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# The MICRobES Project, an Experimental Approach towards “Open Collective Robotics”

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**Abstract.** We focus here on “Open Collective Robotics”, a research domain interested in studying concepts and techniques which could lead to true collectivities between humans and robots. We also present the MICRobES project<sup>1</sup>, a long-term experiment intended to investigate how to design such collectivities. Therefore, the MICRobES robots have no prior specific functionality, they have to develop individual competences, a social organization, and sociability towards humans in order to “survive” in a dynamic environment.

## 1 Towards “Open Collective Robotics”

As an analogy to the definition of Hewitt’s “Open Systems” – work groups mixing humans and software agents – we call “Open Collective Robotics” (OCR) the study of collective robotic systems that would be able to operate in an autonomous, adaptive way in a human environment.

Classical experiments, done either in a close, controlled environment, or in open ones completely adapted to the robots, neglect too much the huge dynamicity of the real world, in which those robots will have to operate sooner or later. Thus, the robots should rather be designed as *physically and socially situated* agents to have the ability to dynamically adapt themselves to a human, complex, environment. Social aptitudes already exist in many multi-robot systems but they usually apply to the organization of the robots only. Some experiments on human-robot interaction have been done, but concern immobile robots. Finally, the museum guides give interesting examples of single robots operating in dynamic environments. The MICRobES project is an attempt to integrate those three issues.

## 2 The MICRobES project

The MICRobES project is an OCR experiment that started in April’99 at the LIP6. It consists in studying the long-term adaptation (at least 2 years) of a micro-society composed by autonomous robots immersed in a “normal” and inhabited environment: the laboratory. The robots colony does not have any specific, functional goal

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but “surviving” in a real ecosystem which is unknown and highly dynamic. Therefore, they have to make maps, localize themselves, organize themselves (to coordinate one with another, to exchange informations...), and interact with humans (source of help or information). Thus they need individual and collective competences that allow them to confront themselves to unexpected situations, environmental changes and new kinds of events, either in their physical environment or in their robotic and human social environments. We think that this “ontogenic” step is absolutely essential before trying to make the robots perform any functional task.

Robots are seen as individuals by humans: thus their social organization must be easily understood by people. However, human-specific features are not essential to build a complex social structure: for example, primate groups exhibit sophisticated social behaviors. Previous works on this subject [1] have shown that simple social cognition models could be successfully implemented to reproduce their behavioral characteristics. They can easily be applied to robotics to define adaptive hierarchies or affiliations between agents, in order to avoid or solve conflicts (e.g. access to energetic resources). Before being implemented on the robots, those behaviors are currently being investigated in simulation. It is also essential to provide the robots with social aptitudes towards the humans working in the lab, since the project is intended to last during a long period of time and therefore implies the elaboration of shared rules of life in society. Two general principles will be applied: to avoid conflicts (not to make the robots a nuisance for the humans, neither the contrary); to encourage interactions (to make the staff pleased or interested in interacting with the robots, and the robots “curious”). We will be helped in this task by sociologists from the ‘École des Mines de Paris’ and from the EHESS.

The originality of our project consists in going against the general trend regarding its working hypotheses and its purpose – to build a long-term social network between two populations (robotic and human) sharing the same environment. At present, a considerable work has been done to give the MICRobES robots physical aptitudes to navigate, make maps, recharge themselves, etc. [2]. A first model of human-robot interaction, applied to map learning, has also been designed [3]. We should go further in the next months by focussing on the social organization and basic interaction abilities with humans.

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