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# Yōkobo

## - A behavioural object to strengthen human-human relationships

**Yōkobo is a behavioural object designed by a multidisciplinary research team to strengthen the connection between retired couples living at home. As a research artefact, Yōkobo is at the crossroads of a sensitive approach and a robotic trend that bridges the gap between humans (Human-Robot-Human Interactions field). This work follows a user-centred design approach spread over three phases. Following field studies regarding newly retired couples, the first phase aimed to identify an experience concept to strengthen the bond within the couple. In the second phase, the team worked on defining the form of the behavioural object, the associated services, and the interaction modalities of this behavioural object. In the third phase, the roboticists implemented a functional prototype used in several studies and explorations.**

### INTRODUCTION AND RESEARCH QUESTION

The work proposed in this article is based on field studies to understand the problems newly-retired couples encounter [6]. These people find themselves having to rediscover life together all day long. It is a time when isolation and misunderstandings can arise, leading some couples to drift apart or even to separate.

The transition to retirement often involves reorganising the couple's daily life. Living together every day requires establishing a "good distance" (time, space) to have personal independence while maintaining a conjugal closeness [2]. Feeling together and, at the same time, feeling free while sharing the same roof is a balance that couples try to reach. If not achieved, this can lead to dissatisfaction related to differences of opinion about the time to be shared [2].

To attain harmony in the couple's life, the Olson and Zabriski and Freeman family models [10, 13] tell



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that engagement and satisfaction in family activities supplemented with good communication bring the family's life satisfaction. These ascertainments led to thinking about a daily animated object that could be a vector between the couple, giving them a way to be closer. Our research does not focus on direct interaction between an individual and a robot. It concerns the couple's interactions in the presence of a robot.

To think of an object animated by autonomous motions is to think of an automaton or a robot. In the home context, studies have been carried out to determine the types of robots likely to meet the expectations of everyday users. These studies show that a domestic butler is the most expected role [4, 8, 11]. A few years ago, the media made numerous announcements about companion robots (Buddy, Zembo, Jibo, etc.) [12]. However, more recent studies have shown that this type of robot represents the lowest segment in the robotics market. This low score is partly due to user disappointment (the gap between user expectations and

