Wybo Houkes
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Technical Functions

On the Use and Design of Artefacts

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Technical Functions

On the Use and Design of Artefacts

Springer

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Preface

This book is about the functions of technical artefacts, material objects made to serve practical purposes; objects ranging from tablets of Aspirin to Concorde, from wooden clogs to nuclear submarines. More precisely, the book is about using and designing artefacts, about what it means to ascribe functions to them, and about the relations between using, designing and ascribing functions. In the following pages, we present a detailed account that shows how strong these relations are. Technical functions cannot be properly analysed without taking into regard the beliefs and actions of human beings, we contend.

This account stays deceptively close to common sense. After all, who would deny that artefacts are for whatever purpose they are designed or used? As we shall show, however, such intentionalist accounts face staunch opposition from other accounts, such as those that focus on long-term reproduction of artefacts. These accounts are partly right and mostly wrong — and although we do take a common-sense position in the end, it is only after sophisticated analysis. Furthermore, the results of this analysis reveal that technical functions depend on a larger and more structured set of beliefs and actions than is typically supposed. Much work in the succeeding pages goes into developing an appropriate action-theoretical account, and forging a connection with function ascriptions.

This goes to show that artefacts and their functions are a complicated and rewarding topic for philosophical analysis. To be sure, function talk about artefacts does not present philosophers with the same problems as function talk in biology. Throughout this book, we treat artefacts and their functions as an autonomous topic of inquiry. This is an implicit (and sometimes explicit) rejection of accounts that assimilate artefacts and organisms, or that treat all functional discourse on a par. Accounts of technical functions have long been treated as a straightforward corollary of accounts of biological functions. We show that, once technical functions are a topic in their own right, the straightforward connection to biology is lost.

Our account is primarily a construction. We have constructed an analysis of using and designing artefacts in terms of plans; and we have constructed an account for function ascriptions by a set of three conditions. There may be alternatives to one or all of these results. To make it possible for others to construct such alternatives, we set out our 'design specifications' in the introductory chapter. It is possible to go beyond the (indeed rather elementary) phenomena on which these desiderata are based. Then, our proposals may no

longer be useful and more sophisticated constructions might be called for.

Although all material included in this book is original to it, we addressed the main topics in a series of earlier papers. The use-plan analysis of using and designing given in chapter 2 was first presented in 'Design and Use as Plans' (*Design Studies 23*, 2002; with Kees Dorst and Marc J. de Vries). In 'Actions versus Functions' (*Monist 87*, 2004), we gave a modified and shortened version of it, and argued that it undermines function essentialist views in metaphysics — an argument presented in greater detail in chapter 7 of this book. The ICE-function theory went through its own *Werdegang*. In embryonic form, it was added to the critical analysis of etiological theories in 'Ascribing Functions to Technical Artefacts' (*British Journal for the Philosophy of Science 54*, 2003). A more developed form was presented in 'Technical Functions' (*Studies in History and Philosophy of Science 37*, 2006). The present work contains the fully matured ICE-theory, which is properly integrated with the use-plan analysis. Integration steps in designing are seldom trivial, and this one is no exception: the ICE-theory presented in chapter 4 of this book is significantly different — and significantly more successful in terms of the standards set out in chapter 1 — than earlier versions.

We worked on the precursor papers and a first draft of this monograph while we were both post-doctoral researchers in the 'Dual Nature of Technical Artefacts' program at Delft University of Technology. We are grateful to the other researchers in this program, Maarten Franssen, Peter Kroes, Anthonie Meijers, Jeroen de Ridder and Marcel Scheele, for numerous comments on equally numerous drafts, and more general discussions.

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Chapter 1

Introduction

This book is about many of the most mundane objects surrounding us. It is about the objects that we use at home, outdoors or at work; objects otherwise as diverse as tea bags, television sets, bridges and microchips. Throughout this book, we shall refer to such objects as 'technical artefacts'. Typically, these are tangible, material objects that serve a practical purpose, either incidentally or regularly. By calling these objects 'artefacts', we take them as objects that have been created, sometimes by ourselves, but more commonly by others. We may occasionally build a makeshift bridge for personal use but most of the bridges that we encounter were built by other people. By calling these objects 'technical artefacts', we bring into focus the skills involved in taking objects as serving our practical purposes. It takes experience about materials to create that makeshift bridge, and those other bridges are typically the work of a specific group of trained professionals, namely engineers. Engineers design most of the objects that we use, and some of those objects are available only because engineers designed them: the creation of microchips exceeds the skills of most people, but evidently not those of all people. By focussing on technical artefacts our analysis excludes, in first instance, objects such as laws and organisations ('social artefacts'), statues and symphonies ('aesthetic artefacts' or 'works of art'), and theories and models ('scientific artefacts'). But we do not limit our analysis to engineering; this book is about technical artefacts broadly conceived, analysing objects ranging from everyday items such as tea bags and television sets, to technologically complex objects such as bridges and microchips. Our analysis gives an integrating account of this spectrum of objects, which may even be expanded to include natural objects such as stones and batches of water that serve practical purposes. In short, our analysis is about useful material.

