ADioS: Angel and Devil on the Shoulder for Encouraging Human Decision Making

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***Abstract*—"Angel and Devil" expression has been used to cause a dilemma in various animations and comics. In this video demo, we implemented this expression with multiple robots. We supposed a scene in daily life, a student carrying a backpack and two robots riding on both shoulders to encourage the student to make decisions. This research concept can be the novelty use case of personal AI robots. In future works, the decision-making methodologies suggested by behavioral economics, such as nudging and boosting, can adopt to human-robot interaction by using multiple robots.**

***Index Terms*—Multiple Robots, Nudge, Boost, Decision-Making**

I. Introduction

"Angel and Devil" are used to express a character's dilemma in stories. The angel represents the conscience, and the devil represents temptation. They advise on how to act from the perspective of good and evil, respectively. As a result of this interaction, the person becomes aware of their problems and actions. Therefore, it is an effective way to express visually human's inner conflict. It is often used in fiction, such as animations and comics, to create humor.

With the development and spread of AI technology in recent years, personal AI agents (PAIAs) are expected to become widespread and influence human decision-making in daily life [1]. The PAIAs need to be close to the user at all times, providing information and advice, and can be implemented by a wearable robot. Furthermore, the proximity effect may make listening to the robot's opinion easier. Some papers showed that physical contact with a robot has improved trust in the robot [2] [3] [4]. Moreover, it is important for robots and humans to share the real world, as joint attention is made possible by the robot's gaze and pointing [5] [6]. Carrying around by attaching robots to one's shoulder may facilitate sharing the real world and increase the situations where people can interact with robots. In this paper, we produced this expression with multiple robots riding on a backpack to create a dilemma.

II. Video Concept

This research concept is shown Fig. 1. An angel robot and a devil robot disagree from the standpoints of a good decision and a bad decision, respectively, which creates a dilemma. After listening to the opinions of both positions, a person thinks and selects the opinion of the angel (good decision) spontaneously. According to this decision, the person's behavior is changed. This is equivalent to boosting suggested by behavioral economics [7]. We believe that this decision-making methodology leads people to well-being (human-enriched life).

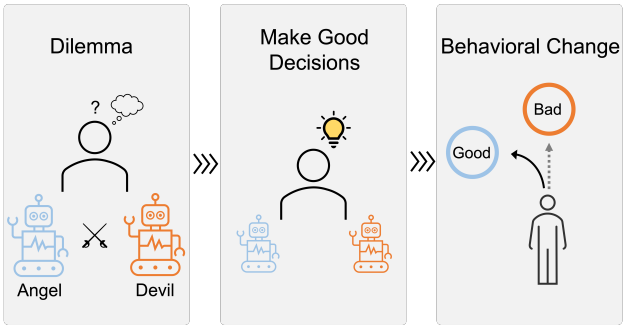

Fig. 1. Video concept image

III. Video Description

This research implements the characters of an angel and a devil to robots. We used two RoBoHoN developed by SHARP. The robots sit on boxes attached to a backpack (Fig. 2 and Fig. 3). One robot will be an angel in charge of reason, encouraging good decision-making. The other robot will be a devil in charge of instinct, which tempts bad decision-making. We envisioned a scene in daily life where a student is carrying a backpack, and two robots ride on both shoulders to encourage the student to make decisions.

In case 1, a student goes classroom using an elevator. However, a notification on the wall near the elevator says to

use the stairs to go up two floors or down three floors due to saving electricity. The student is only urged not to use the elevator, not have to follow it. In other words, the student is free to make her own decision, and some students like her ignore this notification and use the elevator. The robots are used to create a dilemma and encourage behavioral change. After listening to the advice of the angel/devil robot, the student thinks about whether to take the stairs/elevator. Finally, she agrees with the angel's advice and decides to take the stairs.

In case 2, a person uses a smartphone to contact a friend while walking. The angel reminds her that it is dangerous to walk while using a smartphone and that she should use it near the wall side of the hallway. The devil says that it is inevitable that she contacts using a smartphone and she can continue it because nobody is around. The person agrees with the angel's advice and stops walking the hallway, thus avoiding any collision with a pedestrian.

Fig. 2. Two RoBoHoN sit on boxes attached to a backpack.

Fig. 3. The perspective of a person.

IV. Conclusion

In this video presentation, "Angel and Devil" was expressed with two shoulder-mounted robots to demonstrate the research concept. Based on this concept, we believe that further implementation and experimental verification of the system will provide a new perspective for research in the field of human-robot interaction.

We plan to implement the concept proposed in this video presentation as a robot system and conduct evaluation experiments. Moreover, it may be possible to encourage people to make good decisions using two robots, as shown in this video. Nudge and boost are methods to encourage human behavior change [7]. Nudge is to encourage people to choose in a specific direction by using the power of choice architecture. Boost is an intervention to help people make judgments and decisions while maintaining their autonomy by enhancing their cognitive skills or helping them acquire new ones. These are future works.

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