From Infology to Artificial Science
A Study of the Philosophical Practice of Börje Langefors and Bo Dahlbom

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Abstract

This paper studies the ideas of two actors in the Scandinavian field of Information Systems development. It analyzes the writings of Börje Langefors and Bo Dahlbom in the 1980s and 1990s, and focuses on their collaboration resulting in the publication of Langefors' *Essays on Infology.* Langefors was at that time honored as the founder of the information systems discipline in Scandinavia, but had also been criticized by several authors in the field. Dahlbom was a philosopher who had ventured into information systems development in the late 1980s. At the brink of the 1980s significant changes in both computer technology and Western society were evident. Computer technology saw a development from mainframe computing towards networked computing, as well as the advent of the home computer and the beginnings of the internet. Western societies changed significantly in the same period. I analyze the writings of Langefors using Paul N. Edwards concept of the cybernetic paradigm as a framework. Taking this as my starting point, I investigate whether the two writers can be said to operate within the cybernetic paradigm. Furthermore I interpret their theories along two axes. One seeing a shift from modernity to post-modernity, and one seeing a shift from humanism to post-humanism. I argue that both Langefors and Dahlbom can be understood as part of a cybernetic paradigm, although not univocally. Langefors can largely be interpreted as a product of Swedish post-war modernity, while Dahlbom related to a "postmodern condition" in Lyotard's terms. As well as investigating the two authors as actors in the information systems development field, I investigate whether their theories also could be read as philosophy. I take Louis Althusser's notion of "the spontaneous philosophy of scientists" as my starting point for this discussion. I argue that Langefors and Dahlbom can be understood as philosophers from two different perspectives. Langefors took his experiences as a practitioner and generalized them into philosophy, while Dahlbom wanted to bring philosophical reflection to the practice of systems development. Finally, I ask what motivated Dahlbom and Langefors, two very different theorists with very different backgrounds, to collaborate. My findings indicate that Dahlbom was partly motivated by his intention of developing a "new informatics" in Sweden, and saw Langefors as an inspiration for this project. Both of the authors were motivated by seeing common adversaries in the information systems development field.

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Introduction

In his introduction to Börje Langefors' *Essays on Infology*, Bo Dahlbom emphasizes the importance of meeting and working with Langefors.[1] "No one has meant more for systems development in Scandinavia than Börje Langefors, the first professor and founder of the academic discipline in Scandinavia."[2] At the time of their first meeting in Gothenburg in 1991, Dahlbom was himself a significant actor in the field of information systems development, having just published the draft of what would later become *Computers in Context*, and appointed editor of the *Scandinavian Journal of Information Systems*.[3] Two years later Dahlbom edited the largest body of work from Langefors in more than a decade, the aforementioned *Essays on Infology.* Another two years later he also edited a *festschrift* for Langefors' 80th birthday.[4] At that time Dahlbom had published his book *Computers in Context,* written together with Lars Mathiassen, that would prove to be one of the most influential publications of the 1990s in the Scandinavian information systems development field.

The focal point of this paper is the 1993 publication of the book *Essays on Infology,* a collection of essays written by retired professor of business information systems Langefors, and edited by the philosopher Dahlbom who had during the 1980s ventured from philosophy towards the field of information systems development.[5] It represents both an expression of Langefors' theories of information systems, but also stands as the product of the meeting and mutual interest the two authors had for each other. Afterwards, this meeting can be seen as an image of two generations representing two different theoretical perspectives on theory of computer technology and informatics, each approaching the same subject-in-the-making. It is simultaneously a meeting between two individual life trajectories, irreducible to the greater trends and currents they may be said to have been part of. These figures played different parts in the introduction and diffusion of computers in Swedish society. While much has been written about the political processes behind the

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1 Börje Langefors, *Essays on Infology, Summing up and Planning for the Future*, Department of Information Studies, University of Göteborg, 1993.

2 Bo Dahlbom, "Introduction - An Engineer from SAAB?", in Börje Langefors, *Essays on Infology*, 1993, p. 12.

3 Bo Dahlbom & Lars Mathiassen, *Struggling with Quality: The Philosophy of Developing Computer Systems,* Chalmers University of Technology and the University of Göteborg, 1991. This was a draft that was to be revised the following year after having been used in computer and information science programmes in Scandinavia. That revision resulted in Bo Dahlbom & Lars Mathiassen, *Computers in Context*, *The Philosophy and Practice of Systems Design,* Blackwell, 1993.

4 Bo Dahlbom (ed.), *The Infological Equation, Essays in Honor of Börje Langefors*, Gothenburg Studies in Information Systems, 1995.

5 Börje Langefors, *Essays on Infology*, 1993.

introduction, importance, and influence of information systems development in Sweden after the end of World War II, Dahlbom and Langefors are interesting because they both formulated theories, and reflected on practice.[6]

I will study the writings of Langefors and Dahlbom, at the point in time where their careers intersect. Their connection is manifested in the publication of *Essays on Infology*. These two writers and the time they meet, represent a moment of change in the history of computer technology and the world in general, but also a time when some of the black boxes of today were not yet closed. This was the same year that the World Wide Web was made public, and the PC had just become accessible to the regular consumer. The metaphor of the black box is often used to describe the difficulty of seeing the alternatives that once existed in the history of a technology. When it has become a matter of everyday use it becomes closed off from us and we do not perceive it in terms of its inner workings or history. The black boxes studied in this essay are theoretical and philosophical in nature. Both Dahlbom and Langefors saw it as their role to change the way practitioners and people in general thought about computers and technology.

Problem

Looking at the now ubiquitous computer technology and its derivatives in everyday life, it can be hard to remember that these technologies and practices were not inherent in the «inventions» of the first computers, but had to be formulated, both to the «outside world» but also reflectively to the practitioners themselves. There is an assumption of determinism that is surprisingly resilient in the everyday talking about information technology, and the historical process of its development. In many ways we think of our laptops, operating systems, the internet, our cellular phones, and the ATM machines, if we think about them at all, as if they were destined from the beginning to be like they are. Could the internet or cellular phones have existed, given another historical reality of post-war Europe? It seems hard to imagine a world so radically different from the world we know. Technologies, as they become everyday objects, are taken for granted. This process from invention and design to the everyday use is sometimes called blackboxing, which means that while new technologies have to be understood to be developed, used and perfected, when a technology is

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6 An example of literature on the political processes behind the computerization of Sweden is Hans De Geer, *På väg til datasamhället, Datatekniken i politiken 1946-1963*, Kungliga Tekniska Högskolan, 1992. Also the conference «History of Nordic Computing» has been characterised by this perspective, a good example being Anders Carlsson, «On the Politics of Failure, Perspectives on the Mathematics Machine», *History of Nordic Computing, IFIP International Federation for Information Processing*, 174 (2005), pp. 95-110.

"successful", that is, been taken into use, the understanding of how it "works" and the process of how it got there is put into a metaphorical black box. Still there but, away from view until need be.[7]

The history of informatics and systems thinking correlates to the introduction of early computer technologies and their dissemination into society over time. The introduction of new technologies can make people change the ways they speak and think about the world around them in order to make sense of it. The cause-effect relationship between some technologies and ideas may nevertheless be difficult to assess. One could argue that figures like Ada Lovelace, Charles Babbage or Alan Turing, formulated the *idea* of the modern computer abstractly, long before the actual technology existed.[8] On one hand, one could claim that the idea of mechanical computing preceded its actualization, and in a narrative this could be constructed as a cause effect relationship. On the other hand, one could be critical against such linear relationships, and the idealism present in such narratives of «who thought of it first».