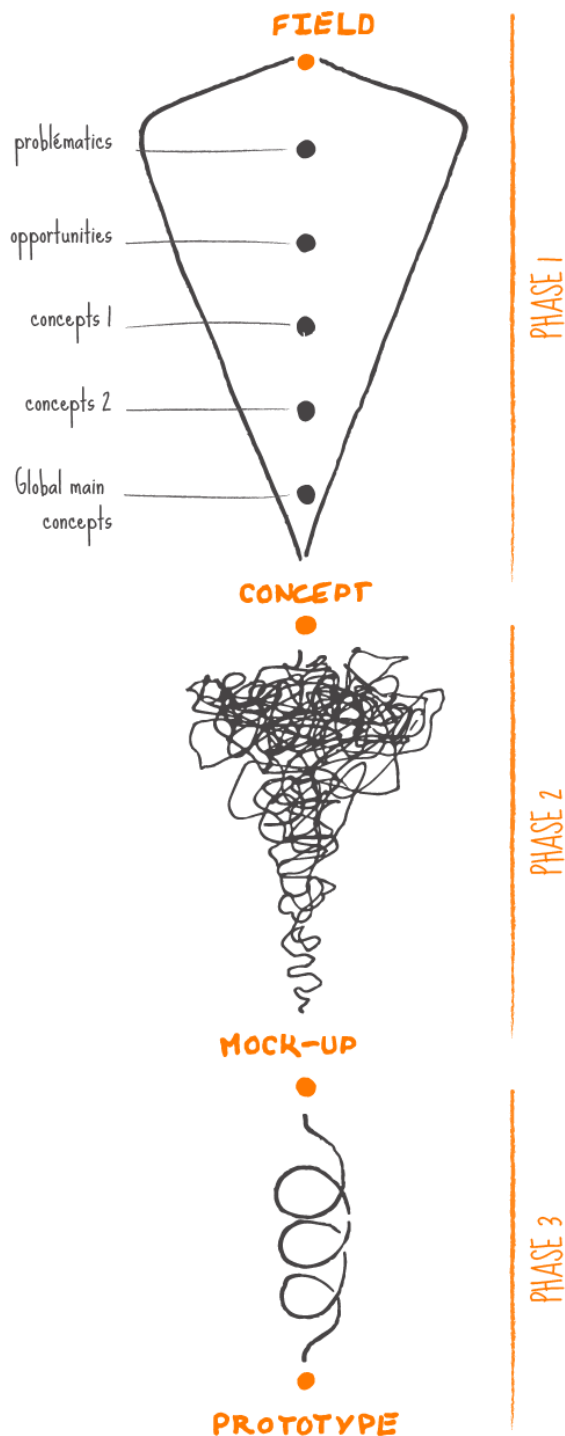


Figure 1: Global design process

robot functions) and the rise of voice assistants [5]. So, it is worth noting that the robots imagined for the home are far from today's robots (hoovers and lawnmower robots).

We decided to work on behavioural objects, defined as non-voice objects with non-anthropomorphic shapes, which perform autonomous spontaneous motions leading us to believe that they have a will and an intention on their own [1].

### DESIGN CONTEXT

The context of this work is a collaboration between the GV Lab for its expertise in robotics, Orange for the field of connected home applications, and the LS2N and Strate Research laboratories for user-centred design approaches. This context is a Japanese-French collaboration that offers the opportunity to create a multidisciplinary team involving two researchers in ergonomics and design, one PhD student in ergonomics-design, two student designers from France, and three researchers and three PhD students in robotics from Japan.

### DESIGN PROCESS

The design process is divided into three phases that we presented further (Figure 1).

#### Phase 1

The first phase, which lasted three months and included the ergonomists and designers, covered the whole ideation process. The outcome resulted in a service concept with a behavioural object. This phase was composed of several divergence-convergence moments to specify the concept progressively. The divergence moments consisted of designers' workshops for generating ideas or designers' individual works to draw concepts. The convergence moments allowed the team to discuss ideas and concepts and make decisions for future steps. The ideation phase led to Yōkobo, an animated object placed in the home entrance to appreciate life's little moments. We selected this

location since the robot is not constantly in view and avoids reinforcing the human-robot bond to leave more space for human relationships. Moreover, this room enables each spouse to think of the other as he/she leaves or enters the home. With Yōkobo's concept, we thought of two ways to reinforce the link between the couple: indirect and direct. A function to welcome people could bring the couple closer indirectly through discussions concerning their experiences with Yōkobo and how it represents and symbolises the welcome of their home. A creative message delivered from one person to his/her spouse through Yōkobo could be a direct way to communicate between spouses.

#### Phase 2

The second phase gradually made it possible to clarify the design of the behavioural object. During this stage, the design of the interaction modes, the shape and the first technological developments were considered simultaneously.

A paper mock-up was constructed to simulate the comings and goings of users and the objects potentially present in an entrance hall (Figure 2). This initial mock-up made it possible to choose a pin tray as the foundation for our behavioural object, and it created scenarios based on the pin tray's proximity (Figure 4).

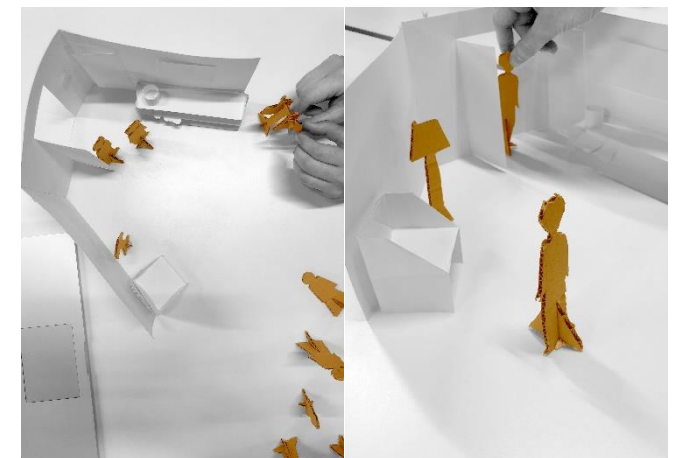
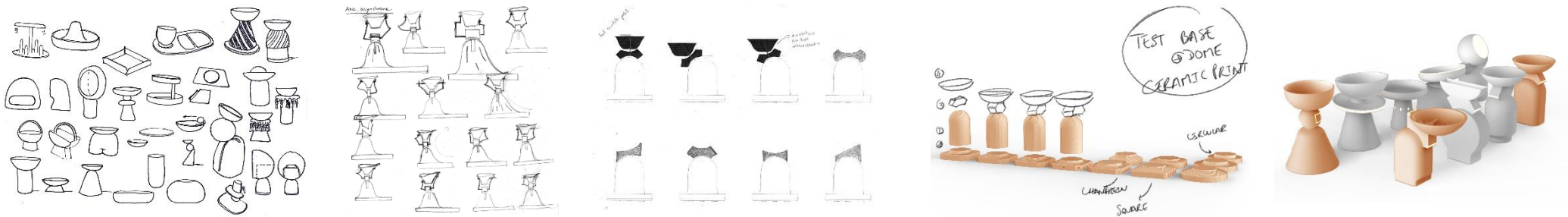
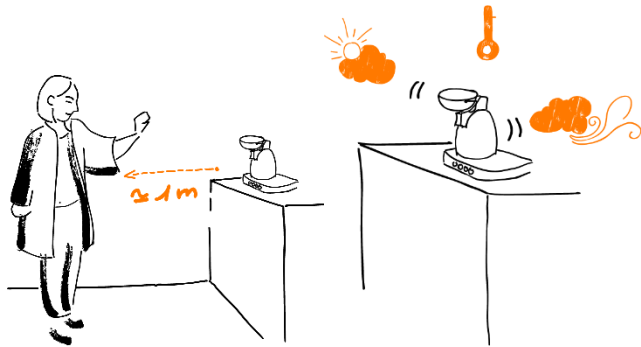


