When Psychology and Technology Converge. The Case of Spatial Cognition

Orazio Miglino

Natural and Artificial Cognition Lab, Department of Humanities, University of Naples Federico II, www.nac.unina.it, orazio.miglino@unina.it

Abstract. The behaviors of spatial orientation that an organism displays result from its capacity for adapting, knowing, and modifying its environment; expressed in one word, spatial orientation behaviors result from its psychology. These behaviors can be extremely simple (consider, for example, obstacle avoidance, tropisms, taxis, or random walks) but extremely sophisticated as well: consider for example, intercontinental migrations, orienting in tangled labyrinths, reaching unapproachable areas. In different species orienting abilities can be innate or the result of a long learning period in which teachers can be involved. This is the case for many vertebrates. Moreover, an organism can exploit external resources that amplify its exploring capacities; it can rely on others help and in this case what we observe is a sophisticated collective orienting behavior. An organism can use technological devices as well. Human beings have widely developed these two strategies - namely either exploring its own capacities or learning new orienting skills - and thanks to well-structured work groups (a crew navigating a boat, for instance) and the continuous improving of technological devices (geographical maps, satellites, compasses, etc.), they have expanded their habitat and can easily orient in skies and seas. It also is possible to observe orienting behaviors in an apparently paradoxical condition: exploring a world without moving ones body. In the present day a lot of interactions between humans and information and communication technologies (mobile phones, PCs, networks) are achieved using orienting behaviors. The best example is the World Wide Web: the explorer in this pure-knowledge universe navigates while keeping his/her body almost completely still. Spatial orientation behaviors are the final and observable outcome of a long chain made up by very complex psychobiological states and processes. There is no orienting without perception, learning, memory, motivation, planning, decision making, problem solving, and, in some cases, socialization. Explaining how an organism orients in space requires study of all human and animal cognition dimensions and, for this reason, psychology, and in more recent years anthropology, ethology, neuroscience all consider orientation a very interesting field of study. Bulding-up artificial systems (digital agents, simulated and physical robots, etc.) that shows the (almost) same behaviors of natural organisms is a powerful approach to reach a general theory of (spatial) cognition. In this framework the artificial systems could be viewed as new synthetic organisms to be behavioural compared with biological systems. On the other hand,

this approach could produce more adaptive and efficient systems artificial systems (such as autonomous mobile robots). I will present different experiments in Evolutionary Robotics designed to explain spatial cognition at different level of complexity (from avoiding behaviours to detour behaviours). Finally, I will try to delineate some general principles to building-up adaptive mobile agents.