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Abstract

論文内容の要旨　(博士)

Title of Thesis 博士学位論文名	Proto-communication, Social Bonding and Persuasiveness for Minimally Designed Robots Scaffold by Non-Expert Trainers

(Approx. 800 words)
(要旨　1,200 字程度)

In aiming to build teachable robots, child development, persuasive techniques and the human learning process serve as inspiration. Children naturally interact with adults to learn new things in social situations. They motivate caregivers that seek out learning partners and learning opportunities. Caregivers in return try to teach the children new abilities by mirroring the most used (child's requests, caregiver's previous responses) combinations to identify the best answer that suits the child's real time request.

We call this action of teaching children new abilities on-line, dynamic scaffolding. A primary hypothesis of this work is that a social robot can be considered as a child while the non-expert trainer is the one responsible of doing this dynamic scaffolding.

In a dynamic scaffolding situation, the caregiver maintains a mental model of the learner's understanding and structures the learning task appropriately with timely feedback and guidance. The learner contributes to the process by expressing their internal state via a visible feedback. This reciprocal interaction enables the learner to leverage from instruction to build the appropriate representations and associations so that a smooth meaning construction emerges (communication protocol).

The problem in the case of the human-robot interaction (HRI), is that a non-expert trainer could assign some instructions to the robot and then forgets about them, etc.. That it is why, dynamic scaffolding of robots by non-expert trainers could lead incrementally with difficulties to the construction of a protocol. However, such HRI could encounter several breakdowns during the protocol construction or reuse. In fact, to incrementally build up a smooth stable protocol, we need to track how in the case of the human and the robot, patterns of communication could be formed. In this context, we intend to use the sociable dining table (SDT), to explore the proto-communication process based on a WoZ experiment. After extracting the redundant patterns

of interaction while the communication channel is the knocking, we propose an architecture that enables the robot to interact with the human autonomously.

If we suppose that the robot could have been abandoned for a long period and the non-expert trainer decides to use it, it is very probable that he could have forgotten the protocol's different rules. That it is why, the reuse could encounter many difficulties. In such a case, the robot is taken as a scapegoat while it is the human's fault if the interaction was not smooth during the communication protocol reuse. Consequently, the robot should try to mitigate the previously established communication protocol (PECP) reuse process different breakdowns as we cannot face the human with his faults because this may threaten his social face.

We propose to use inarticulate utterances (IUs) as a way that may refresh the human's memory. In fact, if we suppose that IUs are used during the first interaction's instance (encoding phase), the remembrance of the PECP could be facilitated if the robot generates the IUs before that it executes the behaviors so that the human could remember the rules of the PECP and avoids the faulty robot's behaviors without that the human's social face is attacked. We tested our method on two robotic platforms: SDT and mobile-robot (ROBOMO).

Such a method could be useful for people who are relational but for some cold-hearted people, it is difficult for them to afford the needed attention and feel the bonding for the robot so that they can encode the communication protocol during the first interaction's instance. That it is why, in our work we propose a tool that helps to measure the social bonding to detect whether a behavior could have led to an increase in the positive emotions. Positive emotions are the motivator for people to encode the rules on their minds using the audio icons (IUs). We validated our tool and we use it in a case study where we prove that using a proactive robot is better suited for the case of minimally designed robot-non expert trainer interaction. ROBOMO was used during the experiments that are related to the social bonding problematic.

As the reuse of a the PECP could be difficult for some people which we classify under the blanket of "utilitarian people" (because the social bonding is low for them), we show in a first study that there is a period of time called "gamma window" during which the human's mind is easy to be guided by a persuasive message so that the non-expert trainer keeps on training/ or reusing the PECP. We call upon the persuasiveness rather than only the bonding that could evolve to make sure that users continue taking part in interaction with the robot any how is their profile (whether utilitarian or relational). We prove that if a persuasive strategy is used by the robot during the gamma window, the human could be persuaded to continue interacting with the robot.