Wisp: a Design Case for Temporality in Research through Design in Human-Robot Companionship

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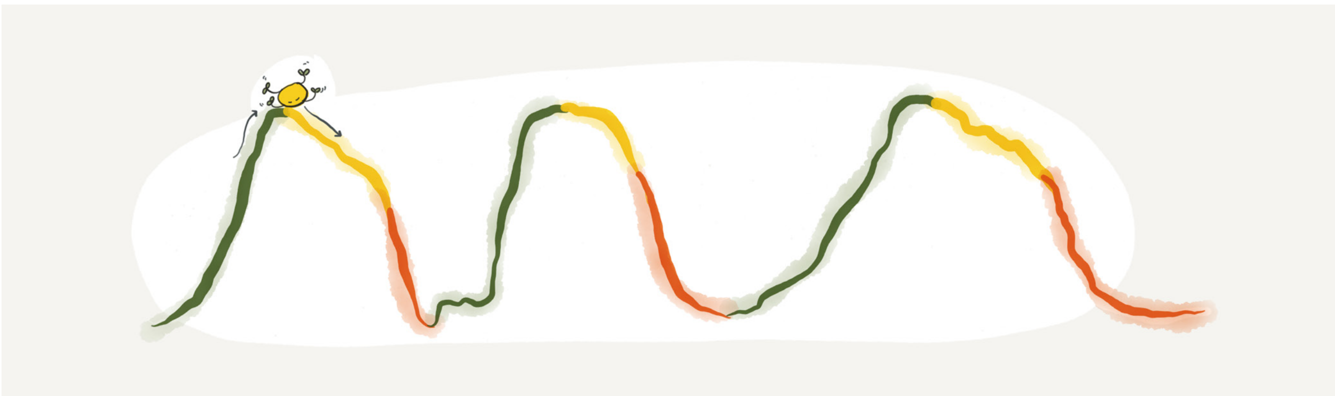


Figure 1: A sketch of Wisp flying up and down a curve, mimicking a user's breathing patterns.

ABSTRACT

Research through Design is a well known approach within Human-Computer Interaction, putting the emphasis on the design process as a tool for producing knowledge, strongly based on the craft of design. In this position paper, we present temporality as an important aspect when designing companionship, and as a relevant dimension which is naturally embedded in Research through Design; incorporating both fast and slow development, leeway for failure, and longevity.

CCS CONCEPTS

• **Human-centered computing → Interaction design process and methods**.

KEYWORDS

research through design, human-computer interaction, human-drone interaction, prototyping, longitudinal studies

1 INTRODUCTION: TEMPORALITY AND RTD

The RtD approach is very suitable when considering the temporal aspects of User Experience (UX). While usability is central to UX, there are aspects beyond it which are tightly connected to how the relationship between a human and an interactive artefact is formed, first through increasing familiarity, functional dependency, and ultimately emotional attachment. Throughout these forces, there are different phases: orientation, incorporation, and identification [3]. It is vital to consider that the UX journey starts at anticipation, progressing through stages of momentary, episodic, and cumulative UX [7]. Studying temporal aspects is extremely relevant when designing companion and domestic robots [8].

Two possible ways to tackle temporality is through considering designing for (a) specific rituals between human and robot [3, 6, 9] and (b) to incorporate a philosophy of slow technology, embracing an inefficient design process, offering latitude for reflection [2].

These strategies are well suited to be paired with RtD. Prototyping and creating probes is a process that necessarily accommodates for failure and slowness, as materials require time to settle, glue time to dry, electronics time to charge. An interesting example of this process applied to a digital tangible artefact is Slow Game [5], a game tailored to take time, lowering the frequency of each possible move for two remote players. A byproduct of this design process is that prototypes can remain on a shelf for extended periods of time, ageing, and being interacted with in a more natural and unstructured way. Companionship has similarities as it varies through time: an example is the relationship between a human and a pet, where the steps of training are relevant to building trust. Even in interactive systems such as drones, animacy can be achieved through the temporal process of training [10]. Robots often are embodied beings, so their prolonged use and materiality also ought to be considered. The concretization of prototypes with different materials works better when also combined with prolonged and repeated interactions. Therefore, it is valuable to approach the design of robots with a research through design lens, as this perspective will naturally include a number of temporal aspects.

