Demonstrating the Potential of Interactive Product Packaging for Enriching Human-Robot Interaction

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Figure 1: *Illustration of interactive product packaging for child-robot interactions:* Through co-design sessions with children, we developed a box with a social entity to guide initial interactions with social robots during the "unboxing" of the robot. The box was designed with aesthetic features to support a narrative for the box and robot, including both verbal and non-verbal communicative features to socially engage with the children. While serving as a "home", the box supported and facilitated the initial child-robot interaction, by providing introductions of the robot and instructions for initial ice-breaker activities.

ABSTRACT

While social robots are increasingly introduced into domestic settings, few have explored the utility of the robots' packaging. Here we highlight the potential of product packaging in human-robot interaction to facilitate, expand, and enrich user experience with the robot. We present a social robot's box as interactive product packaging, designed to be reused as a "home" for the robot. Through co-design sessions with children, an narrative-driven and socially engaging box was developed to support initial interactions between the child and the robot. Our findings emphasize the importance of packaging design to produce positive outcomes towards successful human-robot interaction.

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CCS CONCEPTS

• **Human-centered computing → User studies**; **Empirical studies in HCI**; **Interaction devices**; **Participatory design**.

KEYWORDS

Product packaging, human-robot interaction, initial interactions

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1 INTRODUCTION

Product packaging has a significant effect on users' first impressions of a product, initial product interactions, and re-usability to protect or sustain the product over time. These effects have important implications for the design of packaging for any product, including social robots. For social robots to be successfully adopted into everyday environments, it is important for users to develop positive perceptions and favorable relationships toward the robot during early interactions. The manner in which various design factors (e.g., packaging design, opening of the box, initial robot greeting and expression) are curated during this stage can strongly influence user engagement, expectations, perceptions, and behavior [2, 4–6] throughout the product life cycle of the robot. However, most social robots do not utilize the great potential product packaging holds as an opportunity to enrich user experience during robot interaction.

In our work, we designed an unboxing experience [3] for a commercially available social robot, *Miko* [1]. Most notably, the designed unboxing experience involved a reusable, narrative-driven, socially expressive, and interactively engaging packaging design to enrich the children's interactions with the robot. The box served as a "home" to the robot, expressed communicative features through verbal and non-verbal cues, and facilitated initial activities between the child and the robot. In this abstract, we provide an overview of the design, technical implementation, and demonstration description of the box. The associated demonstration offers a hands-on experience of the box to further illustrate the potential product packaging holds for enriching human-robot interaction.

2 DESIGN OF THE ROBOT PACKAGING

The design of the robot packaging, i.e., the "box," was based on insights we gained in exploration and co-design sessions with children [3]. Through iterative design sessions, we first explored how children naturally unboxed and interacted with a Miko robot to understand children's unboxing experience and the flow of initial interactions with the robot. We then conducted co-design sessions where children developed their preferred packaging design for a social robot. From the findings of these sessions, we created a prototype box for the robot's packaging and followed up with children to elicit their feedback. We deployed the final prototype at children's homes to assess children's experiences with it.

2.1 The Box as a Social Entity

In our co-design sessions, children described their desire to reuse and interact with the box to actively engage and build a continuous story with the robot. Participants also suggested that the box should have a social character such as a sidekick [e.g., 7] for the robot itself. From these findings, to the robot and to have its own social entity, "Freddy the Butler," which was meant to support meaningful interactions between the child and social robot. The box contained socially

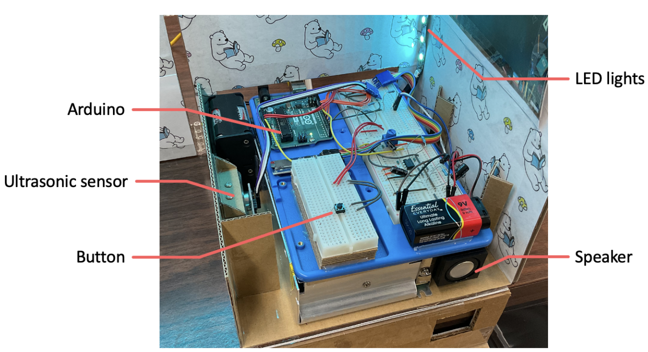

Figure 2: Technical implementation of the box

interactive elements that were used to communicate with and guide the child through the initial encounter. The main functions of the box were to introduce the robot, provide instructions on how to operate the robot and engage in ice-breaker activities, and enrich the initial interactions between the child and robot toward building familiarity and bonding with the robot. The box included an audio narrative detailing how Freddy became a butler after retiring from being a social robot itself.

3 PROTOTYPE IMPLEMENTATION

System Implementation. We used an Arduino microcontroller to implement the socially interactive characteristics of the box. Figure 2 illustrates the system implementation of our prototype.

Audio Cues. The introduction of the robot and instructions for the initial activities were delivered through pre-recorded audio cues from the box's speaker. These cues were triggered by children pressing a button for the box to "speak."

Visual Cues. LED strips were used to display lights on the box. Although lights were not tied to specific emotions, they were used to represent responsive and interactive cues. Blinking lights were used to welcome the child and express excitement, while static lights were used throughout the duration of activities.

User Detection. An ultrasonic sensor was used to detect opening of the box and to automatically initiate the unboxing experience.

4 DESCRIPTION OF THE DEMONSTRATION

In the demo, visitors will be able to interact with the box, examine its features, and participate in a "mock" unboxing experience which involves a four-phase interaction procedure – *prior interaction*, *packaging*, *first interaction*, and *first impression* [3]. The demo will show a proof-of-concept for how the box can support child-robot interactions. A typical unboxing experience with children includes opening and interacting with the box before meeting the robot. Then, guided by the box, children begin their first activity with the robot, following the instructions voiced by the box. In a similar manner, the box guides three to four initial activities to help the child gain familiarity with the robot. A supplemental child-robot interaction video will be present at the demo.

5 CONCLUSION

In this abstract, we highlighted the potential product packaging holds for enriching human-robot interaction. The design of the "box" as well as the design of the unboxing experience can overcome usability issues during initial interactions, help users gain familiarity towards the robot, build meaningful connections with the robot, and serve as a reusable "home" for the robot during its long-term use. The accompanying demo provides hands-on experience with Freddy the Butler as an instance of interactive, reusable product packaging designed for robotic products.

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