Figure 1: Participants lead or follow a drone as it facilitates meditative movement.

Are Drones Meditative?

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ABSTRACT

Meditative movement involves regulating attention to the body whilst moving, to create a state of meditation. This can be difficult for beginners, we propose that drones can facilitate this as they can move with and give feedback to whole body movements. We present a demonstration that explores various ways drones could facilitate meditative movement by drawing attention to the body. We designed a two-handed control map for the drone that engages multiple parts of the body, a light foam casing to give the impression that the drone is floating and an onboard light which gives feedback to the speed of the movement. The user will experience both leading and following the drone to explore the interplay between mapping, form, feedback and instruction. The demonstration relates to an

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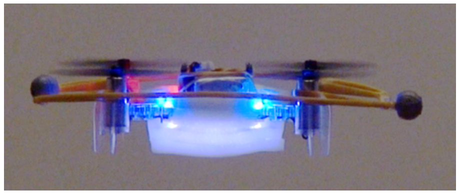

Figure 2: The drone emits a soft glow to give feedback to movement.

[1] See [2] for a review of use cases and design concerns for interactive drones.

expansion of the attention regulation framework, which is used to inform the design of interactive meditative experiences and human-drone interactions.

CCS CONCEPTS

• **Human-centered computing** → **User interface design**.

KEYWORDS

drones; meditative movement; Tai Chi; movement; human-drone interaction

INTRODUCTION

Meditative movement (MM) can be described as regulating attention to the body whilst moving to reach a meditative state [12, 13]. A well studied example of meditative movement is Tai Chi, where a large body of research suggests that Tai Chi can have positive effects on balance [14], attention [3], depression [12] and perceived quality of life [6]. Drones have the potential to serve as a versatile and pervasive platform for interactive experiences [2, 4]. Their capabilities include[1] enhancing virtual environments through tactile feedback [7] pervasive displays [5], accessibility [1] and sociability [10]. As such, interactive drones are expected to be ubiquitous in the future.

Most of the aforementioned applications require a person's attention to be placed largely on the drone. We believe that opportunities are to be found in human-drone interaction (HDI) designs that can draw attention to the human body. Furthermore, we wish to leverage the idea that MM be incorporated into everyday life for sustained benefits [11]. We believe the versatile and potentially pervasive nature of drones can present people who are new to MM with novel opportunities to try it, or further motivate practitioners to engage in MM. This could manifest itself in a range of ways from personal consumer products to a public amenities, such as drone parks.

Previous work has called for the need to explore the interplay between form and feedback and its ability to facilitate MM [8]. The current demonstration will explore not only the effect of the form and feedback of the drone but also mapping and literal instruction (such as lead or follow the drone) in the broader context of MM. The interaction design is based on three considerations. Firstly, the system allows MM to be performed without any electronic equipment attached to the body which can be distracting to participants [13]. Secondly, a flying drone can always situate itself in the line of sight of the participant if needed, making it comfortable to move the body and still receive feedback. Thirdly, a physical flying object affords additional sensory experiences which are not currently found in its virtual reality counterpart—this relates to a phenomenon described by Lupton as the "complexities of the affective embodied knowledge" [9].

Currently, the main limitations of our design include battery life, which allows for a flight time of around 5 minutes for the drone used in our implementation. This limits the depth of meditation

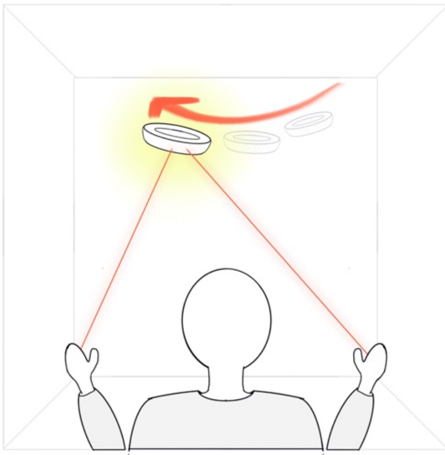

Figure 3: ***Lead*** **mode – the user controlling the drone as it flies at the intersection of two imaginary lines projected from the palms.**