In this book, we focus on what appears to be — and in fact is — the central feature of technical artefacts: their intimate connection to teleology.

The need for an analysis of the teleology of technical artefacts is not self-evident. After all, artefacts have been described in teleological terms for ages; and whereas these terms have become problematic in other domains in which they were once applied — most notably, of course, in biology — they continue

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to be used in the domain of technical artefacts, apparently to everyone's satisfaction. Philosophical scrutiny seems uncalled for. Yet, on closer inspection, artefact teleology is more problematic than one might think. This is illustrated by the notion of function. Nothing seems more common-sensical than describing artefacts in terms of their technical function or functions: even artefact kinds that are not explicitly named after their functions are easily categorised in terms of functions. There may be counterexamples, i.e., artefacts that *cannot* be characterised functionally, but since it is sufficiently difficult to find such examples, functional artefacts are the rule. Consequently, some philosophers have gone as far as claiming that functions are *essential* to artefacts. Yet, despite the general emphasis on functional characterisations of artefacts, there is no consensus about who and what determines technical functions. Moreover, most of the existing attempts to resolve this issue have been so sketchy that they raise more problems than they solve.

One traditional answer is that the intentions of agents fix the functions of technical artefacts: technical functions are characterised as intended effects. But developing this answer to full-fledged theories, theories that we will call *intentional function theories*, only leads to further questions: which agents? Can every user determine his or her individual functions? Or is function-setting the prerogative of engineers who design the technical artefacts; is function-setting somehow part of their professional duties? If so, which of the many intentions, wishes and beliefs of these agents are relevant for determining functions? Another, traditional answer is Robert Cummins' (1975) function theory, in which the functions of an item correspond roughly to the causal contributions the item makes to systems containing it. This theory, which we call the *causal-role function theory*, raises issues about how to single out the right causal contributions as functions of artefacts. Artefacts make all sorts of those contributions and not all correspond to their functions. If the intentions of agents single out functional contributions, we are back at the questions raised by the intentional function theories. Moreover, artefacts may — unfortunately — sometimes fail to work by not making the contribution to realising the practical purpose for which they are used. In that case Cummins' theory cannot take that non-existing contribution as the function of the 'malfunctioning' artefact. A third and less traditional answer is that intentions are largely irrelevant in determining artefact functions. Instead, these functions are shaped by evolutionary forces of variation and selection, much like those that shape the biological world. And indeed, artefacts have to survive in an even more competitive environment than many organisms, and the history of technology — especially in the last two centuries — is one of continuous mass extinction. There is no doubt that there are many similarities between the natural and the artificial realm. The way functions are determined may be one, but also the *evolutionist function theories*[1] this third perspective leads to, raise several questions, most obviously concerning the relevant processes of selection and the remaining role of purposive design

[1] In philosophy of biology and philosophy in general, these evolutionist function theories are better known as etiological theories.

and use.

The core chapters of this book are devoted to a new theory about artefact functions that falls squarely in the intentionalist tradition. We shall explore the similarities between the natural and the artificial realm insofar as functions are concerned, and we shall find that they are insufficient to overthrow the tradition, but more than sufficient to refine existing intended-effects accounts. Defending intentionalism on artefact functions is, despite the entrenchedness of this perspective, surprisingly difficult, and we shall find that answering the questions to which the intended-effects account gives rise requires incorporating elements of the causal-role and of the evolutionary perspective. The function theory that results from this operation is called the *ICE-theory*, to honour its three ancestors while putting the intentionalist *I* first. But although we give designer intentions priority in determining the functions of artefacts, we can only avoid the problems hinted at above by endorsing a rather liberal and decidedly non-standard account of designing. On this account, Alexander Graham Bell, who developed the first telephone to aid the hard-of-hearing, counts as a designer but so do later engineers, who adapted telephones for use as a general communication device, and even innovative consumers who use their telephone to listen in on their sleeping children.