Figure 2: Context paper mock-up



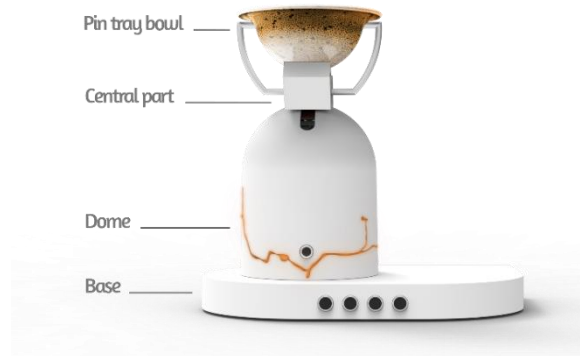
**Figure 3: Sketches and 3D model rendering**



**Figure 4: Scenario's sketches**

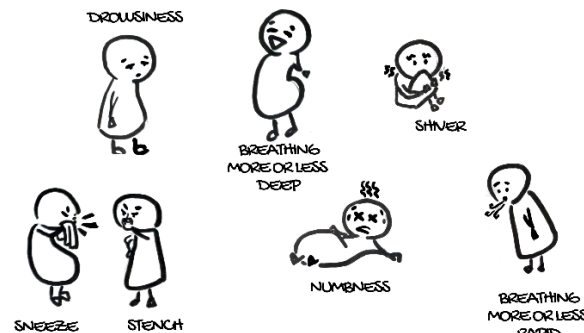
We continued the formal exploration through numerous sketches followed by 3D models (Figure 3), cardboard (Figure 7) and plaster (Figure 8) mock-ups led to the final form of Yokobo. It consists of a base (including the electronic elements), a dome (containing a strip of LEDs and the motors), a central part (including the RFID sensor) and a ceramic bowl corresponding to the pin tray (Figure 5). The aim was to minimise anthropomorphism and maintain the distance between man and machine.

Regarding interaction modalities, designers worked on drawing specific animations that make Yōkobo move and interact with users. The aim was to maintain interest by introducing unevenness into the motions. To reach unevenness, we based Yōkobo's movements on evolving data as a weather station and as the human body. In Yōkobo's concept, the weather station is a way to inform users about the weather perceptibly and