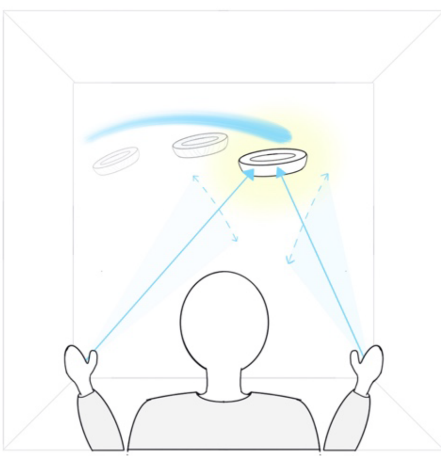

Figure 4: ***Follow*** **mode – the user aiming their hands towards the drone as it flies its own path.**

reached. The drone also emits a noise which some people find distracting. We have taken steps to minimize the noise but it cannot be completely eliminated.

DEMONSTRATION OVERVIEW

The demonstration is to be set up in a 3 m × 3 m tent, the size of which can be adjusted to meet space requirements. Motion capture cameras track the movement and orientation of both palms to allow the participant to lead the drone or follow it. In lead mode, the drone flies at the intersection of two imaginary lines projected from the palms of the participant's hands. This mapping is designed to draw the participant's attention to their movement as they coordinate their arms. The participant is free to move the drone to any position within the tracked space. To encourage slow and gentle movements, the drone dims when it is moved aggressively. Leading the drone is designed to bring about a focused state of meditation as the drone is constantly engaged with the body, and requires the participant to pay attention to both the drone and their body.

In follow mode, the drone moves in a random path at a normal speed. When the participant faces their palms towards the drone, it slows down to a gentle pace and begins to glow. Feedback is given to the participant by changing the brightness of an onboard glow, as a function of how accurately oriented the participant's palms are to the centre of the drone. Following the drone is designed to bring about a calm state of meditation as the graceful movements of the drone are followed. (For CHI delegates about to give a talk presenting their research paper, it is advisable to try the exercise in follow mode to calm the nerves, and then lead the drone after the talk to focus the energy!)

SIGNIFICANCE

Users will be able to explore which of the above aspects of the experience allowed them to regulate their attention to their body, possibly learning more about themselves and how they could reach a meditative state through movement. The outcome of this work will be used to build upon the attention regulation framework [13]. This framework supports the notion that, by using technology to detect and give feedback to movement, we can help people to regulate their attention to the body and bring about a meditative state. Our interpretation to this framework introduces an expansion to the term "feedback to movement" in order to include "mapping of movement," "instruction to movement" and "form of object" (see Figure 5).

CONCLUSION

We present a HDI experience which explores the relationship between feedback, mapping, form and instruction when performing MM. The experience is designed to help the user regulate their attention and reach a meditative state through movement. Its essence is to allow the user to lead or follow the

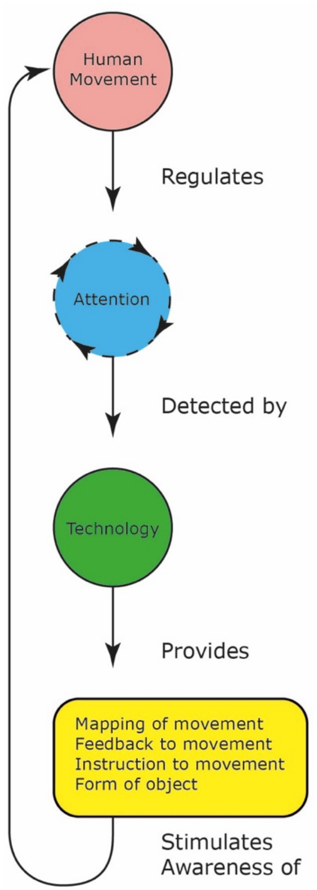

Figure 5: The Attention Regulation Framework with additional aspects provided by technology to facilitate meditative movement.

movements of a drone with their body. It builds on and investigates the use of the attention regulation framework [13] to inform the design of interactive meditative experiences and HDI.

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