

Chapter 12

Intention and Body–Mood Engineering via Proactive Robot Moves in HRI

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ABSTRACT

This chapter focuses on emotion and intention engineering by socially interacting robots that induce desired emotions/intentions in humans. The authors provide all phases that pave this road, supported by overviews of leading works in the literature. The chapter is partitioned into intention estimation, human body-mood detection through external-focused attention, path planning through mood induction and reshaping intention. Moreover, the authors present their novel concept, with implementation, of reshaping current human intention into a desired one, using contextual motions of mobile robots. Current human intention has to be deviated towards the new desired one by destabilizing the obstinance of human intention, inducing positive mood and making the “robot gain curiosity of human”. Deviations are generated as sequences of transient intentions tracing intention trajectories. The authors use elastic networks to generate, in two modes of body mood: “confident” and “suspicious”, transient intentions directed towards the desired one, choosing among intentional robot moves previously learned by HMM.

1. INTRODUCTION

Recent developments on both artificial intelligence and hardware capabilities for the robots resulted in greater advances in the field of Human-Robot Interaction (HRI). Nowadays, robots are integral parts of both industry and our homes, assisting or replacing humans but working with them (Erden & Tomiyama, 2010). Assistant robots should thus understand and model intents and tendencies in these interactions if they want to satisfy needs of their interacting human agents (Yokoyama & Omori, 2010). Such robots

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have the capability to recognize intentions and emotions of other agents and can interact exhibiting social behaviors and are consequently called socially intelligent robots (Kerstin Dautenhahn & Billard, 1999).

During social interactions between intelligent agents, estimating the intentions and emotions of one another, termed social cognition (Fong et al., 2003), is required to infer the social behavior of the opponent which eventually results in inducing one's own intentions onto the other by compromises or persuasion (Heinze, 2003; K. A. Tahboub, 2006). Morphing actions on intentions also called reshaping (Durdu et al., 2011) are strategic moves of an agent with the purpose of attaining a desired change on the other interacting agent based on the statement that one's intentions direct one's future planning (Bratman, 1999). In our previous study Durdu et al. (2011), introduced a new approach on intention reshaping performing social moves for changing current human intentions. We extend this work by controlling this change according to obeying a desired intention trajectory. Full-autonomous robots then model social cognitions from the on-line observations of human headings and trajectories, planning their own trajectories in ways familiar to the human using elastic networks. According to the detected human-body mood and the estimated current intention of the person, generation of trajectories aims first to break the obstinance of the person increasing his/her confidence with the robot and the environment, then enabling reshaping actions. This approach emulates a social interaction between humans, increasing the chance of the robots to understand human behaviors and react proactively.

The main motivation behind developing such sociable robot having enhanced social cognition abilities is to realize real life cooperation scenarios with human, such as guiding people in emergency situations where verbal communication is impossible by classifying them as being confident or suspicious and treating them accordingly. In addition, these robots can be used commercially catching the attention of the people and leading them towards their shops generating purchase intentions. Moreover, they can be versatile companions for the needy in smart homes by understanding intentions and offering service even when intentions are quickly forgotten by patients.

The phases in our intention reshaping system as it is for every social engineering attempts of socializing agents are: choosing a desired intention; estimating the current intention of the person; also detecting human body-mood as *confident* or *suspicious* underlying resilience to social engineering; generation of transient intention trajectories (way points) towards convergence to the desired one. Transient trajectories are generated in dense intention areas in the feature space "familiar" to human subjects around the current intention until a *confident mood* detected on the human. The aim of this generation is to "break the obstinance of the person" and "gain the curiosity and the trust of the person" relying on the psychological research that a *confident mood* results in more external-focused attention (Fredrickson, 2003; Grol et al. 2013; Sedikides, 1992). The idea of generating transient intentions close to the human's current one with the aim of inducing confidence originates from the research that, inducing a *confident mood* is realized by gently approaching to the person, making him/her feel more comfortable with the social interaction (Butler & Agah, 2001; Huettneraich et al., 2006; Mead & Matarić, 2011). In addition, detection of the human body-mood is based on the orientation of the human heading towards the robots adapted from "proxemic behaviors" in psychology to HRI as studied in (Pacchierotti et al., 2005). Each generated transient intention is realized by the robot choosing adequate heading and trajectory planning based on learned experience.

Figure 1 demonstrates our approach on intention reshaping with all essential phases in robot cognition towards intention engineering. As in the figure, after the robot moves, human intention is estimated and compared with the desired one. A mismatch results in the detection of the human body-mood and then

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