We can bring this last balancing act between the priority of the intentions of designing pioneers, of redesigning engineers and of innovative users to a successful conclusion only by firstly analysing artefact teleology in general. As the earlier questions about agents and intentions show, an accurate intentional theory of technical functions requires an analysis of the using and designing of these artefacts. The analysis that we present is an action-theoretical one that incorporates some epistemological notions. This task involves some trailblasing. Of course, the theory of action is a well-established part of contemporary philosophy, but to the best of our knowledge only Randall Dipert (1993, 1995) has attempted to apply it to artefacts. We acknowledge Dipert's work as an important source of inspiration. In our exploration of the unfamiliar terrain of artefact use and design, we draw upon more general action-theoretical analyses. In particular, we adopt the notion of plan and reshape it for our own purposes, leading to a 'use-plan' analysis of artefact using and designing.

By addressing the phenomenon of artefact teleology, this book breaks new ground. Our function-theoretical project is, to a large extent, located within a well-articulated — some might say, over-articulated — philosophical debate. Yet, since most work in this field has been concerned with the understanding of biological functions, both critical distance and considerable sophistication were needed to arrive at a function theory for technical artefacts that is worthy of its name. By contrast, constructing an action-theoretical analysis of artefacts, for which there are relatively few reference points in the literature, led us to complement typical analytic step-by-step arguments with a more explorative mode of analysis.

Most broadly, we aim to provide the groundworks for a philosophical analysis of artefacts. This goal is realised in several ways. First and foremost, we study and analyse the basic concepts in terms of which artefacts are described,

concepts such as 'using', 'designing' and 'function'. We offer arguments for taking some of these concepts as basic and others as peripheral. In fact, one of the results of our efforts is that functionality is not as important for describing artefacts as it is often taken to be. This calls for a change of focus: for properly understanding technical artefacts philosophers, but also engineers, should consider the intentional actions that involve these artefacts instead of merely regarding them as functional objects. Second, by analysing and clarifying artefact functionality and teleology, we examine the intuitive distinctions between technical artefacts and other objects — in particular, between artefacts and natural objects including biological organisms. And finally, we show that several features in the domain of technical artefacts can be accounted for by terminology and themes familiar from analytic philosophy: we analyse actions in terms of *rationality* and *plans*, which provide a background for a theory of *functions*; and we draw on resources mined in disciplines such as *action theory* and *epistemology*. This choice means that we approach both artefacts and the actions in which they play a role largely from a *normative* rather than a descriptive perspective. We do not offer a theory about how people actually use or design artefacts, or how they in fact describe them in functional terms; instead, we seek to provide a framework for evaluating some aspects of these activities, and we theorise about rational and proper artefact use, and about justifiable function ascriptions.

Conceptual engineering

Before presenting an overview of this book, a few remarks about our method are in order. Our aim to develop a function theory for technical artefacts based on an action-theoretical analysis of artefact using and designing, calls for a careful choice of means. The first part, developing a function theory, is a theme that has become increasingly familiar in philosophy over the last decades, although it is regarded by many as an exhausted field, characterised by what two authors have memorably called 'the dull thud of conflicting intuitions.'[2] Indeed, function theory occasionally gives the impression of philosophical angler's tales. Unlikely events like nuts and screws falling into machines and making them work and Bibles preventing people from being shot in the heart appear to be the yardstick by which the performance of function theory is measured. The problem is not so much that an appeal to intuitions is needed to account for these cases, but that intuitions about them are weak and almost bound to diverge, and that it is unclear what is at stake in accounting for these cases in the first place. For our project, this problem seems to arise with a vengeance, because we plan to cover some unfamiliar ground: the domain of technical artefacts. Although we do attempt to phrase our analysis in philosophically familiar terms, such as 'rationality' and 'justification', the fact remains that, because few philosophers have thought and theorised about artefacts, intuitions are likely to be unschooled, weak and divergent.

[2] Bigelow and Pargetter (1987, p. 194).

The proper-accidental desideratum:
A theory of artefacts should allow that artefacts have a limited number of enduring proper functions as well as more transient accidental functions.

The malfunctioning desideratum:
A theory of artefacts should introduce a concept of a proper function that allows malfunctioning.

The support desideratum:
A theory of artefacts should require that there exists a measure of support for ascribing a function to an artefact, even if the artefact is dysfunctional or if it has a function only transiently.

The innovation desideratum:
A theory of artefacts should be able to ascribe intuitively correct functions to innovative artefacts.

