C. Urdiales, J. Peula, C. Barrué, E. Pérez. A new collaborative-shared control strategy for continuous elder/robot assisted navigation. Gerontechnology 2008; 7(2):229. Autonomy in an agent can be defined as the ability to perform activities independently. It has been reported that mobility is of key importance for a person to be autonomous. However, a physically and/or cognitive challenged person may require some assistance to achieve autonomous navigation, either from a machine or from other persons. The lack of human resources to assist elderly people has lead to the creation of supportive systems. The most typical mobility assistive devices are powered wheelchairs. However, not everybody is able to fully control a powered wheelchair. Poor design can result in systems that are difficult to learn to use and may even lead to catastrophic errors. Traditionally, robotics has offered an alternative to human controlled wheelchairs. A mobile is considered to be autonomous when it can perform a task in a dynamic environment without continuous human guidance. It can be observed that most approaches to shared control usually rely on swapping control from a human to a machine according to a more or less complex algorithm. We propose a new-shared control approach. Its main novelty is that the machine and the human, in particular elderly, cooperate continuously to achieve a better result than when one or the other performs, but it always keeps the human in charge of his/her own navigation. Our approach relies on locally evaluating the performance of the human and the wheelchair for each given situation. Then, both their motion commands are weighed according to those efficiencies and combined in a reactive way. This approach benefits from the advantages of combining typical reactive behaviours from different sources of information into an emergent trajectory in a simple, seamless way. The system has been tested amongst 30 volunteers presenting different disabilities ranging from minor to mild and a Meyra wheelchair modified to run an autonomous navigation system. All tests have been performed at the FSL (Fondazione Santa Lucia) in Rome under the supervision of engineers and doctors. Performances were carefully evaluated using common metrics in wheelchair navigation and also new metrics designed specifically for this type of control. A representation strategy has also been developed to visually evaluate efficiency at each point of a trajectory in terms of the local efficiency factors. In almost every case, the combined performance of person and machine improved the driving of the human, even when he/she did not realize it (*Figure 1*). In many cases it also improved the performance of the robot, especially in situations where reactive control has been reported to fail, like doors or closed obstacles. Future work will focus on extending this study to persons presenting more severe disabilities and more complex scenarios. In these cases, development of higher-level layers will most likely be necessary. Doctors are also interested in correlating present results with the functional disability degree of each in-patient.

References

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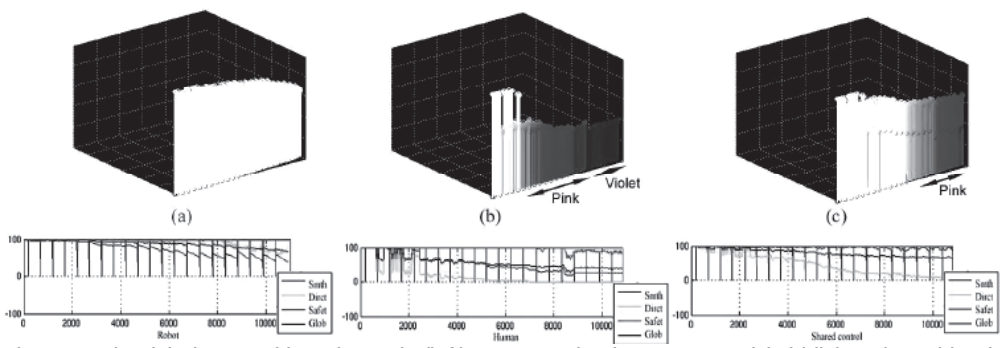

Figure 1 Wheelchair control by robot only (left), compared to human control (middle) and combined control (right)