing patterns to strengthen mindful breathing habits. The 28-day duration was selected since evidence indicates low-dose digital interventions effectively improve focus and well-being within a 4-week window. After this period, players should be able to employ in their daily life in-game learnt skills. Players can complete one level per day, but can replay old levels indefinitely.

Breathing Pattern Progression The breathing patterns start with simple inhale/exhale cycles and gradually introduce more complex rhythms to encourage improvement in breath-work and breath awareness. Every breath pattern is done for multiple days to let the player practice the pattern repeatedly and alternated to balance challenge and variety. The game begins with balanced breathing (4-4s inhale-exhale), progressing to the 'perfect breath' of 5.5-5.5s [7]. Later stages introduce extended exhales (4-6s to 4-8s [3]), triangle breathing (5-5-5 s) and ending with box breathing (4-4-4-4s [18]) For 7-day playtesting, representative patterns were selected to ensure variety and gradual difficulty.

Target and Environment Progression The environment of the game progresses across four seasons: summer, fall, winter and spring, as seen in Figure 4, each with 7 levels progressing through the time of day (starting with dawn and ending with night). The journey from summer to spring symbolizes relaxation, change, introspection and renewal. After each level, players collect pieces of the environment that fill a multi-season panoramic collection scene, to visually encourage progression.

3.7 Sound and Style

The game has a stylized forest aesthetic, viewed from an over-the-shoulder perspective. It uses audio cues such as wind gust sound effects during the inhalation

and exhalation phases, and sound effects for drawing the bow and successfully hitting a target. The game also includes calming, meditative background music with ambient soundscapes of nature to reinforce calmness and to help the user focus. Using headphones creates an immersive and distraction-free environment.

4 Evaluation

To assess whether Breath of the Bow supports repeated practice of mindful breathing and contributes to improved perceived attention and calmness of players, we propose a 28-day play test. This allows the players to experience the complete progression of breathing patterns as intended by the game design and enables investigation of effects over a longer period of sustained practice. For the proposed study, participants are asked to play the game daily for four weeks (approximately 5-10 minutes per session) in a quiet area and as a focus session.

To measure the short-term changes in mindfulness, players are asked to fill in a short questionnaire after every daily play session. The questionnaire includes the questions of the State Mindful Attention Awareness Scale (State-MAAS) [4]. As the State-MAAS measures mindfulness as a temporary state rather than a stable trait, it is well suited for assessing the immediate perceived effect of gameplay. Long-term engagement will be assessed through gameplay activity during the 28-day period, including the number of completed sessions and the frequency of returning to the game.

At the time of writing, a preliminary 7-day play test with 20 participants has been completed, of which 11 finished all 7 levels. Initial results suggest improvement in players' perceived focus and calmness following gameplay. However, a full 28-day progression play test must be done for a more comprehensive assessment of the game's effectiveness in supporting mindful breathing practice.

5 Conclusion

We presented Breath of the Bow, a novel game for mindful breathing. By utilising the medium of a digital game, our game appeals to a diverse audience and keeps users engaged, helping them practice mindfulness. A preliminary 7-day evaluation seems to confirm the game improves players' focus and calmness in the short term. However, a thorough game evaluation over the entire 28-day period using the State-MAAS scale still has to be realised.

We identified two main limitations in the present implementation. First, accurately detecting breathing proved challenging without an extensive dataset to train a neural model on. For future development in the field, it is likely necessary to train a more accurate model; moreover, it may be valuable to study whether accurate detection is critical or if a simple breath-guiding animation would produce comparable positive effects. Second, the 7-day pilot revealed challenges in maintaining the intended daily practice schedule, suggesting it may prove beneficial to examine additional incentive mechanisms, such as notifications, badges, streaks, etc., to support long-term adherence in the proposed 28-day progression.

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