Chapter 4

Modeling Perception and Action in Parity Logic

The central theme of this chapter are foundational aspects of intrinsic measurement bases for perception and action. It includes a concise exploration into the nature of efficient action, the conjugacy of perception and action, ecological physics and psychology, and measurement bases provided by Cantor's discontinuum, fractal rescalability and recursive computation in parity logic. The basic thesis is that perception and action can be merged into an ecological action potential at whose level perceptual target parameters specify effectual control- viz. manner parameters, and vice versa. The intricate relationship between perception and action resembles that of learning and memory. One requires the other in a genuine reciprocal manner, whereby they constitute a unity for each living system. The reciprocal relationship between perception and action endorses their conjugacy and thus the interchangeability of characteristic perception and action variables, the dual parallelism between perception and action.

Perception and action are both conjoint and disjoint. They are conjoint inasmuch as they serve a mutual aim, namely the satisfaction of a goal, and they are disjoint to the extent that they serve that aim in reciprocal and thus interchangeable ways, in particular by the detection of information that constrains action and by the control of actions that produces changes in perception due to alterations in the system's task environment. This view of perception and action involves clearly intentional systems and is called the intentional dynamics approach to perception and action ([SHT81], [SHK88], [EFS91]).
methodological framework of this ID-approach concerns also artificial systems that mimic goal-driven behavior in order to rule micro-worlds, i.e. efficient control of technological task environments.

The contents of chapter 4 are structured as follows. Section 4.1 provides a preliminary account of the nature of efficient action. Two introductory examples serve as "vehicles" for spreading out the idea that duality cuts the work in half. This is exemplified by the meaning of target and control parameters as determinants for perception and action.

Section 4.2 reconsiders the conjugacy of perception and action in a more refined, but bipartite way. First by summarizing the essence of the ID-approach from the perspectives of ecological physics in section 4.2.1, then by discussing related concepts in ecological psychology in section 4.2.2. Since the conceptual framework in section 4.2.1 is quite demanding from a model theoretic point of view, we refer the reader to Shaw & Kinsella-Shaw's ([SHK88]) seminal paper for further in-depth studies regarding the foundations of ecological physics. We restrict ourselves only to aspects which are pertinent to the prerequisites for intrinsic measurement bases of perception and action.

Section 4.3 is then devoted to formal details of intrinsic measurement bases. This includes the fuel coin metaphor for finding a common currency for information and energy, a formalization of ecological action potentials which unite psychological information potentials with physical energy potentials, and finally the issue of constructing commensurate but dual measurement bases in terms of Cantor's fractal rescaling techniques and methods derived from the mathematical foundations of parity logic.

4.1 The Nature of Efficient Action

To provide a clear background of the dual relationship between perception and action or that between detection and control, we start out with two examples that exhibit the role of the most important parameters.

Example 1: Hemodynamic monitoring and treatment

"In intensive care, selecting a treatment goal allows a clinician to detect information needed to control therapy and specifies the action required to detect additional relevant information about the goal. Successful treatment requires three kinds of information (target parameters) about how the patient's current status