Swedish computer history can in a similar way be traced back to the Scheutz machine, but it was only after World War II that raised computational power made an impact on both society and thinking. After World War II, computer technology developed rapidly in the USA. The interest for this technology, was shared between large industrial firms, and the central government administration. Several conferences were held to discuss the opportunities and advantages of computer technology. One of those was held in 1954, in which Saab, Elektrolux and Volvo, among other industrial companies, and the state financial department and other central state agencies were present. Representatives from IBM and Remington were invited to present what they could offer.[9] Demand for new technology had to be established among decision-makers by making them aware of what its potential uses could be, but also a domestic competence had to be created for the use, maintenance and development of the computers for use in Sweden. The 1954 conference was the background for the establishing of the Integrated Data Processing group in 1955, which purpose was to organize and host conferences in the same vein as the 1954 conference, and in the longer run

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7 The term "black box" is used by several authors. Notable examples are the economical historian Nathan Rosenberg, *Inside the Black Box, Technology and Economics*, Cambridge University Press, 1982, and also Bruno Latour for whom the "opening of black boxes" was a central point in several of his works. See for example: Bruno Latour, *Science in Action*, *How to follow scientists and engineers through society,* Cambridge University Press, 1987.

8 More on this in Herman H. Goldstine, *The Computer from Pascal to von Neumann*, Princeton University Press, 1972. For a more contemporary view see: Sadie Plant, *Zeroes and Ones, Digital Women and The New Technoculture*, Fourth Estate, 1997, where Plant among other things argue that Ada Lovelace was the visionary to foresee the modern computer, not Babbage. Whereas Babbage constructed his computer, Plant argues that Lovelace had in fact developed a much more advanced machine in her theoretical notes.

9 Hans De Geer, *På Väg till Datasamhället*, 1992, pp. 46-48. At this time Saab was mainly concerned with manufacturing airplanes, the car company today known as Saab Automobile AB was sold to General Motors in 1990.

create a market for computers in Sweden. In this group Langefors was the representative from Saab.[10]

The wider problem to be touched upon in this essay is the relationship between technology, theoretical reflection and concrete practice. The study of computers from the perspective of the historian of ideas poses a fundamental question, which takes its problematic from the fact that the computer at first glance seems like a compound object outside us like any tool. However, the advent and widespread circulation of the modern computer has changed what we think and how we think. My interest focuses on how ideas in the sense of concepts, metaphors, ways of thinking and ways of speaking, emerge in the interplay between humans and the technologies they interact with. If ideas and technologies are closely connected, can we make sense of the causal relation between the two (as in some form of Marxist understanding of the world) or can we only study the correlation between the two, or worse, can we only study technologies as ideas or phenomena?

Source material

The primary source material to be studied in this essay is comprised of publications by Langefors and Dahlbom in the 1980s and the early 1990s. This periodization must not be seen as an absolute, and does not exclude works that were written or were published outside this period. It should rather be seen as an indication of the focus of this study, as the publications of Dahlbom and Langefors together span more than almost 70 years. Langefors published his first article in 1944, and Dahlbom is still active as a writer.[11]

However, the scope of this study will not cover the whole of the output of Langefors and Dahlbom. I have chosen to study those sections of the works of Langefors and Dahlbom that I find to operate on the borderline between the particular discourse of their own discipline and the more theoretical one, not strictly limited to the information systems development discipline. For this reason I will not go into detail regarding Dahlbom´s dissertation on naturalized philosophy, nor will I cover in detail the technical intricacies of Langefors' "*Theoretical Analysis of Information Systems*". I will, however, use these works as reference and background material.

From Börje Langefors' works I will focus on one publication in particular: *Essays on Infology,* published in 1993, which was edited by Dahlbom. It represents both Langefors' "summing

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10 Ibid. An account of this can also be found from Langefors himself in Börje Langefors, interview from 2005 by Janis Bubenko, Anita Kollerbaur and Tomas Ohlin. Available online here: http://www.tekniskamuseet.se/download/ 18.6aa228912529fe96108000155/1259138890880/67_B%C3%B6rje_Langefors.pdf.

11 Börje Langefors, "Rotationssymmetrisk böjning av hyperboloidformade plattor", *Teknisk Tidsskrift*, 74:24 (1944), pp. 747-748.

up" of his own theoretical production as well as the connection between the two writers.[12] The essays were both older unpublished texts, and newly produced material for the collection. *Essays on Infology* is a significant work in the context of my study for several reasons. Firstly it stands as a concrete product of the meeting of the two theorists. It marks an intersection between two generations of information systems theorists. Moreover it marks a concise statement by Langefors with regard to his theories of information systems at the end of his career. As such it is both a summary of and review by Langefors of his own theoretical production. They are characterized by a non-confrontational language, not going directly into neither theoretical nor political debates. The theories expressed in the book were elaborations the theories Langefors developed in the 1960s. However, there can be read many indirect references to the state of information systems development in the 1980s. As a publication it also represents the question as to why Dahlbom took it upon himself to edit and publish Langefors' essays.

 Essays on Infology contains nine essays by Langefors, as well as an introduction by Dahlbom and a preface by Langefors himself. This book can be understood as both a retrospective summary and Langefors' own revisions to his early theories and concepts based on the experience and history of the decades since the publication of his magnum opus *Theoretical Analysis of Information Systems.* These essays treat many subjects related to computer technology and information systems, but the overall focus lies with the subfield of information systems theory that Langefors himself developed, called infology. Some publications dating back to the 1970s are of special interest to this study. The report "Hermeneutics, Infology and Information Systems" gives us insight into the influence of the hermeneutical tradition on Langefors thinking that is seldom made explicit elsewhere.[13] The articles "The Infological Model", and "Information Systems Theory" give condensed expositions of two core aspects of Langefors' theory of information systems.[14]

 For a closer study of Dahlbom I have chosen the book *Computers in Context,* written in collaboration with Lars Mathiassen, and the report *En Artificiell Värld,* written with Jan-Erik Janlert.[15] While *Computers in Context* is written with the purpose of introducing information

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12 Börje Langefors, *Essays on Infology*, 1993.

13 Börje Langefors, *Hermeneutics, Infology and Information Systems*, Royal Institute of Technology & Stockholm University, 1977.

14 Börje Langefors, "Information Systems Theory", *Information Systems*, 2 (1977), pp. 207-219; Börje Langefors, "Infological Models and Information User Views", *Information Systems*, 5 (1980), pp. 17-32.

15 Dahlbom & Mathiassen, *Computers in Context*, 1993; Bo Dahlbom & Lars-Erik Janlert, *En Artificiell Värld, Forskningsläge och Forskningsbehov*, Arbetsmiljöfonden Styrelsen för teknisk utveckling (STU), 1988.

systems development students to philosophy, it also stands as an extensive expression of Dahlboms stances in both philosophy and informatics. The report *En Artificiell Värld* was written in 1988 for the state funded research program "Människor-Datateknik-Arbetsliv" (Humans-Computer Technology-Working Life), and two years later an article the two writers published a summarizing and complementing article in English titled "An Artificial World".[16] In these publications we can find in condensed form much of Dahlbom's views on the relationship between computer artifacts and theory. More importantly, the two publications present Dahlbom positioning himself in relation to the history of Artificial Intelligence and cybernetics, the two dominant traditions in post-war computer science and theory. Dahlbom conceived of cybernetics and Artificial Intelligence, not primarily as research programs in modern science, but also as different world-views, partially created by technology and society.

Although the aforementioned publications are the major works that will be subjected to close readings in this thesis, I will also take advantage of articles and other publications from the two writers published in this period. Significant among these are the articles Dahlbom wrote for the journal *Scandinavian Journal of Information Systems,* of which he was the first editor. Also of note is the book *Dennett and his Critics,* edited by Dahlbom, which serves to deepen the view of Dahlbom as a philosopher.[17] Neither of the publications chosen from Dahlbom are formally statements of philosophical programs. *Computers in Context* is in its function pedagogical, and *En Artificiell Värld,* is directed towards a government funded research program. Furthermore, all views cannot be attributed solely to Dahlbom since both books are co-written with other authors. These are complications that call for careful readings of the material. Also, cross-referencing other material from Dahlbom, is of importance.

The contribution of this paper to the research on the history of information technology and theory is characterized both by its perspective, and choice of empirical material. By choosing to study the Scandinavian information systems development discipline in the period of transition from organization-based systems to individualized networks in the 1980s and 1990s, I bring attention to a period that has not yet received much historical attention from neither the information systems development community itself, nor from historians of science and technology. While Langefors has been studied extensively both as a theoretician and as a historical figure, Dahlbom has not been studied in depth as being an influential figure in the field of information systems development.

