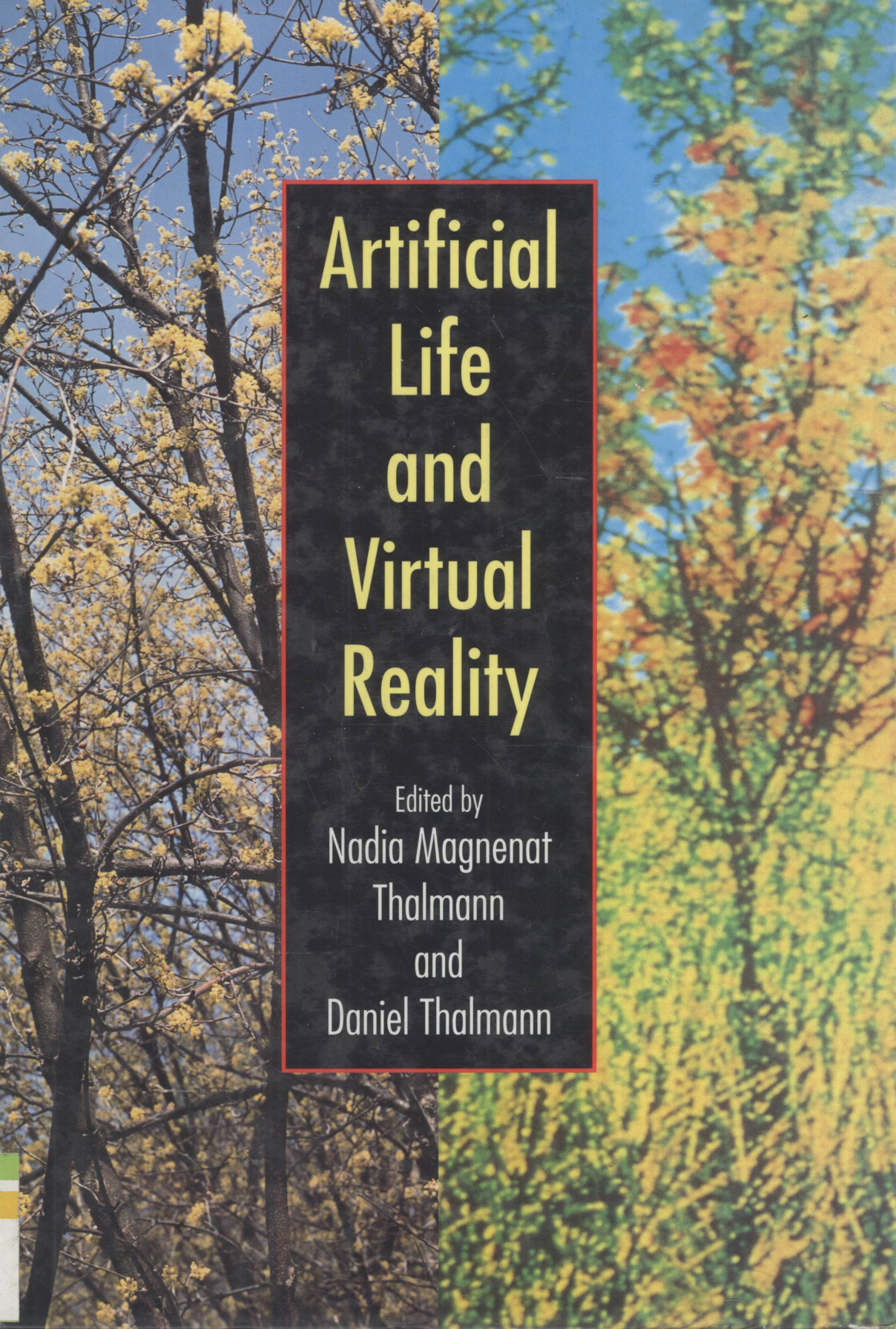
Artificial Life and Virtual Reality
Edited by
Nadia Magnenat Thalmann
and
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Chichester · New York · Brisbane · Toronto · Singapore

Baffins Lane, Chichester
West Sussex PO19 1UD, England
National Chichester (0243) 779777
International (+44) 243 779777

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Rexdale, Ontario M9W 1L1, Canada

John Wiley & Sons (SEA) Pte Ltd, 37 Jalan Pemimpin #05-04,
Block B, Union Industrial Building, Singapore 2057