Table 1.1: Four desiderata for a theory of artefacts

Our response is not to avoid an appeal to intuitions, but to make this appeal as explicit and circumscribed as possible. In line with the subject matter of this book, we take an engineer's attitude towards our intuitions: we list our intuitive, phenomenological 'data' and then translate them into clear specifications — or desiderata, as we shall call them — for a theory of technical artefacts.[3] We take these desiderata, and these alone, as touchstones for our own theory. Furthermore, our phenomenological data are relatively unassuming, leading to minimal specifications for an effective function theory. Still, it is possible that someone disagrees with our choice of phenomena and intuitions, or that someone doubts whether these should be accounted for in terms of functions. Some of these disagreements and doubts will be addressed later, but we are not apologetic about our choice of desiderata: it is a choice and therefore, to some extent, arbitrary. Yet the only way of disagreeing productively with our choice is to construct alternative desiderata, and an alternative theory, leaving the ultimate choice to the users of both theories. Similarly, our tightly circumscribed goal means that we regard successful uses of our conceptual apparatus for other purposes than satisfying our desiderata as, at most, beneficial side-effects of our efforts.

Table 1.1 lists our four desiderata for theories of technical functions. As said, each of these desiderata captures an aspect of everyday involvements with artefacts and reflects an assumption that this aspect ought to be accounted for in terms of the functions of these artefacts. Thus, two choices are made for every desideratum: we choose to select one aspect of artefact using or designing as especially salient, and we choose to hold a theory of functions accountable for this aspect. In the remainder of this section, we shall briefly justify both

[3]This way of appealing explicitly and exclusively to certain intuitions is not original to our book. Our method is similar to, for instance, Jackson's recent attempt at defending conceptual analysis (Jackson 1998).

choices.

The four desiderata reflect, consecutively, the following four phenomena: use versatility, possible lack of success, physical restriction and innovation. Each of these is a broad and variegated phenomenon, best described by means of multiple examples and real-life narratives; in this respect, they are on a par with phenomena such as object persistence and personal identity, which are also encountered in many different forms and guises. For the sake of brevity, we only give a few short and simple illustrations, just to show the intuitive appeal and wide scope of the phenomena and the resulting desiderata.

First, artefact use is versatile. Virtually every artefact can be used for different purposes and in different ways. Chairs may be used for sitting on, for resting one's legs on while sitting, for standing on; and one can sit up straight or slouch in a chair. Cars may be used for transporting people from one place to another, for relaxation, even for ramming the front of a store to make possible a robbery. Not all of these uses are on a par, however. Chairs are most standardly or most appropriately used for sitting on. The force of this standard is not just one of numbers. Using a car for personal transportation is common practice; intentionally ramming it into a storefront is not just unconventional, but also a crime. By contrast, standing on a chair to change a light bulb is at most mildly frowned upon and not uncommon. Standing on a swivel chair to change the light bulb that hangs over a staircase may raise eyebrows, but presumably for different reasons than it does in other situations. Moreover, these differences in evaluating common and uncommon ways of using artefacts are not just a matter of intuitions: the warranties of many products contain void clauses mentioning *improper* use. The existence of such void clauses, like that of written restrictions and prohibitions in general, shows that alternative uses are possible and that some are disapproved of. These cases show that different standards and sanctions are at work in evaluating the many ways in which artefacts are used. For the moment, we refer indiscriminately to all these standards by calling artefact use 'limited'. Many existing philosophical analyses of functions contain a distinction, or call for a distinction, that seems the perfect counterpart of the phenomenon of limited artefact-use versatility. For it is common practice to make a distinction between an item's proper function(s), which are more or less persistent, and its more transient accidental features, and to maintain that a function theory needs to honour and explicate this distinction.[4] Thus, it makes

[4]Many theories in the literature aim at distinguishing proper and accidental functions, albeit often not in exactly those terms. One of the earliest places to find this distinction is Larry Wright's seminal paper on functions: 'Very likely the central distinction of this analysis is that between the function of something and other things it does which are not its function [...] This is sometimes put as the distinction between a function and something done merely 'by accident'.' (1973, p. 141). An even more influential theory of function is explicitly presented as one of proper functions, in contradistinction to accidental functions or 'functioning as': E.g., 'I have said that the definition of 'proper function' is intended to explain what it is for an item to have a function or purpose, but not what it is for an item to function as something.' (Millikan 1989, p. 290). More recently, Beth Preston (1998b) formulated a theory that makes a distinction between proper functions and system functions, and has explicitly extended it to the realm of artefacts. More precisely, she argues that a function-accident distinction as desired by Wright can be drawn in an account of proper functions and is impossible to draw