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16 Dahlbom & Janlert, *En Artificiell Värld,* 1988; Bo Dahlbom & Lars-Erik Janlert, "An Artificial World: An invitation to creative conversations on future use and design of computer technology", *Scandinavian Journal of Information Systems,* 1:2 (1990), pp. 85-100.

17 Bo Dahlbom (ed.), *Dennett and his Critics, Demystifying Mind*, Blackwell, 1993.

Actors within the field of information systems development have conducted extensive work on analysing the theoretical discourse of their discipline. However, what characterizes this research, as exemplified by for example Hirschheim et al. and Iivari & Lyytinen, is a tendency towards abstraction and classification at the expense of understanding the individual theorists and their particular historical contexts. In terms of perspective, the contribution of the present study is that it studies its subjects as individual theorists rather than as proponents of specific schools or paradigms, and at the same time see them as parts of the larger contexts of society, technology and philosophy.

Method

For this thesis I have chosen a biographical approach for the meeting of *a veteran practitioner* who founded a theoretical discipline, and *a theorist* who has as his project to bring practice back to a discipline he sees as too rationalist. These were two people whose lives intersected over a period of few years, but each of them were interested in something in the other. By reading publications from both authors, I will study the way the two of them, as individuals and representatives of their generations and backgrounds, related to each other, what they aimed to achieve with collaborating. Rather than taking a diachronous approach I have chosen to make a certain focus point of my study, namely the meeting of Langefors and Dahlbom, and the publication of *Essays on Infology*. Thus I will follow the subjects of this study over a shorter period of time; I have chosen as a frame the years between 1980-1995. This periodization is not absolute. When needed, I will also refer to earlier works by Dahlbom and Langefors. This is frequently necessary in the case of Langefors, whose career starts in the late 1940s. I will make use of two perspectives in studying Dahlbom and Langefors. Firstly, I will make a comparative study of their theoretical and philosophical stance. *Philosophy* and *theory* are in this case understood in their broad senses. They refer to those aspects of Dahlbom and Langefors writings can be read as concerning the foundations of the discipline in which they are engaged, information systems development, but also when touching on subjects regarding epistemology and ontology in general.

To tackle questions about the relationship between theory in information systems development on the one hand, and philosophy on the other hand, we need to provide some working definition of theory in information systems development and at the very least specify what kind of philosophy we are talking about. Both of these questions are non-trivial to say the least. The nature and definition of philosophy is itself a philosophical question. Theory is a notoriously slippery term.

It can refer both to abstract "theories about the world" and to the concrete "I think that this is the way this specific situation is and works", or combinations of these.

My goal is not to "explain" Langefors as a product of the cybernetic discourse of the 1960s. The first task must be to complicate his position in the narrative of Swedish post-war history, not the least with regard to the relationship between information systems development and power. The second task must be to find those aspects of Langefors theories that stand out as his own.. Rather than reading Langefors as purely a product of his socio-historical context, I am interested in locating those aspects of his writing that can be classified as philosophical.

Similarly, but from the opposite point of view, I must resist the temptation of reading Dahlbom as secondary literature. Dahlbom consistently includes a historical perspective in his writings, and places himself firmly in a tradition of intellectual history. The awareness of his own historicity and also the inherent reflexivity of Dahlbom's writings, poses a problem of distance when trying to study Dahlbom historically. If the subject of my study was Langefors exclusively, Dahlbom would be a natural source of secondary literature and theory. Our temporal proximity to Dahlbom also contributes to this problem. He often writes about the same things I am aiming to analyze in ways that are tempting to use for my own purposes. The solution to this problem may be to contextualize this reflexivity in itself.

The relationship between technology, theoretical reflection and concrete practice is a theme that was central for both Dahlbom and Langefors. Even though their points of view were at times opposite to each other, they both struggled with these questions in their writings. In this respect, doing a limited historical study, provides some advantages. The object of my study is the theoretical reflection and debate in the information systems development field. The method for studying this is first to situate the positions of the two writers into a historical context. This means in part giving an account of the history of the information systems development field. It includes taking a biographical view to each of the actors in order to identify their differences. Second, I will read closely works by each of the actors with the goal of assessing if, and in what ways the writings of each of the actors, can be considered to be philosophical.

State of Research

The research on the history of the information systems development discipline in Scandinavia is dominated by two perspectives. The first is the research that members of the information systems development field themselves do into the history of their own field. Their research in the history of information systems development often is motivated by the wish to understand and reflect on their own field. However, the history of the discipline often also serves a rhetorical or argumentative purpose, in debates which the writers themselves have interest in.

The second perspective is the research done from the field of computing history into the role the discipline had in the introduction of computers to Scandinavian societies after World War II. This is exemplified by the conference *History of Nordic Computing.*[18] It uses historical methods, but places its focus in the early stages of implementations of computers, and often has a power/control perspective, seeing computer technology mainly as a means to rationalize the welfare state control mechanisms.

Other approaches exist. Somewhere in the middle of the two main bodies of research comes the project "Från matematikmaskin till IT" (From Math Machine to IT) managed by the Museum of Technology in Stockholm. This project, aiming to document the history of computers and information technologies in Sweden, includes a significant oral history project of interviewing the actors of Swedish computer history. It spans 154 interviews conducted by professional historians as well as by members of the field of information systems development. As such it provides a valuable and detailed source material for any account of Swedish computer history. For this study a lengthy interview with Langefors is of special interest.[19]

The research done by actors within the field of information systems development generally goes into detail, and is explicitly concerned with theory. The literature documents the history of the field, but it also takes part in debates and polemics, which will be seen later in this paper. This requires us to take a particularly critical stance with regards to the partiality of these accounts of the history of information systems development. The research from the field of history is mainly concerned with the role of information systems and their proponents in the larger context of society. From the field of history of science and technology there is much written about the development of information systems in relation to its societal and historical context but little about the development and dynamics "internal" to the field itself. The actors in the information systems development field

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18 The conference *History of Nordic Computing* is organised under International Federation for Information Processing, and the location alternates between the nordic countries.

19 Börje Langefors, interview from 2005 by Janis Bubenko, Anita Kollerbaur and Tomas Ohlin.

were, even in its early years, aware of its historical significance. Moreover they were aware of its historicity. Much of the writing in the field includes historical accounts of the development of theory in the information systems development field. What lacks in many of these historical accounts (although not all) is a critical view to the social context of the academic history. The motivation for writing these versions of the history of information systems development was not seldom to argue for one's own position.

For an overview of the history of information system development in Scandinavia, I rely heavily on two papers written by members of the field, but from two different perspectives. Iivari & Lyytinen's "Research on Information Systems Development in Scandinavia - Unity in Plurality" is a historical account of the discipline with focus on the theoretical development until the 1990s.[20] It is written from an insider's perspective, engaging closely with the theoretical differences in the history of Scandinavian information systems development. Floyd et al. "Out of Scandinavia" delivers an outsider perspective on what is defines the "Scandinavian Approach" to systems development.[21] It gives an extensive survey of the history and present of the Scandinavian information systems field, with a view to what differentiates the field from the international field of systems development and computer science, and moreover socio-cultural explanatory factors for those differences. The two articles give an interesting diversity in perspective. By viewing the field from both inside and outside, we can see different aspects of the history of the information systems field in Scandinavia. Notably, there seems to be a willingness to explain aspects of the Scandinavian Approach by socio-cultural and historical factors in Floyd, while Iivari & Lyytinen are more reserved towards such explanations. However, there are some shortcomings to using these articles as a main background. They are both quite close temporally to the period I am studying, being published in 1989 and 1998, respectively. The fact that all authors have been involved in the field that is the object of study, has the advantage that the accounts are detailed and accurate when it comes to understanding and using the vernacular of the field. The downside of this approach is the lack of historical distance. Although it may be said that no historian is objective, the lack of professional historians in these narratives, and lack of distance both in time and in terms of being part of the object of study, demands an attentive gaze to problems of objectivity.

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20 Juhani Iivari & Kalle Lyytinen, "Research on Information Systems Development in Scandinavia - Unity in Plurality", *Scandinavian Journal of Information Systems,* 10:1-2 (1998), pp. 135-186.