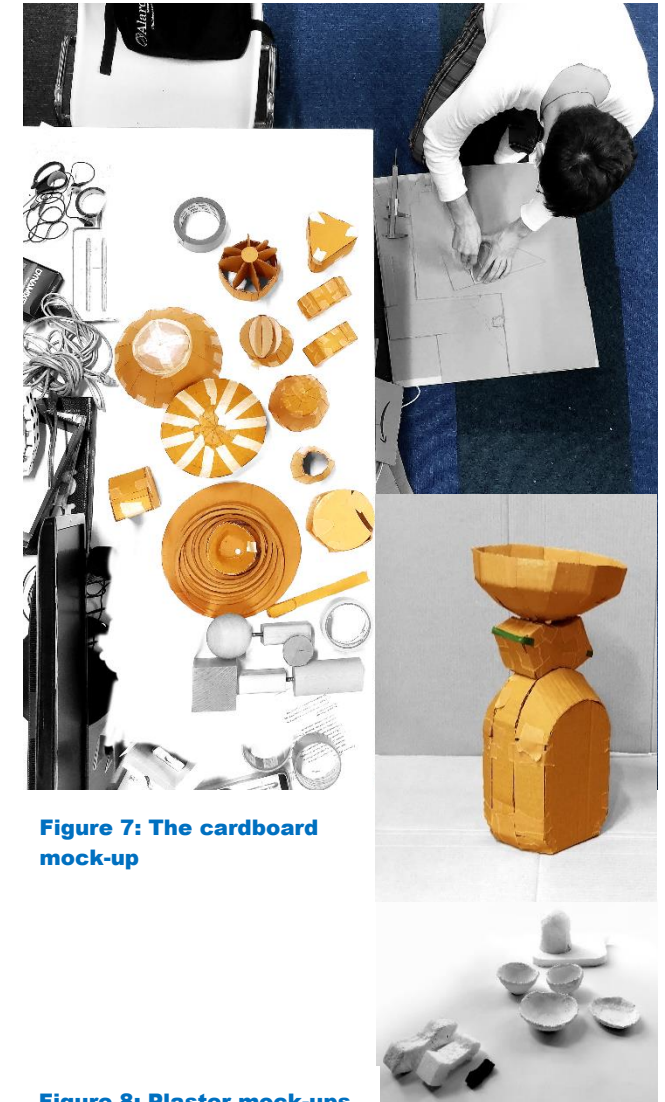


**Figure 5: Parts of Yōkobo**

the home ambience. To create motions for Yōkobo, designers began by exploring the human body's movements to animate objects through animated movies. In this research train, we based Yōkobo motions on the human body's reaction to extreme weather and air conditions (Figure 6).



**Figure 6: Inspiration from the human body's motions**



**Figure 7: The cardboard mock-up**

**Figure 8: Plaster mock-ups**



For the welcoming function, Yōkobo's motion is based on the mimic of the person who faces it.

This work was a moment to share ideas and experiences between designers and roboticists to create feasible motions.

### Phase 3

Following an agile iterative process, the last phase focuses on developing Yokobo as a functional prototype (Figure 9). The three robotic PhD students developed the motor motions, hardware, and software architecture.

After achieving an initial working prototype [7], several modifications continued the prototype evolutions. The shape changed to make the bowl stand out more. The team improve motion expressions to make them livelier. Yōkobo interacts primarily through movement, and the lighting has been chosen to support Yōkobo's expressiveness better.

### YŌKOBŌ, A DISCREET BEHAVIOURAL OBJECT AT THE ENTRANCE'S HOME

Yōkobo is an everyday object with the primary function of being a pin tray. In addition to its function as a pin tray, Yōkobo is also connected to a weather station. As a result, its movements are tuned to temperature, air quality, humidity and atmospheric pressure data.

To welcome the visitors, Yōkobo performs spontaneous motions, depending on someone's body data that moves in front of it.

These two data-connected functions offer spouses a way to discuss a funny object.

Finally, spouses could leave messages to one another through Yōkobo. Used in tandem with house keys, Yōkobo records a symbolic trace that a spouse left to his/her partner. The latter receives the trace through motion and light in a poetic way. A trace is a memory of the spouse's passage in the entrance hall. In this way, Yōkobo offers spouses an original way of communicating tangible messages directly.