Library of Congress Cataloging-in-Publication Data

Artificial life and virtual reality / edited by Nadia Magnenat
Thalmann and Daniel Thalmann
p. cm.
Includes bibliographical references and index.
ISBN 0 471 95146 3
1. Human-computer interaction. 2. Virtual reality. I. Magnenat
-Thalmann, Nadia. II. Thalmann, Daniel.
QA76.9.H85A785 1994
006—dc20 94-12672
CIP

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

ISBN 0 471 95146 3

Produced from camera-ready copy supplied by the editors
Printed and bound in Great Britain by Bookcraft (Bath) Ltd

Artificial Life and Virtual Reality

Preface

Artificial Life (AL) refers to all the techniques that try to recreate living organisms and creatures by computer. Originally introduced to recreate, by computer, biological phenomena, artificial life includes today the simulation of behavior processes which result from consciousness and emotions. We can now speak of behavioral artificial life.

Virtual Reality (VR) means the immersion of real humans in virtual worlds, worlds that are completely created by computer. This means interaction with objects from the virtual world, their manipulation, and the feeling that the human user is a real participant in the virtual world.

Actually, artificial life and virtual reality are associated; most virtual worlds will become inhabited by virtual living creatures and users. Real persons, through VR will be able to communicate and interact with these synthetic living beings. Application areas of such systems are simulation, entertainment, and multimedia.

In conclusion, this book is a first attempt to show artificial life in virtual reality. The specificity of simulating artifical life in VR are to visualize life. That means, mainly the behavior, which is a consequence of biological life. In virtual worlds, little has been done to attempt to reproduce biological processes. People interacting with VR, as in real life, expect to be able to interact with plants, animals, and humans as a whole, just as if they were real living beings.

Most of the texts are results of presentations during the workshop "Artificial Life and Virtual Reality" held in November 1993 at the University of Geneva. This workshop was sponsored by the "Troisieme Cycle Romand d'Informatique" and allowed participants to discuss the state of research in these areas. We would like to thank the "Troisieme Cycle Romand d'Informatique" for their generous support in offering all workshop participants a copy of this book, so nicely edited by John Wiley and Sons. Finally, we would like to thank Gaynor Redvers-Mutton for her active collaboration in the making of this book.

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I.1. Virtual Worlds

For about 20 years, computer-generated images have been created for films, generics and advertising. At the same time, scientific researchers, medical people, architects discovered the great potential of these images and used them to visualize the invisible or simulate the non-existing. It was the genesis of Virtual Worlds. However, these virtual worlds had two severe limitations:

- There was very little visual representation of living organisms or only very simple creatures in them
- Nobody could really enter into these worlds: the access to the virtual worlds was looking on 2D screens and 2D interaction.

Today, new interfaces and 3D devices allow us a complete immersion into these virtual worlds or at least a direct and real-time communication with them. This new way of immersion into the virtual worlds is called *Virtual Reality*. At the same time, researchers have been able to create plants, trees, and animals. Research in human animation has led to the creation of synthetic actors with complex motion. Moreover, a new field based on biology has tried to recreate the life with a bottom approach, the so-called *Artificial Life* approach. Now all these various approaches should be integrated in order to create truly Virtual Worlds with autonomous living beings, plants, animals and humans with their own behavior and real people should be able to enter into these worlds and meet their inhabitants.

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In this introductory chapter, we try to identify the key parameters for creating Artificial Life in Virtual Reality, by referring mainly other chapters of this book. Artificial Life is concerned with biological aspects like *Embryonics* (Mange and Stauffer 1994), a basis of natural mechanism of development of living multicellular beings. Artificial Life also includes living organisms created by rule-based languages (Noser and Thalmann 1994) and topology methods (Françon and Lienhardt 1994) or control of mobile robots (Gaussier and Zrehen 1994). However, this introductory chapter emphasizes the Artificial Life of Virtual Humans (Magnenat Thalmann and Thalmann 1993) in Virtual Reality.

I.2. Artificial Life of Virtual Humans

I.2.1. Why Virtual Humans ?

The fast development of multimedia communication systems will give a considerable impact to virtual worlds by allowing millions of people to enter into these worlds using TV networks. Among the applications of such virtual worlds with virtual humans, we can just mention:

- computer games involving people rather than cartoon-type characters
- computer-generated films which involve simulated people in simulated 3D worlds
- game simulations such as football games which show simulated people rather than cartoon-type characters.
- interactive drama titles in which the user can interact with simulated characters and hence be involved in a scenario rather than simply watching it.
- simulation based learning and training.
- virtual reality worlds which are populated by simulated people.

