2 What is Enterprise Ontology?

Enterprise ontology is a novel subject, and writing a book on this novel subject puts the author under the obligation to provide at least two kinds of explanation. One explanation regards the justification of presenting yet another point of view on enterprises. Why and how would enterprise ontology assist in coping with the current and future problems related to enterprises? The other explanation concerns the particular approach towards enterprise ontology that the author takes. Why would this approach be more appropriate and more effective than some other one? These are serious questions indeed, and anyone who takes the pain to study this book deserves satisfying answers. You will get the answers; however, not straight away. A first attempt is in this introductory chapter. Definite and fully satisfying answers can only emerge from a dedicated and thorough study of the book. The lasting reward of such a study is a novel and powerful insight into the essence of the operation of enterprises; by this we mean insight that is fully independent of the (current) realization and implementation.

Let us start by noting that managing an enterprise, but also getting services from it as a client or collaborating with it as partner in a network, is nowadays far more complicated than it was in the past. Be assured, we will not elaborate on it, you probably have heard that tune in all pitches and keys. And in case you have not, glance over an arbitrary management book from the past five years and you are informed. The problems in current enterprises, of any kind, are well investigated and well documented. More than well, in fact, because far less effort is put in thinking about how to cope with them. Anyhow, the common denominator of these problems is complexity, and complexity can only be mastered if two conditions are fulfilled. One condition is that one dispose of a comprehensive theory about the kind of things whose complexity one wants to master. The other condition is that one dispose of appropriate analysis methods and techniques, based on that theory.

The knowledge that one acquires at management or business schools does not suffice anymore. Actually, it never did; managers were just lucky that the shop floor workers ultimately always managed to really solve problems and implement desired changes. Even the gifted entrepreneur can

nowadays not succeed without a basic, systematic, and integral understanding of how enterprises work. In order to really cope with the current and the future challenges, a conceptual model of the enterprise is needed that is coherent, comprehensive, consistent, and concise, and that only shows the essence of the operation of an enterprise model. By *coherent* we mean that the distinguished aspect models constitute a logical and truly integral whole. By *comprehensive* we mean that all relevant issues are covered, that the whole is complete. By *consistent* we mean that the aspect models are free from contradictions or irregularities. By *concise* we mean that no superfluous matters are contained in it, that the whole is compact and succinct. The most important property, however, is that this conceptual model is *essential*, that it shows only the essence of the enterprise, its deep structure. In particular, we mean that the model abstracts from all realization and implementation issues.

We shall call such a conceptual model an *ontological model*. The original Greek word from which the English word "ontology" stems, means study or knowledge of what is or exists, and the philosophical branch with the same name has taken up the term as referring to the reality around us, regardless our own view on it. In other words, ontology requires us to make a strict distinction between the observing subject and the observed object. This requirement puts the author under another obligation, that of clarifying the philosophical stance taken with respect to this subject-object dichotomy. We will do it only briefly, without much elaboration. The interested reader is referred to [25] and [56]. There are three philosophical positions that are relevant for our discussion: the objectivist, the subjectivist and the constructivist position. *Objectivists* believe that the world they live in exists in itself, fully independent of them. In other words, they believe in a true objective reality. *Subjectivists* take the opposite position. They believe that there is no reality outside the subject (human being) and, in the extreme, that every subject has its own image of reality. Somewhere in between is the position of the *constructivists*. They agree with the subjectivists that there is no absolute objective reality (as the objectivists believe), but they believe that there is instead a kind of semiobjective reality that they call an intersubjective reality. It is built and continuously adapted through negotiating and achieving social consensus among subjects. Our position is this constructivist one. We consider the ontology of a particular part of reality as the basis for sensible communication about that part of reality. At the same time, we recognize that this ontology is built, rebuilt, and adapted in communication; it cannot be otherwise.

We like to add to this tripartite philosophical stance two sociological paradigms regarding the study of systems, namely the functionalist para-