21 Christiane Floyd, Wolf-Michael Mehl, Fanny-Michaela Reisin, Gerhardt Schmidt & Gregor Wolf, "Out of Scandinavia: Alternative Approaches to Software Design and System Development", *Human-Computer Interaction,* 4 (1989), pp. 253-350.

Rudy Hirschheim and Heinz K. Klein give a third synthesis of the history of the information systems development field.[22] They differentiate between what they call paradigms of data modeling, which are distinguished from each other based on certain "paradigmatic assumptions", that is, implicit philosophical foundations of a certain paradigm. Four main paradigms are posited, that, although not put to practice in equal degree, have significant bearing in the theoretical discourse of information systems development. These four paradigms of data modeling are: a) the functionalist paradigm, b) the social relativist paradigm, c) the neo-humanist paradigm and d) the radical structuralist paradigm. We can see how these four "paradigms" can be made to correspond loosely to broader intellectual trends in the period we are studying. At the brink of the 1980s, positivism in the social sciences had been under attack for decades, both internationally and in Scandinavia, from different alternating perspectives. Notable among these were academic marxism, hermeneutics, and french structuralism. Also what was popularly known as postmodern, or post-structuralist theory, had been gaining publicity and some popularity in the 1980s. If we let the functionalist paradigm correspond to the tradition from positivism and empiricism inspired both by the Vienna circle and by the perceived primacy of the natural sciences, we can thus plot the other three paradigms described by Hirschheim et al. as follows: The social relativist paradigm corresponds loosely to hermeneutic thinking inspired by Martin Heidegger and Hans-Georg Gadamer, the neo-humanist paradigm corresponds to the critical marxism tradition following the Frankfurt School, and the radical structuralism relates to the French structuralist tradition.

The advantage of this approach is that it focuses on the information systems development field as a whole. It puts the Langefors and the Scandinavian approach into a historical context that spans the international field. It is also the most up-to-date historical view from the field itself. The article provides a rudimentary periodization into four eras of the development of the information systems development field, that I will make use of, although not dogmatically. One of the subjects that will be studied in relation to Dahlbom and Langefors is how the interpretations and classification of the history of the information system development field were subject to debate, and were often partially used to back up own positions. As such, the classification scheme proposed by Hirschheimer and Klein cannot be taken as a representation of the consensual view within the information system development field.

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22 Rudy Hirschheim, Heinz K. Klein & Kalle Lyytinen, *Information Systems Development and Data Modeling, Conceptual and Philosophical Foundations,* Cambridge University Press, 1995; Rudy Hirschheim & Heinz K. Klein, "A Glorious and Not-So-Short History of the Information Systems Field", *Journal of the Association for Information Systems,*13:4 (2012), pp. 188-235.

Dahlbom was himself concerned with historicizing the information systems development field. Both by putting his own work in the context of the history of information systems, and by thinking of information systems in a broader context encompassing both the history of ideas and philosophy, notably conceiving of the competing trends in information systems thinking in terms of *romantic,* and *mechanistic* world-views.[23]

To put the ideas of Langefors and Dahlbom into a broader context, I will attempt to use two concept-pairs as possible framings for their thought. The first approach states that from the seventies on, the western societies were on their way from *modernity*, and they were approaching a state of *post-modernity.* This idea, of a post-modernity, as a state of culture and society, was introduced in the form I use it by the philosopher François Lyotard.[24] Modernity for Lyotard was characterized by a drive towards the rational society. Post-modernity is really, in Lyotards view, a stage of modernity in which its inner contradictions have become apparent, and the drive is rather towards overcoming these contradictions.

The second pair of concepts is *humanism* and *post-humanism.* Less so than is the case with the concepts of modernity and post-modernity, are these concepts easily applicable on social, reality, and rather bear connotations to the plane of ethics. Taking the cue of Katherine Hayles, I will read human as a category that is a construct as well as a biological fact, but neither are the biological facts stable, in the century that saw the sophistication of genetic engineering, organ transplantation, and prostheses.[25] Katherine Hayles argues that the ideas that originated in the cybernetics movement and AI, together with the disembodiment of information in informatics were closely interrelated with a shift from "human" to "post-human".[26] Post-humanism is the break, in both physical reality and in the sphere of culture, with the human as the constant immutable category against which all other things are measured. Hayles sees this break as closely connected to the development of computer technology and more specifically with the narratives put forwards by the cybernetics movement and information theory.

For Hayles the development of the figure of the *cyborg* in the discourse of cybernetics constitutes a break from the Cartesian model of the human as a rational being first, and a material body only secondarily. The notion of machines as seamlessly extending both the mind and the body,

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23 Dahlbom & Mathiassen, *Computers in Context*, 1993. An example can be found on p. 8.

24 Jean-François Lyotard, "The Postmodern Condition", in Michael Drolet (ed.), *The Postmodernism Reader, Foundational Texts*, Routledge, 2004.

25 Katherine Hayles, *How We Became Posthuman, Virtual Bodies in Cybernetics, Literature and Informatics*, University of Chicago Press, 1999.

26 Ibid.

and that of feedback loops that that break down the borders between subject, outside, and object, are important consequences of the history of cybernetics and informatics.

In the book *The Closed World,* Paul Edwards argues that American culture and society after World War II was dominated by what he calls the cyborg discourse and the closed-world discourse. Closed-world discourse refers to the paranoid functioning of the political language game under the cold war. It describes "the language, technologies, and practices that together supported the visions of centrally controlled, automated global power at the heart of American Cold War politics."[27] The cyborg discourse is the "psychological/subjective counterpart of closed-world politics."[28] Characterized by the conflation of the human mind and machines, in particular computer technology, it is primarily characterized by considering minds as "natural-technical objects [...] through the metaphor of computing".[29]

The idea of post-humanism, in Katherine Hayles terms, is still closely related to the figure of the human. As in Lyotards account, the notion of post-modernity is seen as a historical phase of modernity, where it is its reflective self-image that changes, Hayles sees the post-human condition as relating to a change in the ways humans understand what "human" means. While one can say that Hayles in the vein of Donna Haraway is investigating changes in subjectivity, Yuk Hui on the other hand investigates the possibility of new ontologies of objects. Drawing on both the phenomenological tradition after Edmund Husserl and Martin Heidegger, as well as cybernetics and AI research, Hui calls for research into the ontology of digital objects. Digital objects are, in his view, distinct from both natural objects and technical objects.[30]

The research done about Langefors by actors in the information systems development field is extensive. Deserving special mention is *The Infological Equation,* the festschrift to his 80th birthday, which is comprised of articles interpreting Langefors' as a theoretician and historical figure, but also criticizing his position.[31] I must mention that Dahlbom, the second subject of my study is editor and contributor to this publication. Moreover I consider his included essay "From Systems Thinking to Networking" as source material for my study of Dahlboms version of information systems theory. As such it could be considered problematic to include this as reference

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27 Paul N. Edwards, *The Closed World, Computers and the Politics of Discourse in Cold War America*, MIT Press, 1996, p. 7.

28 Ibid., p. 2.

29 Ibid., p. 21.

30 Yuk Hui, "What is a Digital Object?", *Metaphilosophy*, 43:4 (2012), pp. 380-395.

31 Bo Dahlbom (ed.), *The Infological Equation*, 1995.

material to studying Langefors. However, as the essays included stand as expressions of their authors own views, rather than as uncritical praise of Langefors, or following a program dictated by Dahlbom, I consider this collection as a valuable source of secondary literature on Langefors and the information systems development discipline in general. Of special interest are the essays "The Infological Equation Opening Two Perspectives on Information Systems" by Hans-Erik Nilsson and "On Some Constructs and Ideas Introduced by Börje Langefors" which bring important insights to the task of analyzing Langefors theoretical production as a whole. Moreover the essays included in *Examining Langefors' Ideas,* published in 2007, give updated perspectives on Langefors' theories. but from a quite partial perspective.[32] It is also worth noting the results from a project at Linköping University in 1994 and 1995 that focused exclusively on Langefors' theoretical work and resulted in a research report with contributions from the PhD. students who participated.[33]

In Dahlbom's case there is fewer publications specifically treating him as a theoretician. This has several explanations. One is that Dahlbom's work is significantly more recent than Langefors'. The second that he still is active in his field. The greatest body of work specifically treating his contribution to the information systems development field is collected in *Informatics in the Next Millennium,* a festschrift celebrating his 50th birthday.[34] The caveats to using *The Infological Equation* as secondary literature also holds for this publication. In addition Dahlbom himself contributes with an essay to the collection. *Informatics in the Next Millennium* is also characterized by less distance, and perhaps less distance to its subject than is the case with *The Infological Equation.* However, in my view *Informatics in the Next Millennium* presents the most coherent and comprehensive narrative of Dahlboms career available. Of special interest is the essay "The Old and New Informatics" by Thanos Magoulas and Kalevi Pessi which deals specifically with the relationship between Dahlbom and Langefors.