These applications will require:

- realistic modeling of people's behavior, including interactions with each other and with the human user.
- realistic modeling of people's visual appearance, including clothes and hair

For the modeling of *behaviors*, the ultimate objective is to build *intelligent autonomous* virtual humans with *adaptation*, *perception* and *memory*. These virtual humans should be able to act *freely* and *emotionally*. They should be *conscious* and *unpredictable*, Finally, they should reinforce the concept of *presence*. But can we expect in the near future to represent in the computer the concepts of behavior, intelligence, autonomy, adaptation, perception, memory, freedom, emotion, consciousness, unpredictability, and presence ? In this introductory part, we will try to define these terms and already identify research aspects in these concepts.

In summary, virtual humans should have a certain number of qualities that are represented in Figure I.1

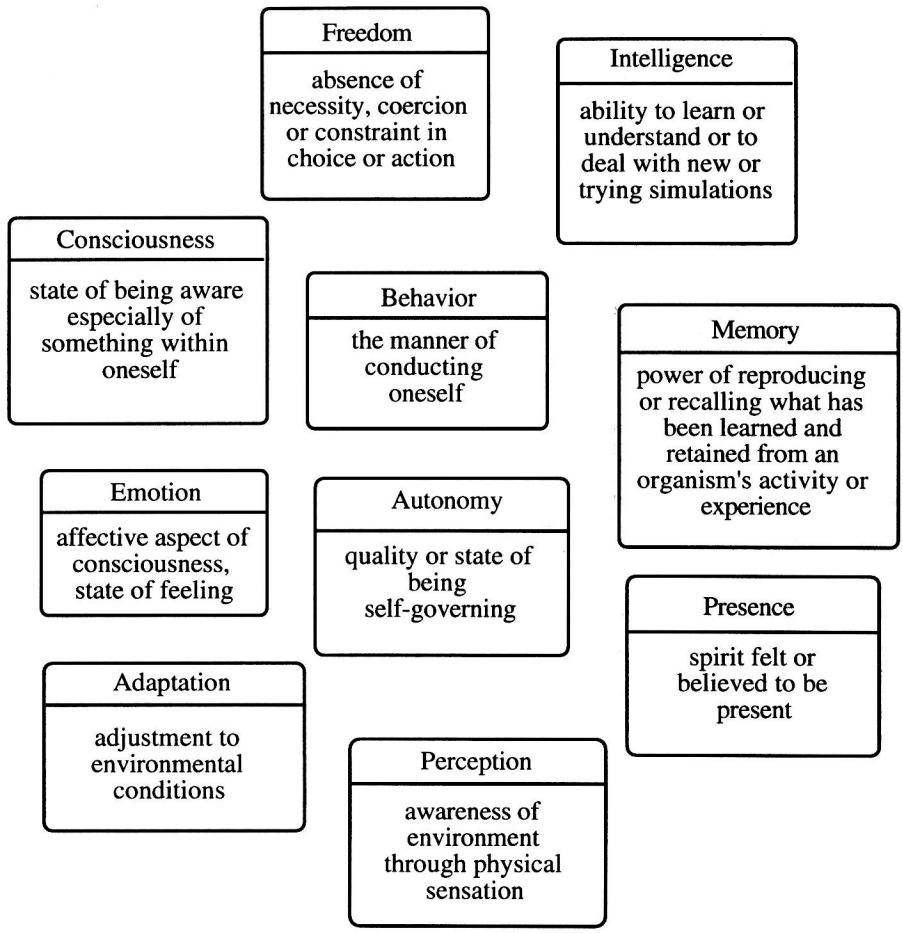

Figure I.1. A few definitions.

Based on classical definitions (Merriam-Webster 1989), we will try first to identify which mechanisms should be simulated in order to implement truly virtual humans or actors.

I.2.2. Behavior

First, virtual humans should be able to have a behavior, which means they must have a manner of conducting themselves. Behavior is often defined as the way in which animals and humans act, and is usually described in natural language terms which have social, psychological or physiological significance, but which are not necessarily easily reducible to the movement of one or two muscles, joints or end effectors. Behavior is also the response