

RobotCub: An International Project on Humanoid Cognitive Systems

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Until recently, the study of cognition and the neuro-physiological basis of human behaviour was the subject of quite separate disciplines such as psychology, neurophysiology, cognitive science, computer science, and philosophy, among others. Mental processes were mainly studied in the framework of abstract theories, mathematical models, and disembodied artificial intelligence. It has now become clear that mental processes are deeply entwined with the physical structure of the body and its interaction with the environment. The physical body and action together play as much of a role in cognition as do neural processes. Human intelligence develops through interaction with objects in the environment and it is shaped profoundly by the interaction with other human beings. These concepts are now altering in a fundamental way disparate fields such as neuroscience, information science, psychology, and robotics which before had been worked in isolation but are now learning from each other and together are building a new interdisciplinary science. As such, the study of cognition and intelligence is more and more dependent on the use of physical bodies, and, ultimately, on the use of humanoid robots. Humanoids are essential tools in the study of human intelligence: since cognition and the development of cognitive skills are a function of both neural and physical activity, it is important to simulate human action when investigating the components of intelligence (learning, adaptation, anticipation, reasoning, memory, communication, and language).

RobotCub is an Integrated Project funded by European Commission through its Cognitive Systems and Robotics Unit (E5) under the Information Society Technologies component of the Sixth Framework Programme (FP6). The project was launched on the 1st of September 2004 and will run for a total of 60 months. The consortium is composed of 10 European research centres and is complemented by an international advisory committee from the USA and Japan, all specialists in robotics, neuroscience, and developmental psychology.

RobotCub has two main goals: (1) to create a new advanced humanoid robot – named the iCub – to support Community research on embodied cognition, and (2) to advance our understanding of several key issues in cognition by exploiting this platform in the investigation of cognitive capabilities. The iCub is a 53 degree-of-freedom humanoid robot of the approximate size of a three year-old child. It will be able to crawl on all fours and sit up. Its hands allow dexterous manipulation and its head and eyes are fully articulated. It has visual, vestibular, auditory, and haptic sensory capabilities. The iCub is an open platform. Users and developers can use it and customize it freely under a GPL license. It is intended to become the research platform of choice for Cognitive Systems research.

The iCub will develop its cognitive capabilities in the same way as a child, progressively learning about its own bodily skills, how to interact with the world, and eventually how to communicate with other individuals.

Apart from the scientific activities, RobotCub is establishing an international Research and Training Site (RTS) with the goal of maintaining and updating the iCub design. The RTS will be equipped with three complete iCubs and develop a programme of short-term visits for scientists to use the iCub for experimental research. The RTS will provide training courses for scientists and students on building, using, and developing the iCub. The RTS is located in the premises of the Italian Institute of Technology (IIT) in Genoa. Further, to help researchers get their own iCub, the RobotCub project has launched an Open Call for proposals. Six successful proposers were selected and will receive a complete iCub free-of-charge. Roll-out of the iCubs to the successful applicants will be effected in three phases, each phase lasting six months. The first two robots are scheduled to be delivered by the summer of 2008.