the function of an artifact is regarded as being grounded in, or elsewhere linked to the goals of the designer. This seems to be too strong a requirement, since one also talks about functions with respect to components of biological organisms, where no reference is made to any intended goal. The concept of biological function is often based on that of design (e.g., Kitcher, 1993), and the non-intentional concept of general design allows therefore for a definition of functions that can be applied to the intentional case of technical artifacts as well as to possible non-intentional cases of functions in societies.

The structure of a socio-technical system and the functions of its components may come quite close to what was intended by those who had designed it. Therefore, a socio-technical system may be regarded as a designed one without much deduction. The situation may be different for larger social systems, like societies, to which I will proceed in the fourth section. Societies are planned to a much lesser extent than socio-technical systems. Nevertheless, the structure of a society will rely to a considerable extent on planned factors, since it is influenced by the constitution of the society, by laws, institutions, etc. Moreover, the structure of a society will be influenced by the design of the machines used by its members and by the design of the socio-technical systems that are embedded in it. As Merton states, "[n]ew applications of science to production by the engineer … are inescapably social decisions affecting the routines and satisfactions of men at work on the machine and, in their larger reaches, shaping the very organization of the economy and society" (1947, 567). Some of these influences of artifact design on society and some functions of artifacts in society may be intended. Nevertheless, additional, non-intended effects will occur in many cases. Therefore, if such larger social systems are at least in part designed systems, which will be shown in section four, we are confronted again with non-intentional – or at least partly non-intentional – design.

2 The Concept of General Design

There is no canonical conceptual framework that allows us to deal equally well with the different sorts of design that are related to different classes of functionally organized entities. I aim for a unified rather than a separating view: it seems to be plausible that, if we have three or four classes in which function and design go together in a similar way, then a commonality on the conceptual level can be expected. If we do not rely on such commonalities, we forego the chance to learn from one field with respect to the other.

Non-intentional design, being the more general case, can be found in biological systems. Most concepts of biological design focus on the design process (Allen and Bekoff, 1995; Buller, 2002). That reference to the design history is essential is often taken for granted in the case of artifacts as well (e.g., Lewens, 2004, 51–52).[5] At first view it seems obvious to refer to the design process: all important

[5] A different view is put forward by Houkes et al. (2002) but since this approach is applicable in the realm of intentional design only, it is too restricted to account for the partly non-intentional design of social systems.

decisions with respect to the final product are made within this process, and here is the place where goals are considered that have to be met by the product. Consequently I had to refer to the design process in the last section. However, any account that was to *identify* design with the process of designing would have insurmountable shortcomings. First, two convergent design processes may yield the same result. There might be many different ways to come up with the identical design of a technical artifact, like a chair or a combustion engine. The order of many steps in the process may be inverted, processes may branch or some process may bypass another. As long as the processes converge, the result will be identical, and the result matters with respect to the designed entity, not the way by which it was reached. Only the distinction between design and design process allows us to speak about identical results being reached in different ways. Second, we say that the design of, e.g., a car may be modified. This does not mean that the process of designing may be modified in a retrospective manner; even a Huxleyan ministry of truth can only mock a changed past rather than really change it. What we mean when we talk about a modification of a design is that a new design process starts from the results of a previous one, resulting in a different design. So, again, the design of an entity should not be identified with the process of designing. Instead, it has to be conceived as the outcome of the design process (Davies, 2001, 61–62; Krohs, 2004, chap. 4; Krohs, 2007). But what is the outcome? Sometimes, it is assumed to be the structure or internal organization of a complex entity (e.g., Lauder, 1982), but if the design really was the internal organization of the entity, we would also have to talk about the design of the solar system and other organized purely physical entities, because the organization of a non-designed entity does not necessarily differ very much from the organization of a designed entity. Consider cloud streets or sand ripples in the sea as highly organized but non-designed structures, or compare the organization of the solar system with that of a (perhaps very particular) carousel. So design should neither be identified with the process of designing, nor conceived as the structure or organization of a designed entity. Design rather seems to be something that mediates between these two.

If we consider that in technical designing the design may be finished even before the construction of the first prototype, we may regard as the design the result of the design process that fixes the designed entity, or, more precisely, the type of the designed entity. We have to refer to the type and not to a concrete entity since the design is realizable more than once, using different tokens of the component types prescribed in the construction plan.[6] According to this account, the design fixes the types of the components of a complex entity, and it lays down how parts of the respective types have to be assembled to construct an entity of the type that is specified in the design. This explicates a concept of general design.

Design as type fixation of a complex entity involves the type fixation of its components and the fixation of how to arrange them. There has to be a link

[6] Accordingly, the term "prototype" is confusing since it often applies to an experimental, but nevertheless concrete, entity. In this sense, the prototype is a proto-token rather than a type.