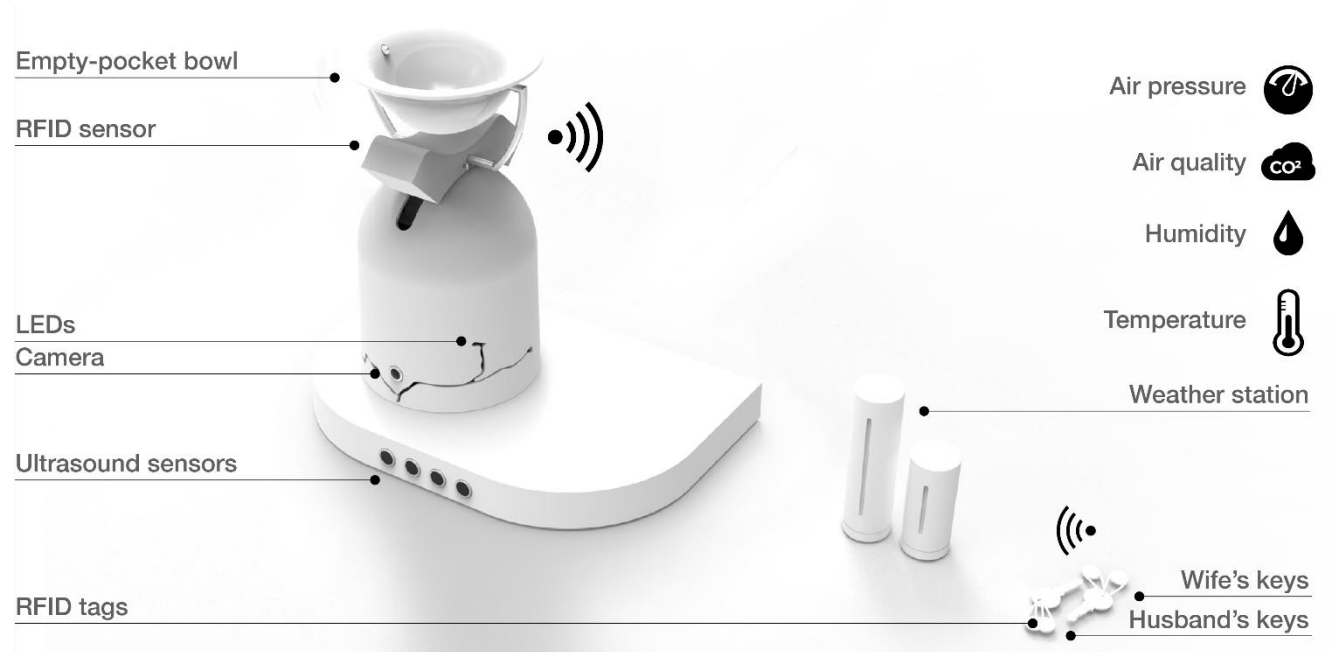


Figure 9: Yōkobo's technical description

Figure 10: Yōkobo under construction

### CONCLUSION

This paper presents Yokobo (Figure 11), a behavioural object that explores the roles of robots as Human-Human mediators to strengthen human relationships at home [3].

Yōkobo might also be considered an object in the "slow technology" trend [9]. Indeed interacting with Yōkobo requires accepting not to have a clear, repetitive, and instantaneous response to an action. Therefore, the user should be in a specific mindset to perceive Yōkobo sensibly and poetically. Yokobo is a background object that conveys information perceptibly rather than directly, as a number or figure might. Initial feedback from a four-weeks experiment shows that Yokobo is an object that adds a sense of presence to the room in which it is placed.

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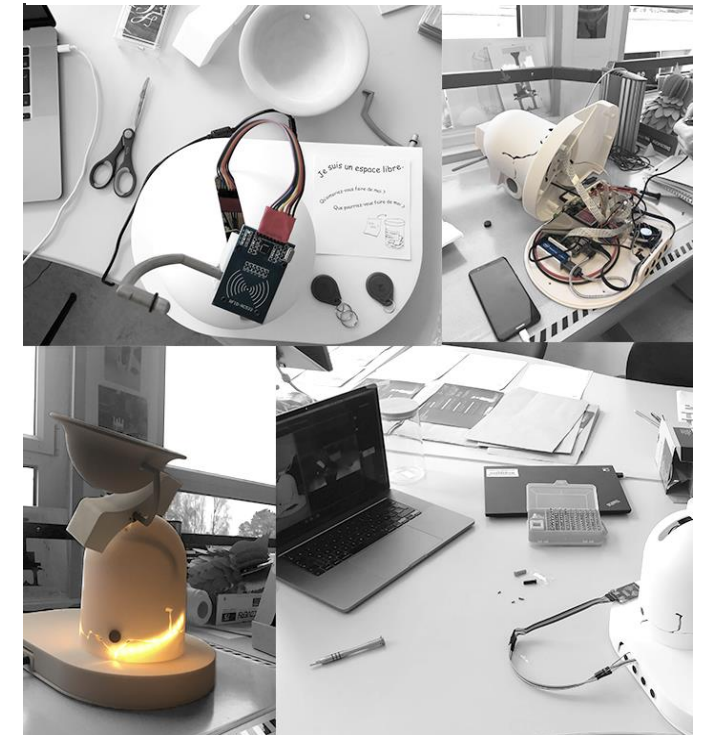




Figure 11: Photomontage showing Yōkobo in a Japanese entrance hall.

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