Two relevant questions are: What outcomes can we derive from conducting longitudinal RtD HRI projects and incorporating slow processes? What is the relevance of RtD for designing the different stages of user experience within HRI?

(a) Wisp works by replicating the breathing motion of its user, introducing breathing exercises, and exhibiting behaviour when the exercises are complete.

(b) A sketch of the experience of breathing with Wisp: an experience in a dimly lit room, where the expression of the colours of the drone is particularly intense.

(c) Sketches for the protective casement. The materiality of these casements is an important part of the RtD project.

Figure 2: A collection of preliminary sketches for the development of Wisp

2 WISP - THE BREATHING COMPANION DRONE

To explore the previous questions, and conduct a RtD project within HRI, we have conceived practical case study.

2.1 What is Wisp

Wisp is a companion drone that mimics a user´s breathing patterns by flying up and down, and changing its lights. This micro-drone (not bigger than a human hand) will visualise the breathing of its human, but also exhibit particular behaviour which can be trainable (e.g. Wisp can be programmed to flip if three deep breaths are taken consecutively, or to yaw when the breath is held longer than thirty seconds). Wisp is slow and has no evident usefulness: the first reaction to it ought to be "what is this for?". To interact with this companion, a user must wear a harness where the drone is mounting to be charged. This harness also includes a Bitalino breathing sensor [1], that communicates with the drone; however, breathing sessions with the drone should be intermittent, which is particularly relevant by the robots own need to recharge. Using breathing as input is valuable as it sets the bar for the interaction at a level which can be achieved by most users: they only need to be able to breathe and take in the movement the drone creates, be it light or flight.

2.2 Process

While Wisp is intended as a companion, the first phase for its development will be focused on an artistic, non-utilitarian, and even anti-solutionist [1] perspective. The ultimate aim of Wisp is to support the future definition of the role of companion drones from a critical perspective. Our RtD process follows the following steps:

2.2.1 A Technical Feasibility Study: using programming a research material combining motion capture, biosignals (respiration sensor), and micro-drones. The drones used are an off-the-shelf Tello Edu[2] and an expandable open source Crazyflie 2.1[3].

2.2.2 A Materiality and Shape Study: to inform the design of a new protective casement for the drone and breathing harness for the user, with expressive qualities of the intended companionship. These studies will define if the drone should be soft, fragile or sturdy, if it should decay with time, or be repairable. Furthermore, the possible incorporation of anthropomorphism ought to be considered as an important factor.

2.2.3 An Interaction Design Study: including expert interviews to aid on designing both the behaviour and interactions.

2.2.4 Anticipated UX:. The development of manuals and packaging, tackling preliminary design of anticipated user experience.

2.2.5 Design of the behaviour of the drone and its interaction modes: will it follow or lead; what should be the colour of the LEDs, what should be the feedback to different breathing inputs, what type of flight patterns should the drone produce, etc.

2.2.6 Designing for the ritual of using Wisp: from opening the box, to putting on the harness, calibrating, breathing, testing, exercising, charging and playing. Initially, Wisp will be designed as an exhibition experience, or a showroom supporting the creation of debate amongst users [4].

2.2.7 Testing Wisp: with a variety of participants, particularly children and adults with accessibility issues. These groups are not as commonly studied, and the set-up of this case allows for their inclusion and would strongly benefit from their input.

