Perceptual functionalities are among the distinctive features of intelligent systems. On one side, they provide such systems with dynamic internal representations of the world, in a strict connection with cognitive activities (learning, reasoning, linguistic communication, planning); on the other side, they mediate the physical interactions with the world by senso-motorial and communication acts. The role and the physical supports pertaining to each functionality cannot be crisply defined - especially in biological systems - but the outcome of their interplay is the emergence of additional functionalities and, ultimately, of an intelligent behaviour, as the capability to achieve goals in effective and efficient ways.

Reviews on some of the key subjects in human and machine perception are included in the present section: the same topics are covered by several other papers in this volume.

Cognitive issues are addressed by Luccio, who discusses the profound influence of the *Gestalt psychologists* on the current research work on visual perception. Parisi and Nolfi provide an *artificial life* view of learning through a connectionist approach: they discuss the training of artificial neural creatures in an environment which is evolutionary - i.e. subject to selective reproduction and mutation.

The classical *pattern recognition* approach to perceptual problems is reviewed by Di Gesu', with an overview on the current mathematical models of visual processes. *Machine vision architectures* are discussed by Biancardi, Cantoni and Lombardi from a special perspective: that of emulating attentional mechanisms in biological systems.
Gestalt Problems in Cognitive Psychology: Field Theory, Invariance and Auto-Organisation

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Abstract. The Gestalt psychology no longer exists as a school. Nevertheless, still today its lesson cannot be ignored. In this paper the concept of primacy of the whole over parts, of field, and of auto-organisation are identified as the main issues of Gestalt psychology, issues that determined a true turning point in the history of psychology in the present century. It is shown how the Gestalt ideas have deeply influenced the contemporary cognitive psychology, and how such an influence has been particularly evident in the last years. Two examples are presented: the first shows the place of the concept of field in contemporary theorising about perceptual invariants - especially with the so-called geometric psychology developed by Hoffman; the second introduces the theory of dynamic formation and recognition of patterns, as elaborated in the framework of synergetics by Haken; it is shown that such a theory can be seen as a natural development of the Gestalt ideas on auto-organisation.

1 Introduction

As a school, after the death of its main exponents - Wertheimer, Köhler, Koffka - the Gestalt psychology no longer exists. Nevertheless, the lesson of this psychological school is such that still today it cannot be ignored, at least by students of perception and thinking. At the same time, the ideas of Gestalt psychologists were often misunderstood, and this has given room to mistakes and wrong interpretations, that are late in clarifying. However, one has to emphasize that often such misunderstandings originate from theoretical incongruities, or from the ambiguities in some concepts as expressed by the Gestalt psychologists themselves (Kanizsa and Luccio, 1986; Kanizsa, in press).

In this paper I will first try to point out - beyond trivialities and misunderstandings - which actually were the main issues of Gestalt psychology that determined a real turning point in the history of psychology of this century. It is important to identify this, as distinguished from those misunderstandings that have followed the diffusion of Gestalt concepts - mainly through a number of misinterpretations by American psychologists.

We will see how Gestalt ideas have deeply influenced the contemporary cognitive psychology, and how such influence has become particularly evident in the last years. Specifically, I will present two examples, showing first the place of a very important metaphor - the concept of field - in contemporary theorising about perceptual invariance, mainly in the so-called geometric psychology developed by Hoffman (1978, 1964, 1966); secondly, we will see how the theory of dynamic formation and recognition of patterns, as elaborated in the framework of synergetics