Chapter 6
Once More, with Feeling

No, No, Yes, No, I tired that, yes both ways, no I don’t know, no again, are there any more questions? Good.

- Xena, the Warrior Princess

At this point, we knew the protocols by heart, so we followed every step once more, only this time it was decided to work in a house-like environment. This would provide a more realistic place to run our tests and, also, we could work with persons with higher disability indexes and not interfere with hospital activity. FSL kindly provided access to Casa Agevole (Fig. 6.1), a 60 m² house built within the hospital complex in Rome (http://www.progettarepertutti.org). Casa Agevole has the minimum requirements to be standard-compliant, specifically meaning, in our case, that doors width and room sizes are very reduced, yet appropriate for wheelchair navigation and should fit our needs. Or, in other words, if our wheelchair can not navigate within this house, it could be of no use to operate in a common one.

6.1 A New Beginning

Our new experiment setup consisted of entering the house via its main door (150 cm wide), moving on to the main room and then turning right to enter a second room. This second room was split in two by a cupboard, that the person would face immediately after turning right. Then, he/she had to move between the wall and the cupboard, separated approximately 90 cm, and again to the right, to reach a table in that area. The only guideline provided to the person, after a short tour of the house, was to reach that table. Since we also wanted to check the impact of cognitive disability in direction keeping, it was not allowed to provide further instructions while driving, but, as in previous experiments, there was always someone walking behind the wheelchair to stop it in case of emergency. A tentative trajectory is printed in Fig. 6.1 along with some views in key points of the path, but it must be noted that each person would most likely follow a different path depending on how soon or fast they turn, how close they get to obstacles, etc.
The population involved in these experiments is briefed in table 6.1. In this case, some persons presented severe disabilities so severe that some of them required mechanical help to be transferred to the wheelchair. Others had a very low MMSE and in some cases it was even hard for them to remember what they had to do during the tests. In fact, they had been specifically chosen by the medical staff to test collaborative control to the limit with a population structured to cover all disability profiles we could think of.

In this case, they trusted us enough to let us capture benchmark trajectories for every volunteer in standalone mode, as long as the safeguard layer was always active. Then, we repeated the test with collaborative control. From this second trajectory, we captured traces to let the system learn how the person drove and made a third go with the proposed CBR based technique. It is important to note that our CBR actually learns from collaborative data for two reasons: i) some persons were not even able to cross the doorway on their own; and ii) if a person was not capable of a certain action, the system would neither be if it just copied the person’s actions. If we

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1 The wheelchair stopped if obstacles were closer than 30cm.