Ph.D. in Information Technology
Thesis Defense

January 13th, 2022
at 14:00
Conference Room "Emilio Gatti" and online by Webex

Micol SPITALE – XXXIV Cycle

Conversational Agents for Children with Language Impairments: Design and Technology

Supervisor: Prof. **Franca Garzotto**

Abstract:

About 7.5% of children worldwide are diagnosed with language impairments. The traditional linguistic therapeutic interventions usually lack attractiveness and engagement, highlight children's weaknesses rather than their strengths, and focus on stimulating linguistic skills instead of spurring them alongside the extra-linguistic ones, e.g., cognitive aspect and social skills. Recent studies have pointed out the potential of adopting innovative technologies into speech-language therapy to overcome those limitations. Specifically, conversational agents have emerged as promising tools for children with language impairments.

This thesis explores the following research questions to address state-of-the-art gaps: *"Can conversational agents help children with language impairments to improve their linguistic capabilities? What is the most suitable form of embodiment for these agents? What are psycholinguistic methods appropriate to inform their design? How can the development process be improved to facilitate reuse, portability, and scalability?"*

This Ph.D. thesis sought to answer the research questions as follows.

(1) We ran four empirical studies involving a total of 47 children with and without language impairments who interacted with a conversational agent represented by different forms of embodiment.

(2) In collaboration with researchers in speech-language therapy, we identified a psycholinguistics method that we translated into a set of *design patterns* for a therapy-oriented conversational agent. Such patterns, named Activity Patterns, were defined at multiple levels of abstraction - from task

flow and interaction design to implementation architecture - and provide reusable solutions to facilitate the development process.

(3) We designed and implemented a modular, composable, pattern-oriented, and robot-agnostic ROS-based framework for SAR-based conversational interactions, namely HARMONI (Human and Robot Modular Open Interaction). Conversational interactions implemented with HARMONI exploit a variety of behavioral patterns (including the ones mentioned above), are portable on different robotic platforms and can be easily extended/modified to address the requirements of different therapeutic scenarios.

PhD Committee
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