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32 Peter Ekman & Péter Révay (eds.), *Examining Langefors' Ideas, from information systems, technology and learning perspectives,* Mälardalen University, 2007.

33 Anders G. Nilsson (ed.), *Klassisk Informationssystemteori: Fokus på Börje Langefors infologiska teoribildning, Bidrag från 21 doktorander,* Linköpings University, 1995.

34 Fredrik Ljungeberg (ed.), *Informatics in the Next Millennium, Essays in Honor of Bo Dahlbom*, Gothenburg Studies in Informatics, 1999.

Purpose and Research Questions

The initial framing for the present study is this relationship between new technologies, and new ways of making sense of the world. In the case of the object of this essay, it is the consequences in thought of the introduction of computer technology in the 20th century. The problem I take as my starting point is the relationship between technology, theoretical reflection and concrete practice. The computer can at once be seen as a product of the context from which it emerged, and a cause of new developments in society and intellectual life. This is significant because it leads us to analyze computer technology and its relationships to theory and practice not only from a utilitarian perspective, viewing it as a tool, but as both product and cause, intermingled with the history of ideas. The Scandinavian information systems development discipline was a field in which professional practice, theoretical discourse and technological innovation existed side by side. This makes it an ideal case for studying the present problem.

The purpose of the present study is to analyze how actors in the Swedish information systems development discipline related to the technical and social practice of systems development on one hand, and theoretical reflection and philosophy on the other, by studying the theoretical writings of two important actors in the field.

The questions posed to the material fall into two categories, and are posed on two levels of inquiry. One level seeks to understand the writings of Dahlbom and Langefors as products of the history of informatics and the history of philosophy. The other level seeks to identify in their writings aspects of their theories that can be considered philosophical. There are thus two types of questions asked in this paper: those that ask for the actors motives for their actions as conscious and autonomous, and those who seek to explain and understand their actions in the context of larger structures. The actions here considered are texts and the primary contexts I will consider are textual.

First, I seek to understand the texts of Langefors and Dahlbom based on how they relate to each other, how they relate to the limited discourse of the Scandinavian information systems development field, and how they relate to the greater currents in the history of philosophy and informatics. Specifically I ask in what ways Dahlbom and Langefors can be read as philosophers, or as practicing philosophy, and in what ways is it feasible to view the theories expressed in the publications of Dahlbom and Langefors as their theories as philosophical. Second, I will take on the relation to technological change as explanatory factor. However, I will not employ a univocal model of causality between technology and ideas. This leads us to the question of *what kind* of effects the emergence of computer technology had on the thought. Conversely, the question of what kind of

effects had ideas taken developed in theory on approaches to computer technology. I will rather study how technology finds its way into thought by way of metaphor. The subjects of this study, and Dahlbom in particular, are characterized by a high degree of reflection with regard to their relation to the canon of western thought. As such, understanding either of them as solely products of a discourse on technology will be a mistake.

My research questions are as follows:

- In what way does the writings of Dahlbom and Langefors relate to the historical context they were part of? In what ways can they be seen as exceptions to these contexts?

- Why was Dahlbom interested in publishing a collection of essays by Langefors?

- From a philosophical perspective, what are the differences between the two, and what unites them? Which ideas and positions made Dahlbom and Langefors resonate with each other in the early 1990s?

Theory

In my analysis I use the word "philosophy" on two levels, in which the words have slightly different meanings. I use the word philosophy in a broad sense as an analytical concept, which is discussed in the present section. This concept may include what may be considered to be "theory" in other contexts. When I consider whether Langefors or Dahlbom can be *read* as philosophers or practicing philosophy, even though they might not themselves call it by that name, I will use the term in this way. I also use the terms when discussing how Dahlbom and Langefors related to philosophy. In this context the meaning of the word philosophy is more narrow, and refers to what the actors considered to be philosophy or philosophical.

It is appropriate here to give at least a rough definition of what I mean by philosophy as an analytical concept. The question of the nature of philosophy is indeed itself a philosophical question. Deleuze and Guattari understand philosophy as "the art of forming, inventing, and fabricating concepts."[35] In this sense, philosophy is a productive activity, rather than a descriptive one, the purpose being to create new realities rather than making sense of an existing one. Philosophy "is not contemplation, reflection, or communication."[36]

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35 Gilles Deleuze & Felix Guattari, *What is Philosophy?*, Verso, 1994, p. 2.

36 Ibid., p. 6.

Another definition of philosophy comes from the Marxist philosopher Louis Althusser. For him, philosophy consists in a never ending activity of drawing lines of demarcation, in the form of *theses*.[37] He sees philosophy as an activity that stands in relation to science, but at the same time is distinct from it. What distinguishes philosophy from science in Althusser's view is that philosophy lacks an object, other than philosophy itself. However, Althusser notes that in a way, scientists practice philosophy spontaneously, without knowing it. They practice philosophy when they draw lines of demarcation between science and what is not to be considered science, that is, ideology.[38]

Dahlbom and Langefors both reflect on the fundamental principles, goals and concepts of information systems development. Taking Althusser's view of the "spontaneous philosophy of scientists" as a model I look for these reflections in their writings. Although Althusser had a much more limiting definition of what constituted a "science" as opposed to "ideology", we can take as our hypothesis that the reflections and negotiations of the *limits* of the information systems discipline coincides with what we may call philosophy. Given that, I ask what philosophical *theses* can be extracted from the writings of Dahlbom and Langefors in the period in question, and if we can contextualize the two meaningfully as not just partakers in an intra-disciplinary discourse, but also a broader discourse pertaining to the philosophical problems of epistemology, ethics and ontology. Althusser's idea of the spontaneous philosophy of scientists can, in my view, be connected to Thomas Kuhns theory of paradigms and scientific revolutions.[39] Kuhns theory is well-known, and in broad strokes it distinguishes between "normal science" that takes place within a "paradigm", and the science that happens when a paradigm is no longer satisfactory to the practitioners of science. The latter is what Kuhn calls a revolution in science that results in a new paradigm. It is to this "revolutionary" practice of questioning the fundament of what is science or non-science, we can apply Althusser's notion of spontaneous philosophy. However, Kuhns theory of paradigms and scientific revolutions seems too broad to be applied concretely to the objects of this paper. I would rather apply a version of "paradigm" that is less extensive. One could argue that the development of computer science in the 20th century indeed constitutes a scientific revolution in Kuhns terms. However, applying Kuhns theory as is, can be problematic, because Kuhn in many ways sees scientific paradigms as monolithic. Hirschheim et al. operates with a much less extensive

37 Louis Althusser, "Philosophy and the Spontaneous Philosophy of the Scientists", in *Philosophy and the Spontaneous Philosophy of the Scientists and Other Essays*, Verso, 1990. I also rely on Pierre Macherey's reading of Althusser in Pierre Macherey, "Althusser and the Concept of the Spontaneous Philosophy of Scientists", *Parrhesia,* 6 (2009), pp. 14-27.

38 Louis Althusser, "Philosophy and the Spontaneous Philosophy of the Scientists", p. 106.

39 Thomas Kuhn, *The Structure of Scientific Revolutions*, University of Chicago Press, 1996.

version of paradigms. For Hirschheim et al. there is more than one paradigm at a time, and they are sometimes in competition with each other, sometimes complementing each other.[40] The advantage of using this, more limited, version of paradigms, is that we can consider if statements and positions can be considered as expressions of philosophy in Althusser's sense, while not necessarily refer to a revolution in science tout court. This leads us to the possibility of a notion of revolution or paradigm shift that is not negative, as it is presented in Kuhns version, but rather productive, consisting of an activity of *creating* new paradigms, not determined solely by the negation of the one left behind.