digm and the interpretive paradigm [37]. The *functionalist* paradigm takes its name from the fact that it wants to ensure that everything in the system is operating well so as to promote efficiency, adaptation, and survival. An understanding can be gained of how systems work by using scientific methods and techniques to probe the nature of parts of the system, the interrelationships between them, and the relationship between the system and its environment. The expertise it provides should put managers more in control of their operations and organizations, and enable them to eliminate inefficiency and disorder. The *interpretive* paradigm takes its name from the fact that it believes social systems, such as organizations, result from the purposes people have and that these, in turn, stem from the interpretations they make of the situations in which they find themselves. People act and interact in organizations as a result of their interpretations. This paradigm wants to understand the different meanings to collaborative activity and to discover where these meanings overlap, and so give birth to shared, purposeful activity. Managers can be guided to seek an appropriate level of corporate culture in their organizations. They can take decisions, on the basis of participative involvement, that gain the commitment of stakeholders. Some argue that these paradigms are incommensurable. In our opinion, this is not necessarily the case. The notion of enterprise ontology, as conveyed in this book, is primarily functionalist in nature. However, various aspects (e.g., considering an enterprise as a social entity, the focus on social individuals, Habermas' theory of communicative action, the autonomy that is basically allowed to actor roles) also reflect an interpretive perspective. One might argue that a really comprehensive approach to enterprise engineering should be able to address an enterprise from different angles, thus integrating important views from different paradigms. This is what we try to do, as will become clear in Part C. Let this be our final brushstroke in painting the philosophical background for the key notion of enterprise ontology.

In its modern use, ontology has preserved its original meaning, but it has also a definite practical goal. It serves to provide a basis for the common understanding of some area of interest among a community of people who may not know each other at all, and who may have very different cultural backgrounds. If you have ever heard about ontology before, it is most probable that it was in the context of the World-Wide Web, particularly in the context of the Semantic Web [6]. There are various definitions of the modern notion of ontology getting around. Our main source is the ontology of Mario Bunge [10, 11], but, as long as there is no conflict, we will also refer to other sources. A widely adopted definition of ontology is the one in [29]: an ontology is a formal, explicit specification of a shared con-

ceptualization. It states the core properties that our notion of ontology also will have. First, it regards the conceptualization of (a part of) the world, so it is something in our mind. Because of our constructivist stance, we consider these mental pictures be checked and adapted in communication. Second, this conceptualization is supposed to be shared, which is the practical goal of ontologies. This takes also place in communication. Third, it is explicit; an ontology must be explicit and clear, there should be no room for misunderstandings. Fourth, it is specified in a formal way. Natural language is inappropriate for this task, because of its inherent ambiguity and impreciseness.

The notion of ontology as applied in [29], but also in [28], [30], and [58], is what we will call in Chap. 4 a *world ontology*. Common examples of such an ontology are the world of traveling or the world of cooking and dining. The focus is on defining the core elements in such a world and their interrelationships in a most clear and extensive way. The notion of ontology as applied in this book is the notion of *system ontology*. Our goal is to understand the essence of the construction and operation of complete systems; more specifically, of enterprises. As will become clear, this notion of system ontology includes the notion of world ontology. Next, although we fully recognize the need for ontologies for the purpose of worldwide flawless communication among agents over the Internet, our motivation for this book is wider. In our opinion, the world we live in is, and will remain, in the first place, a world of people, of human beings, despite all the technical devices that (can) make our lives much more pleasant. This is a philosophical stance of course; it is a choice. We strongly oppose, for example, the quite common idea that artificial agents are, or at some future time will be, equivalent fellow players in human social life. This idea can only be justified by a severe inflation of such notions as authority and responsibility. Throughout the history of mankind, people have used anthropomorphic metaphors for the purpose of understanding and explaining the operation of natural things as well as artifacts. The only, but at the same time serious, danger is that one forgets that they were metaphors, that one takes the metaphorical reasoning for real. So, for example, if you think that your computer does not understand you, you are twofold right. First, it is quite okay to use anthropomorphic metaphors in the interaction with your computer. You probably do it sometimes also while driving your car or trying to let your video recorder do what you want it to do. Second, in the most true sense, your computer does not understand you, because understanding in the way human beings have internalized the notion and apply it is applicable only to them. We do not believe in a general notion of understanding that human beings would share

with artificial intelligent systems. There is no evidence for such a belief, except for apparent similar external behavior in some cases. To conclude from these cases that these behaviors are brought about in the same way is merely speculation.

