## MOTION AS IT COULD BE: PAVING THE WAY FOR ALIFE ACTORS


ABSTRACT

The time for biology has come. The Decade of the Brain closed the twentieth century, and the new one started with the sequentiation of the entire human genome. Since then, the avalanche of information and knowledge has brought about the rapid development of new tools to process and understand biological data. Scientific fields like computational neuroscience, and bioinformatics have been built upon computer-intensive simulation, and new disciplines will soon emerge to explain embryological development and the evolution of life on Earth. Artificial Life has to do with methods to mimic living phenomena, and its techniques have perfused the animation industry since its very beginning, resulting in well-established contributions in automating time-consuming processes relative to props and secondary characters, like vegetal modeling or crowds animation. Nevertheless there is much more to Artificial Life than just familiar carbon-based life forms, it also concerns life as-it-could-be. Indeed, if biological evolution has given rise to the myriad of species that have inhabited our world (alife and extinguished), evolutionary computation allows us to explore possible morphologies and behaviors, resembling those that might have existed, be it on Earth, or in scenarios ruled by different physical laws. Inspired by this notion, a methodology is presented for behavioral animation that prospects unlimited spaces of possible behaviors, aims at automating concrete motion planning tasks, and are grounded in evolutionary methods and artificial embryology. In essence, it will be theorized (and illustrated with examples) how motion planning for non-trivial reactive behaviors can be automated by (1) evolving a control system (integrating sensorimotor and muscular functions) that exhibits the required behavior, (2) embodying it into the character's body, and (3) animating the character with the behavior that its control system generates in a particular environment. Additionally, it will be shown that the springs network is an adequate model for the physical substrate, to implement the control system, and also that efficient and original controllers can be evolved for some non-trivial behaviors, such as gliding, unpropelled landing, and path-following. This approach allows to start thinking on semiautomating tasks of the animation process that could hardly be attacked in the past, as they heavily rely on human creativity. Now, ALife brings about the possibility of creating a rich and diverse catalog of original behaviors, by simulating them in a cluster of computers: a sort of zoo of computational creatures that continuously adapt and compete to behave in simulated scenarios. These creatures are training hard to become the new actors of computer-animated films.