I propose three different senses of philosophy that I will use for this paper: Firstly philosophy as a spontaneous activity done by scientists when they question the fundamental limits of their discipline. Second, philosophy as the creative activity of creating new concepts. Finally, philosophy as the construction of new paradigms. In the context of this study I will consider philosophical those statements that go beyond the questions internal to the scientific paradigm and touch upon *either* questions of metaphysics that have universal aspirations, *or,* is concerned with the limits of the scientific paradigm itself. I am asking whether Dahlbom and Langefors can be understood as practicing philosophy as discussed above, and if so in what way. In Dahlboms case the answer seems to be given beforehand, as he indeed *is* a philosopher. However the question remains in *what sense* Dahlbom is practicing philosophy.

In my analysis of the relation between the works of Dahlbom and Langefors and the contexts in which they were written, I rely heavily on the framework developed by Paul N. Edwards in *The Closed World.* Especially his notions of cybernetic paradigm and cyborg discourse as central constituents of a paranoid cold-war discourse are important. However, transferred to a Scandinavian and Swedish context this framework needs to be adjusted given the significant differences in the socio-political context of America and Scaninavia at the time in question. One important difference is that the *closed world* discourse Edwards argues defined cold-war America, where all statements about the world ultimately lead back into a enclosed space of discourse, cannot be said to have existed in the same way in the Scandinavian countries. Both by virtue of their histories of neutrality and of the welfare state, fear, although certainly present, was not channeled on the ideological level towards paranoia. However, other aspects of Sweden and Scandinavia fit well with Edwards' analysis. Sweden was a highly developed country in terms of science and technology. Also, as was the case in America, the use of computers was first widespread in the military aircraft industry.[41]

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40 Hirschheim, Klein & Lyytinen, *Information Systems Development and Data Modeling,* 1995, ch. 4.

41 Hans De Geer, *På Väg til Datasamhället*, 1992.

The philosopher and anthropologist of science Bruno Latour describes what he calls the cybernetic moment:

> For a moment, in the fifties and sixties, the coincidence of philosophy, brain sciences, social reforms, world markets and the advent of computers, seemed so powerful that this dream of absolute clarity was shared by everyone (I mean the few who believed they counted for everyone).[42]

Cybernetics is the name of an American research program comprised of computer scientists and psychologists in the 1950s and 1960s, but also a certain line of thought about the relationship between technology and the human organism. The main goal of the research program of cybernetics was to integrate human and machine in theory in practice. This meant conceiving of the human mind as a computer, and conversely understanding computers as electronic brains. The question of artificial intelligence has ridden the history of analytical philosophy ever since the World War II. Paul Edwards calls this a "closed-world" paradigm, and connects the integration between humans and machines with the paranoid ideology of the cold war.[43] Latour, however, takes a more positive view to the cybernetics movement. Latour sees it is at both the expression of a desire to rationalize everything, and make everything "modern", and at the same time undermining that same rationality. Trying to understand man as a rational machine falls short when the machines don't act rationally. Latour describes what we could call the "soft" or in Dahlboms terms "romantic" view as being the natural, but wrong, reaction to this insight. Computers and people are not the objective and rational machines they were thought to be in the 1960s: "Take the human, for instance. Of course, it is no longer a calculating entity which could easily be morphed into silicon chips. But it is certainly not a subjective, reflexive, intentional, embodied unity either."[44]

Paul Edwards describes the cybernetic paradigm, and what he calls the cyborg discourse as ways of simultaneously making sense of machine-human interaction as well as satisfying the need for control and rationalization in the cold-war paradigm. Wendy Chun, on the other hand, focuses on the inherent instability of the processes the cybernetic paradigm conceived of in terms of binary logic. Important in both accounts is the transition from analog computing to digital computing as both technological changes and paradigm shifts. While Edwards argues that the digital propositional

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42 Bruno Latour, "Social Theory and the Study of Computerized Work Sites", in W. J. Orlinokowski & Geoff Walsham (eds.), *Information Technology and Changes in Organizational Work*, Chapman and Hall, 1995, p. 6 (pagination from the version available at Bruno Latour's website: http://www.bruno-latour.fr/sites/default/files/61-COMPUTERS-GB.pdf).

43 Paul N. Edwards, *The Closed World*, 1996.

44 Bruno Latour, "Social Theory and the Study of Computerized Work Sites", 1995, p.8.

logic "won" in that it became the dominant language in the techno-science discourse after the war, Chun points out that this is in a large part due to a theoretical axiomatic being imposed on technology itself. That is, technology had to be made to behave digitally to conform to logic, not the other way around. These two perspectives are not exclusive but rather two sides of the same coin. They show that the language and discourse of power is in a complicated relationship with technology, that is far from univocal. Edwards writes of metaphor as a crucial function, in the sense of the digital computer as metaphor structuring the scientific discourse in post-war America. Chun on the other hand emphasizes the role of analogy, that is, a function that is not limited to the relation language-reality. Again these differences do not exclude each other, but show us different things.

Definition of Concepts

In the present essay I will use a number of concepts that may be unfamiliar to the reader. I will here clarify some central concepts that I use throughout the text that belong specifically to information systems theory.

The term "information systems" can at times be confusing. In the literature on the subject it can refer both to the academic field having information systems as its object of study and the information systems themselves. The academic field of information systems development also goes under different names, sometimes referred to only as "information systems", other times as sytemeering, management information systems, information systems studies, infology, informatics, and versions of these.[45] In this paper I have chosen to use the term i*nformation systems development*, as a term referring to the field as a whole, though some of the actors thus included may not identify with the term. Information systems development as I use it will refer to both the practice of developing information systems, the academic discipline connected to universities and higher education institutions, and the theoretical discourse surrounding these.[46]

Part of what this essay examines is the way the information systems development field forms and disagrees upon analytical concepts for understanding itself. I will nonetheless have to choose some concepts in order to write about this discourse as a historian, at the expense of alternative concepts. This pertains to the core dichotomy between "hard" and "soft" approaches to information systems development. These are the terms I will be using, although there are several

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45 This confusion of terms is noted even in 2013 in Antony Bryant et al., "Information Systems history: What is history? What is IS history?What IS history? ... and why even bother with history?", *Journal of Information Technology*, 28 (2013), p.10.

46 This choice is inspired in part by the use of the term information systems development in Hirschheim, Klein & Lyytinen, *Information Systems Development and Data Modeling*, 1995.

alternatives, as I consider them less loaded with the connotations of a specific historical debate. These are broad metaphors, but roughly I will say that in the field of information systems development, "hard" refers to an approach that emphasizes the technical aspects of systems development, and "soft" refers to an approach that incorporates the perspectives of the human users.

Infology was a term Langefors himself coined for his own theory of information systems, based on the theories he developed in *Theoretical Analysis of Information Systems*. Even though it still is referred to it did not gain status as an "official" theory or discipline.

Cybernetics refers to both the research program that emerged in the wake of the first computers after World War II, and the broader system of thinking the relationship between technology and the human mind. It is characterized by conceiving computers and the human mind as strictly analogous, both being seen as passive information processors.

Artificial Intelligence, commonly referred to as AI, was a research program that sprung out from cybernetics in the late 1950s and rejected some of its fundamental assumptions. The AI research program originated at the Darthmouth conference in 1956 where many of the leading figures of AI in the years to come attended. Rather than aiming at modeling the human mind on the computer on a one to one level, the goal of AI was to simulate the human mind on a larger scale, conceiving of it as a symbol manipulator rather than passive information processor. Its most prominent manifestation was perhaps the research done at MIT led by John McCarthy and Marvin Minsky. The MIT AI group was also the target of the critique from philosopher Hubert Dreyfus, who claimed that AI research was on level with alchemy, in that its premise, that machines could be made intelligent, was false.[47]

Information systems

"Information systems" is not a univocal concept. While information systems initially was conceived of as the computer systems themselves, Langefors along with others went on to generalize the concept to also include the human users as parts of the systems. Notably Langefors developed his own version of information systems theory which he called "infology", first formulated in his seminal work *Theoretical Analysis of Information Systems,* which attempted to incorporate the human users and organization into its systems theory.