A major motivation for this book and for our work in ontology in general stems from the conviction that the world is in great need for transparency about the operation of all the systems we daily work with, ranging from the domestic appliances to the big societal institutions. We are in great need already, and this need can only increase if one imagines a future life in a cyber culture [5]. Our concern is the current lack of an appropriate philosophical counterbalance to the dominant technocratic and bureaucratic thinking. Let us give some examples to clarify the point. First, regarding technical devices, if you read the user manual of a video recorder or a computer or a computer program, you become overloaded with irrelevant details. You mostly end up with a headache instead of any relevant understanding. And in case you persevere, there is a high chance that you will discover so many errors and omissions in the description that reading has become solving a puzzle. As a concrete example, the implementation of an ERP (Enterprise Resource Planning) package in an enterprise, even of only a few modules, may easily take several years and cost the enterprise a huge amount of money. This money is partly spent in having the supplier of the package (or some intermediary company) explain how to use it, and partly to have the enterprise adapt its current way of working such that it fits the straitjacket of the ERP package. Is this societal progress? Do we really need to suffer this? As another example, have you ever phoned the help desk of a company or a government agency in order to get the service they claim you will get in their advertisements? Mostly you end up not by having what you were looking for, but by being frustrated, maybe to the extent that you think of giving up. Why? Because the operation of these institutions is completely opaque to you. You do not know what to believe and what not to believe; you are literally lost in cyberspace. And, in case you have succeeded in penetrating to the right place, there is a chance that the responsible person does not take on his or her responsibility and concludes your case by blaming the computer or any other thing that he or she uses as an aid. Most probably, he or she acts in this way not to hamper or frustrate you, but because the institution is also opaque to him or her.

This situation should stop because it is in no one's interest that it continue, as it has been in no one's interest to have come this far. To the best of our knowledge, there has never anywhere been a plan to organize modern society in such a way that nobody is able to understand how it works.

Likewise, in no manufacturing company has there ever been a plan to design domestic appliances or professional equipment such that it takes the current incommensurable amount of effort to get to know how to use them. Things have just gone that way. But, as was said, there is no reason to let it continue. Instead, there is abundant ground for stopping it. Imagine that it is possible for you to acquire the right amount of the right kind of knowledge about the operation of the equipment you are working with. Imagine that you are not bothered by incomprehensible and irrelevant things but that you get the insight you need in a way that you immediately understand, because it is about what you want to do with the equipment, not how it is designed and assembled. In a similar manner, imagine that it is possible for you to acquire the right amount of the right kind of knowledge of the operation of the company from which you bought something you want to complain about, or of the government agency from which you are trying to get a license but have not succeeded yet. In summary, imagine that the business processes of these enterprises have become transparent to you. Would that not be great? So, this is our goal: to offer a new understanding of systems of any kind, and of enterprises in particular, such that one is able to look through the distracting and confusing appearance of an enterprise right into its deep kernel, like an X-ray machine can let you look through the skin and the tissues of the body right into the skeleton. As a user of systems, this understanding lets you become master again of your activities. As a designer, it lets you design systems in such a way that the resulting design, in particular, the user dialogue and interface, reflects the essence of the system. We will try to achieve this goal through a notion of ontology that includes the dynamic aspects of a system, and that at the same time does justice to the nature of enterprises. This nature is that enterprises are social systems, of which the operating principle consists of the ability of human beings to enter into and comply with commitments.

So, that will be our notion of enterprise ontology; and, as a quality criterion for evaluating enterprise ontologies, we will apply the five properties that were discussed earlier: coherence, comprehensiveness, consistency, conciseness, and essence, collectively abbreviated as C_4E. The particular methodology that we will present lets you develop the ontology of an enterprise in a systematic way. But we do not require you to become a professional developer of ontologies. The explanation of the methodology and the demonstration of the example cases serve only to have you internalize these kinds of ontologies, such that, after having studied the book, you are able to understand them and take full advantage of them. Of course, we recognize that real great benefit can only be achieved if many people get used to these ontologies, ideally, everybody. However, be assured that

even if you will be the only one in your working environment who possesses this new understanding of enterprises, you will be rewarded for studying the book and learning the methodology. We can assert this on the basis of over 15 years practical experience in applying the DEMO[3] methodology, which this book elaborates, to all kinds of enterprises and for all kinds of purposes. Even those who only participated in DEMO projects for one or two days (mostly managers), invariably mentioned that they never before had seen such a coherent, comprehensive, consistent, and concise picture of what they agreed was the essence of the operation of their enterprise. Concluding, you will learn how to have more control over your professional life, how to take the lead again, both as a user and as a designer of enterprises, such that with your help the ideal situation as sketched above may be accomplished at some future time. The only thing you need to do in return is to put aside your current way of thinking about enterprises and to open your mind for new ideas; in short, to be willing to learn.

[3] DEMO is an acronym that has had several long forms in the course of time, starting with "Dynamic Essential MOdelling". The current one is "Design and Engineering Methodology for Organizations". Visit www.demo.nl for more information.