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Chapter IV

Bottom up Management and System Design

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Development techniques almost always use top-down approaches to develop software and business systems. Humans need to simplify the external world by using cognitive models to build a boundary around a problem. These necessary, but artificial, boundaries help us cope with the complexity of the problem at hand. However, this deductive process produces dilemmas, as it leads to misconceptions about the real behavior of systems and the people in them. This chapter will look at system design using the system elements (and their interactions) as the starting point of design, that is an inductive approach. Whilst this will not replace the top-down approach, its use will enhance problem solutions. In a contemporary world of loosely coupled organisational elements, it is necessary to view the system from this perspective to fully understand it. This chapter will offer a preliminary methodology to approach system design using 'bottom up' thinking. This view is not the opposite of top-down thinking but a supplement to it. It results in asking questions about the desired system, which are fundamentally different in nature to conventional techniques

TOP-DOWN THINKING AND ITS LIMITATIONS

To make sense of the world humans create intellectual boundaries around elements to produce concepts. Each boundary is necessarily incomplete to focus on certain elements in the world. The problem solver's worldview and the problem situation form the boundary (Checkland and Scholes, 1991; Wilson, 1990).

It can be said that over the last two decades the energies of systems thinking has concentrated on the formation of the system boundary. Checkland (1981) formulated his Soft Systems Methodology based on the observation that 'hard' system designers had a very narrow focus of what elements entailed the system. It

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was an attempt to make system designers more 'people friendly' by including as many viewpoints of the problems as was practically possible. This was a great leap forward in making the system design process more inclusive and thus, more effective. At a later stage, Ulrich (1987, 1993) created his Critical Systems Heuristics, which in practical terms made the system developer think about the power implications of the design plus increasing the elements to be considered when designing a system. The previous 'hard' system's concentration on input, process, and output had certainly been expanded.

Midgely et al. (1998) expand the idea of the boundary by introducing the concepts of *primary* and *secondary* boundaries. A narrow boundary outline created by one set of people and a wider boundary definition by another will create a group of *marginalised* system elements. The inclusion of these marginalised elements is likely to be contentious and most prone to 'power play.' His work actually crystallised the work of system thinkers of the previous years. The essence of good design was to ensure that it was the secondary boundary that was established in the problem definition and hence, the solution presented. In a practical project development situation, it is the definition of the scope of the project that is important (Hutchinson, 1998).

It is at this point that the two formal types of problem approaches should be introduced: deduction and induction. Deduction reasons from general rules, or theories to particular cases, whilst induction generalises from observation. The most distinguishing feature between deductive and inductive arguments is that of proof (Hospers, 1976). Deductive arguments can have formal justification, while inductive arguments can be defended in pragmatic terms. This chapter will argue that top-down (deductive) arguments dominate formal management and system design thinking. Yet, they do not take into account what happens in the 'real' world, but reflect the assumptions made to justify their acceptance. However, inductive (bottom-up) approaches look at behavior to make sense of situations. Therefore, formal justification is difficult as no theoretical framework is assumed. It is this latter point which upsets many managers, philosophers, scientists, and system designers. The need for the security blanket of a theoretically provable outcome is desired, even if the outcome is not achievable in practice.

Actually, this chapter is probably more concerned with *abduction*, which is less formal than induction. Abduction searches for a pattern in specific observations, and suggests hypotheses to explain the observations. Induction tests hypotheses with empirical data, and justifies the validity of an assertion by asserting a general principle. A good, practical overview of abduction can be found in Waltz (1998, pp. 57-67, 84-88). It must be said here that the definitions of deduction, induction, and abduction are not consistent in the literature. For example, Friedman (1990, p.4) defines abduction in terms of "the generation of hypotheses to explain *given* data", rather than the more informal view of Waltz. It is for this reason that the more general terms 'top down', and 'bottom up' are used here.

In this chapter, the term 'top down' is used to describe this approach to problem solving, where the problem space is defined first. The worldviews of the participants are used to conceptualize the desired state of the proposed system. Once this is achieved, the system is developed within this boundary. The compo-

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