To gain a clear vision of the historical meaning of the terms we must start with what distinguishes the concept "information system" from "computer". One definition of "information

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47 For example: Hubert L. Dreyfus, *What Computers Can't Do, A Critique of Artificial Reason,* Harper & Row, 1972.

systems" is this: "Information systems (IS) is an area of research positioned between management and applied computing, where it is influenced by numerous kindred and reference disciplines."[48] David Alan Grier points out that the concept had shared origins with the concept of computers. While the first post-war computers were used to do just that, compute, calculate, the information system, or information retrieval system "commonly described a machine that could retrieve documents based on keyword searches."[49] More than a machine for processing numbers, the computer as information systems was conceived as a machine for storing and retrieving information and ideas. Having originated as a technology of war, used for calculating ballistic tables, and in aircraft, the computer now parked ideas of possible uses in business and science. We can see here that the emphasis was put on "information" and its retrieval, and not so much on "system". Grier, citing Vannevar Bush, describes the concept of the information system as an encyclopedic tool for the advancement of science and the rationalization of management. The conception of information system I will investigate, based on the writings of Dahlbom and Langefors, differs significantly from this American origin.

Cybernetics and AI

As noted earlier, Langefors can be placed, although not without complication, within the cybernetic tradition. This movement originated in 1942 at the first Macy conference held at Princeton university. It was a research program seeking to integrate humans and computers with each other. Norbert Wiener, one of the driving forces of cybernetics stated that the goal of cybernetics was to be a general theory of "control and communication in animal and machine".[50] Cybernetics was characterized by the assumption that computers and humans can be analyzed on the same ontological level. Paul N. Edwards argues that cybernetic thought included a two-way metaphorical relationship, implying that the human mind could be thought of as a computer, and conversely that a computer would be explained as an "electronic brain".[51]

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48 Chrisanthi Avgerou, Claudio Ciborra & Frank Land (eds.), *The Social Study of Information and Communication Technology, Innovation, Actors, and Contexts*, Oxford University Press, 2004, p. 1.

49 David Alan Grier, "The Relational Database and the Concept of the Information System", *IEEE Annals of the History of Computing*, 34:4 (2012), p. 10.

50 Charlie Gere, *Digital Culture*, Reaktion Books, 2002, p. 54.

51 Paul N. Edwards, *The Closed World*, 1996. Wendy Chun has written more in-depth on the human mind as a metaphor for software and memory in computers in Wendy Hyu Kyong Chun, *Programmed Visions: Software and Memory,* MIT Press, 2011.

A different movement that originated from the cybernetics movement in the USA but diverged on many points was the AI research program. While the cybernetics movement were largely concerned with *integrating* humans and computers, both in theory and practice, the AI researchers wanted to see to what extent computers could be used to simulate or model human behavior. Both these movements proved to be immensely influential well beyond the field of computer science. Notably both cybernetics and AI had a significant impact on psychology and analytic philosophy. It must be pointed out that these were to a large degree American or Anglo-Saxon movements. The dominant current in American psychology known as cognitive psychology drew much on the AI research. Also, the questions posed by both cybernetics and AI research became recurring figures in the analytical tradition of American philosophy, especially in the areas of philosophy of mind and epistemology.

Cybernetics and AI have influenced continental thought, although not in the same defining way as in the anglophone world. The influence of phenomenology and hermeneutics in Europe may have had bearings on this. As the philosopher and AI-critic Hubert Dreyfus points out, the AI notion of the mind as a system for symbol manipulation goes badly with the Heideggerian notion of readiness-at-hand.[52] However, several of the main proponents of postmodern thought, such as Lyotard, Baudrillard and Virilio see the cybernetics movements and AI as central to the notion of a condition of postmodernity.

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52 Hubert L. Dreyfus, "Why Heideggerian AI Failed and how Fixing it would Require making it more Heideggerian", *Philosophical Psychology*, 20:2 (2007), pp. 247-268.

Börje Langefors and Bo Dahlbom

Börje Langefors, born 21. March 1915, was a central figure in introducing computer technology in Sweden, as well as theoretical thinking about the possible uses of the new technology. In 1957 he took the initiative to develop and build SARA, one of Sweden's first computers for SAAB. In 1966 he became the first professor of business information systems and information processing at the University of Stockholm and the Royal Institute of Technology in Stockholm.[53] Central for the legacy of Langefors was his work on an information systems theory, laid out in his main work *Theoretical Analysis of Information Systems*[54]. Some of the main points in his analysis were to distinguish *information* conceptually from *data,* and furthermore to lay out the groundwork for a theory of i*nformation* systems as opposed to general systems theory.

Being a part of an impressive development depending on both government and private interests, as well as scientific and engineering communities, Langefors is frequently cited as a quintessential figure in developing a theory where computers could be understood as information systems, as well as *parts* of information systems. Langefors himself stated that he had a tendency for reflection, and a lifelong interest in philosophy. Even though, as Dahlbom has pointed out, he was more a problem-solver than a man for bold statements, throughout his work there is a line of reflection over the fundamental, and not just practical, questions concerning information systems and computing. More specifically, Langefors became occupied with questions regarding the interface between human users and information systems. Langefors theoretical work developed into what he called infology, which can be seen as a meeting point between the systems theory he laid out in *Theoretical Analysis of Information Systems,* that relied on a largely formal and algebraic exposition, and questions pertaining just as much to language philosophy and hermeneutics.

Bo Dahlbom, born 1949, received his education in philosophy at the University of Gothenburg, where he delivered his doctoral thesis *Structure, Mind, and Meaning* in 1977. Dahlbom took on an academic journey during the 1980s, from his foundations in philosophy, towards an interest in computer technology and information systems.[55] *Structure, Mind, and*

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53 Janis Bubenko Jr., Mats Lundeberg, Anita Kollerbaur & Arne Sølvberg, "Börje Langefors, Gottskär", *Sydsvenskan*, January 11, 2011.

54 Börje Langefors, *Theoretical Analysis of Information Systems*, Studentlitteratur Lund, 1973. Early versions of this book was in use in education programs in sweden led by Langefors from 1964, and was first published in 1966. However the 1973 edition remains the standard edition most commonly referred to by both Langefors and others.

55 A remark to be made about the interesting distinction between theoretical and practical philosophy in the swedish higher education system: The distinction goes roughly between the perceived «foundational» areas of ontology, epistemology and language philosophy on the one hand, and on ethics, political philosophy, and philosophy applied to practical problems on the other hand.

Meaning, treated methodological questions in analytical philosophy, and he cites the American philosopher of mind Daniel Dennett as an inspiration.[56] However abstract the thematic seems of his dissertation, we can find a tone and tendency to apply and learn from the practice of science.

A decade and a half later Dahlbom would write a book together with Lars Mathiassen on the philosophy of developing computer systems, called *Computers in Context.* Directed at informatics and business students to give them a broader and more reflective perspective to systems development, but proved to be influential in the information systems development field in general in the decade to come.[57] It was around this time Dahlbom contacted Langefors and proposed to edit the collection of essays that would become *Essays on Infology.*

In *The Infological Equation,* the festschrift edited by Dahlbom in honor of Langefors' 80th birthday, Dahlbom sketches a possible shift in the theoretical framework of information systems theory.[58] He alludes to Langefors theorizing about the systems approach, correlated to structuralist thought, and from this background, Dahlbom projects a postmodern shift in informatics. In some ways I suspect that he also in this assessment alludes to Langefors who had started off from an early "hard" systems approach, focusing on designing the whole of the system so that it would function. Later he developed thoughts on a more "soft" approach, and on a central note went from thinking in terms of centrally planned standardized systems to proposing a decentralized systems structure at the optimal for modern organizations.

