Designing social robotics systems

Telepresence experiences for educational contexts

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Designing social robotics systems.

Telepresence experiences for educational contexts

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Abstract

Among these assistive technologies, telepresence robotics, which is the subject of this dissertation, aims not only to connect teachers and students at a distance, but also to become a tool for social integration, introducing a new relational paradigm based on machine-mediated communication between people. Telepresence robotic tools were born mainly for commercial, market-oriented work environments (offices, laboratories) with a lower social impact.

Today, the telepresence robot is mainly considered as a connection tool (audio and video), but capable of moving in space with different degrees of freedom, hence its robotic nature. In other areas, however, there are case studies in which the social and relational impact of the telepresence robot becomes the primary objective of its mission, such as in the assistance of patients or the elderly and in schools, the area addressed by this project.

In the school scenario, telepresence robotics offers students who are absent (for reasons of temporary disability or temporary inability to attend) the opportunity to participate in lessons and to share group teaching activities, as well as leisure and socialising moments.

Despite a growing scientific interest in this practice, the experiments carried out worldwide are limited both in number and in innovation in terms of the service and performance offered by a machine that is, in most cases, chosen from those available on the market.

It is therefore the first phase of studies with a strong empirical character, far from being a structured model for a widespread application of this tool in schools, which is the primary mission of this research/action. The thesis focuses on human-robot interaction, in particular on telepresence robotic systems to be applied in the educational context.

The main objective of the thesis is to explore telepresence robotics as a tool for social inclusion in distance learning through design research, in order to define the conditions for the machine to be accepted by students at different levels of education. Specifically, the research aims to answer three research questions.

The first is to understand the dynamics involved in the application of telepresence robotics in educational contexts with a high social impact and the perception of these artefacts by the actors of the system (remote/presence). The second research question is to explore the factors that need to be considered when using telepresence robots in the school context to improve the psycho-physical well-being of remote students. The last research question focuses on investigating the elements to be considered in a telepresence robot to be developed and implemented for service in the educational context.

The first chapter of the thesis lays the groundwork to provide an overview of the scientific problem of school accessibility and the possible technological solutions adopted over the years. This work introduces the topic of telepresence robotics as a tool to support distance learning for the significant social presence of students unable to attend a physical meeting.

The second chapter presents the research methodology based on two approaches: Human Centred Design (HCD) and Research through Design (RtD).

The third chapter is devoted to exploring and describing telepresence robotics in different social contexts of application and the dynamics involved in interacting with the machine, the system of

actors involved and their role in interacting with the machine.

The fourth chapter focuses on the topic of robotics in education, starting with a literature review on educational robotics, moving on to the experiences of telepresence robotics in school settings with the analysis and categorisation of case studies to arrive at the definition of the conceptual framework. The review of educational robotics helped to understand the characteristics of these technologies and how they support social inclusion, expanded accessibility, and active and personalised learning.

The following chapters are devoted to exploring applications of telepresence robotics in two different grade levels, primary and university, to arrive at a customisable service model based on who experiences the machine.
The first *Are you me?* experience was devoted to developing the re-embodiment of the telepresence robot with primary school students through a co-design protocol for prototype development. The second experience focused on telepresence robotics in the university setting to characterize the robot through a workshop, *RoboPoli - my robotic avatar on a university campus*, conducted in co-design with students, again leading to new prototypes. Finally, the last experience explored the topic of telepresence in the university setting through other technologies. Starting from the case study *Avatar Professor,* a holographic projection project for distance education, a speculative design workshop activity was developed with university students, leading to new telepresence artefacts.

The last two chapters are dedicated to the research findings defined through the data reflection process obtained above. Therefore, the research contributes both through methodological implications for theory in HRI, implications for robot behaviour design, and implications for the design of social telepresence robots to be introduced in the school setting.