

Super Wizard of Oz technique to study human-robot interaction

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Résumé:

Les robots humanoïdes sont de plus en plus réalistes mais ces systèmes sont loin d'avoir le même niveau d'interaction qu'un être humain. Les modèles comportementaux contrôlant ces robots ont encore du mal à capturer et répliquer l'extrême complexité de la communication humaine. Afin de déterminer les véritables limites et les points essentiels que l'on doit imposer à un modèle comportemental pour que le robot puisse maintenir une interaction aussi naturelle et efficace qu'un humain, nous proposons de construire et d'utiliser une plateforme de super Magicien d'Oz. Cette plateforme est composée d'un capteur FaceLab qui délivre le mouvement rigide de la tête et la position du regard d'un complice en temps-réel et d'un robot iCub qui réplique les mouvements du complice. En manipulant certains paramètres de façon paramétrique comme le délai, l'utilisation de cette plateforme permettra de déterminer les limites nécessaires à imposer à un modèle comportemental.

Mots-clés : Magicien d'Oz, regard, mouvement de tête

Abstract:

Humanoid robots are more and more realistic but these systems still fail to be as friendly and natural as humans in interaction. Behavioural models of interaction controlling these robots cannot capture and replicate the extreme complexity of human communication. To determine the real limitations and key factors one must impose on a behavioural model to maintain a human-robot interaction as natural and efficient as a human-human interaction, we propose to build and use a super Wizard of Oz setup. This platform consists of a FaceLab sensor able to track a confederate's rigid head motion and gaze in real time and of a iCub robot able to replicate the confederate's movements. By manipulating certain key parameters, we will be able to determine the necessary limits to impose on a behavioural model.

Keywords: Wizard of Oz, gaze, rigid head motion

1 Introduction

Humanoid robots use advanced technologies and theories and are getting more and more complex. Yet, these systems still fail to be as

friendly and natural as a 'real' human in interaction. The main reason of this failure may be due to the extreme complexity of human communication. The common approach consists of building behavioural models of interaction from theories and/or observation of real data. In fact, the implementation of these models commands the limitations of those systems as they cannot replicate the richness of human behaviours. Recently, a small number of teams have started investigating the role of certain nonverbal behaviours in dyadic interaction by turning around the problem. They used an enhanced *super Wizard of Oz (WoOZ)* setup that was mirroring some facial and eye movements on a robot face rather than proposing a set of pre-defined responses as in the traditional WoOZ. For instance, Hiroshi Ishiguro and colleagues [1, 2] developed an android robot Geminoid HI-1 which closely resembles its scientific originator. It can be remotely controlled by teleoperation: a confederate's lips and head movements are cloned on the robot face. The authors have started investigating how real human feel when interacting with this 'almost' human [2]. Another system composed of an eye and head tracker, a robot head, a pair of camera motion devices (robot eyes) and a teleoperation link that connected the motion tracker to the motion devices has been proposed [3]. The confederate (i.e., the puppeteer) watches and reacts to the video stream of the person interacting with the robot. This system is more accurate than the previous one for cloning rigid head motion and gaze. On the other hand, the use of a non-realistic head robot does not allow replicating non rigid facial movements (lips, jaw, eyebrows, etc.).

In order to determine the real limits and key factors one must impose to a behavioural model to maintain a human-robot interaction as natural and efficient as a human-human interaction, we propose to build and use a super-WoOZ setup. The originality of this project relies on the full control of robot's behaviours by a human becoming a puppeteer and on the real time manipulation of specific behaviours.

2 Methods

The *super WoOZ* platform consists of:

- a sensor (FaceLab5, Seeing Machines) to determine the confederate's head rigid motion and gaze position at any time;
- a software program to apply online manipulation to specific parameters;
- a humanoid robot (iCub).

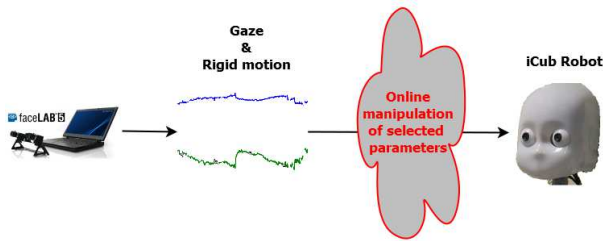


Figure 1: Schematic representation of the super WoOZ setup. A FaceLab sensor captures the confederate's rigid head motion and gaze position continuously; then, an online manipulation can be applied to any parameter; finally the iCub robot replicates the original or manipulated confederate's movements.

A schematic representation of the setup can be seen on Figure 1. The FaceLab sensor provides accurate measurement of the confederate's eye gaze and head rigid motion. On the robot side, the iCub robot (<http://www.icub.org/>), a 1 metre high humanoid robot with eyes, head, arms and hands fully controllable in real-time. Between the sensor and the robot, a software program captures the gaze and rigid head motion data from the FaceLab sensor (latency equals to 50 ms) and applies (or not) modifications to the signals before sending it to the robot which mimics the confederate's gaze and rigid head motion. A perfect correspondence exists between the robot's and the confederate's movements for the eye and head rotations. The con-

federate can sense the scene in front of the robot by either watching the video streams from the two cameras placed in the robot eyes or the video stream from a Kinect sensor placed on top of the iCub's head. This additional sensor is also used to determine the eye vergence by sensing the depth of the current gaze point.

3 Future experiments

The eyes and more specifically the gaze is an important signal for social communication. Several factors influence eye gaze pattern during a dyadic interaction [4]. We will investigate the role of latency by delaying the confederate's gaze and rigid head motion data before applying them on the iCub robot during dyadic interaction. Another topic of interest is the eye vergence. In fact, if the eyes are not converging with the right depth, one may perceive he/she is not the point of interest of the interlocutor. We will manipulate parametrically the eye vergence to estimate the limit of acceptable values during face to face interaction.

Acknowledgements

The authors would like to thank Simon Robert. This work has been supported by the SWoOZ project (ANR 11PDOC01901) and FP7 project EFAA (270490).

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