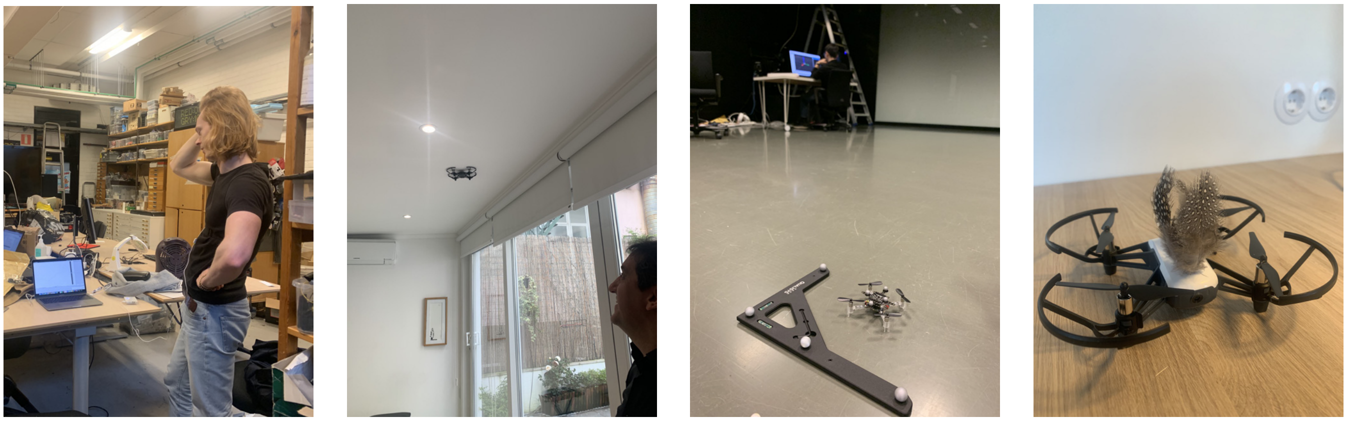
2.3 Current Status

2.3.1 Feasability. : We have conducted part of the feasibility studies, using a sample respiration signal as input to both drones. The reason behind using both Tello and Crazyflie is connected to how they have distinct characteristics and can be studied in different concepts. The Tello is a sturdy and stable drone, more difficult to

[1] https://bitalino.com/

[2] https://www.ryzerobotics.com/tello-edu

[3] https://www.bitcraze.io/products/crazyflie-2-1/



(a) Trying out a respiration sensor by Bitalino. **(b) Flying a Tello drone following a sample breathing signal.** **(c) A Crazyflie drone in an environment with MoCap** **(d) A Tello with some feathers on.**

Figure 3: A collection of images from the first phase of the Design Project

customise, but can be flown in uncontrolled environments. The Crazyflie is somewhat more dependent on a tracking system, but is more flexible in terms of customisation, less noisy and intrusive. Currently, the Crazyflie is set-up to fly according to the input signal from the respiration sensor, and we are working on stabilising its flight and designing the lights feedback.

2.3.2 Expert Interviews. : We are conducting expert interviews to extract specialist knowledge on breathing exercises. These interviews are to be conducted with Yoga instructors, meditation specialists, and even a child psychologist practising with breathing exercises for emotional regulation. The aim is to collect information about how Wisp can lead users to different bodily sensations, particularly from a temporal perspective. We intend to learn if the experience is more valuable as a one time interaction, long term, or even occasional.

2.3.3 Materiality. : We are considering which materials are suitable to build a casement out of. Currently, we are modelling alternative shells using 3D printing and laser cutting.

2.3.4 Interactivity. : The first storyboards for Wisp are now created. The design of the ritual needs to be developed in iterative throughout the RtD process. The forming of particular rituals has already started as the drone has to be placed in specific ways, restarted at times, and reassembled often after collapse.

2.4 Workshop Contribution

We are currently investigating ways to best incorporate RtD perspectives into the plan of the project. Feedback would be appreciated into how temporal aspects and dimensions of User Experience could be studied, but also which techniques are the most appropriate for the project at hand. We suggest contributing to the field influence of RtD in HRI through temporal frameworks informed by the presented design case.

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