Scandinavian Approaches to Information Systems Development

Information systems development in Scandinavia emerged in the 1960s and 1970s as a distinct branch of the international discipline, with what was seen from the outside as a different approach to methodology, theory, and the aims of the discipline. In 1989, Floyd et al. published a study of what they saw as the common features of the Scandinavian approach to information systems development. Although pointing to the diversity of the different schools of thought in the Scandinavia they summarize the common goals of the Scandinavian approach to systems design thus: "[...] efforts towards humanization and democratization as overriding design goals, in keeping with the aim of building an egalitarian society."[59] Iivari & Lyytinen similarly states that what the

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56 Bo Dahlbom, *Structure, Mind, and Meaning, An Essay in Naturalized Philosophy*, Gothenburg University, 1977.

57 Dahlbom & Mathiassen, *Computers in Context*, 1993.

58 Bo Dahlbom "From Systems Thinking to Networking" in Bo Dahlbom (ed.), *The Infological Equation*, 1995.

59 Floyd et al., "Out of Scandinavia", 1989, p. 253.

Scandinavian approach to systems thinking is characterized by "unity in plurality". Plurality in theories and practices, but without divisions in terms of the establishing of rival organizations or competing journals.[60] Information systems development was in Sweden an interdisciplinary project from the beginning, incorporating methods from both the natural sciences and mathematics and the social sciences and philosophy. The field of information systems development was inspired by diverse influences. Actors drew from both positivism and phenomenology in epistemological questions, and from engineering, business management and trade-unionism in its view of the practice of information systems development.[61] However, it is possible to identify two main groups of approaches to the theory of systems development in the 1960s and 1970s. The hard systems approach, which views the system as a rational machine and the human users as components of this machinery, and the soft systems approach that emphasizes the significance of human user participation in the process of development. Langefors can be said to have been a "hard systems" theorist in his early career, while taking a "softer" approach from the 1970s onwards.

Information systems development - modernity and postmodernity

Looking for the philosophical implications of the thought of the two main subjects of this thesis, namely Dahlbom and Langefors, I have so far avoided making any broad-stroked conclusions regarding their position in the broader intellectual landscape of the time. Langefors and Dahlbom were active in the same discipline, but they were so in very different ways. Langefors entered the field of information systems development after first having founded it as an academic discipline in Sweden in the 1960s. Dahlbom entered the discipline in the 1980s coming from a background in philosophy. At this time the information systems development field was established as an academic discipline, with its own theoretical foundations and institutions.

At the turn of the end of the 1980s there were an astonishing number of disciplines that can be called "turns" towards aspects of postmodernity. Examples are the linguistic turn in sociology, the cultural turn in history and so on. However, we must be careful not to confound the buzzword of the late 1980s with a useful analytic for understanding the theories of Dahlbom and Langefors. As a starting point for the discussion of the relation of the information systems theory developed by Langefors and Dahlbom, I will use Jean-François Lyotards classic text *The Postmodern*

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60 Iivari & Lyytinen, "Research on Information Systems Development in Scandinavia", 1998, p. 135.

61 Iivari & Lyytinen, "Research on Information Systems Development in Scandinavia", 1998.

Condition.[62] Lyotard describes the 20th century sociology as being dominated by two methodological metaphors for society: Society viewed as an organism, and an organic whole that functioned as a self-regulatory system and society viewed as a machine. Society viewed as a machine, where the goal is "optimization of the global relationship between input and output - in other words performativity."[63] These two models of society can easily be recognized as Dahlbom's dichotomy between mechanistic and romantic world-views. For Lyotard these two models are alternatives within modernity that, although different, share an optimistic attitude towards progress and a view of society as a unified whole. Lyotard connects the overcoming of these two modern alternatives to the fact that "the functions of regulation, and therefore of reproduction, are being and will be further withdrawn from administrators and entrusted to machines."[64] Lyotards vision of postmodernity is composed of the decomposition of the old narratives, an atomization and individualization of society, and transference of knowledge from humans to machines. Zygmunt Bauman proposes a more positive image of postmodernity, as a drive towards the *re-enchantment* of the world, against the de-enchanting rationalization of modernity and its science and positivism.[65]

In the following section I will attempt to give an answer to the following question: In what way does the relationship between Dahlbom and Langefors relate to the historical context they were part of? In what ways can they be seen as exceptions to the contexts? To answer this question I will take on two complementary perspectives. The first perspective takes the terms modernity and postmodernity to be descriptive of aspects of society, culture and thought in the western world in the 20th century. In the following I ask in what ways the contexts, in which Langefors and Dahlbom operated, can be described as modern or postmodern. The second perspective similarly focuses on the terms humanism and post-humanism as not mutually exclusive aspects of thought and society in the 20th century. Modernity can here be broadly described as a condition of society characterized by a developed industrial capitalism with its complementary processes of rationalization and mechanization of the economy. On the level of ideology the most prominent characteristic of modernity is the belief in scientific rationality as the vehicle for human progress. Humanism will in this context be taken to mean those aspects of culture and society that takes the idea of the human to be the centre in any world-view, be that ethical, epistemological or psychological. A feature of humanism is the idea that humans are ontologically exceptional.

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62 Jean-François Lyotard, "The Postmodern Condition", in Michael Drolet (ed.), *The Postmodernism Reader*, 2004.

63 Ibid., p. 130.

64 Ibid., p. 132.

65 Zygmunt Bauman, *Intimations of Postmodernity*, Routledge, 1992, pp. ix-x.

Humans are distinct from animals and nature on the one hand, but also from the artifacts and tools they create.

Langefors and the modernity of the Swedish welfare state

After having worked as an airplane engineer in SAAB during World War II, Langefors started his career as an academic at what can be described as the peak of European modernity. In the Nordic countries this was the beginning of the Scandinavian welfare state, which was characterized by a functionalist ideology of the rational society, but at the same time also humanistic and egalitarian ideals. Modernity and humanism are highly ambiguous concepts with complicated and contradictory histories of meaning.[66] However, these two concepts can be used to approximate the ideological context in which Langefors was an actor. In this context I understand humanism as the belief that the life and welfare of the individual human is the objective of society in general and, as is the case with Langefors, the objective of science and technology. Modernity is taken to mean the belief in reason as the driving force of progress, and the drive towards rationalization of society as a whole. In Scandinavia, these two currents were manifested in the Scandinavian social democracies, and in Sweden these two currents are found in the idea of the *folkhem,* or a "Society as a home for the people".[67] Thomas Kaiserfeld notes that the Swedish idea of *folkhemmet, the" people's home",* was centered on promoting justice and equality primarily by means of education and housing, and as such did not include new technology as a central component.[68] The idea of the "people's home" was clearly influenced by the idea of social engineering, and a top-down perspective, as is evident in the writings of Alva and Gunnar Myrdal, two of the main proponents of the *folkhem* ideal in Sweden.[69] This context includes the combination of the humanistic view of society as serving as a "home" securing the well-being of its citizens, and the idea of society as functioning as an organism, each part dependent on being "healthy" in order to fulfill its function.

The social democratic welfare state serves as a broad ideological context for Langefors early career. His first major work, *Theoretical Analysis of Information Systems,* was in many ways the

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66 See: Matei Calinescu, *Five Faces of Modernity: Modernism, Avant-garde, Decadence, Kitsch, Postmodernism,* Duke University Press, 1987; Tony Davies, *Humanism,* Routledge, 2008.

67 Thomas Kaiserfeld, "Computerizing the Swedish Welfare State: The Middle Way of Technological Success and Failure", *Technology and Culture,* 37:2 (1996), pp. 252-254.

68 Ibid., p. 254.

69 The Myrdal couple were central in the Social Democratic Party in Sweden and advocates of improving the health of the working class. They promoted social policies for improving the health of the "social organism". Alva Myrdal & Gunnar Myrdal, *Kris i Befolkningsfrågan*, Nora: Nya Doxa, 1997.

expression of the attitude of an engineer towards technology. The theory was partially based on applying methods from engineering on the theory of information systems.[70] Langefors' conception of Infology takes on a structural and holistic view of organizations that can easily be interpreted to express the rationalistic and functionalist drive of modernity.[71] On the other hand the focus on social justice and the role of the user did not have a prominent place in Langefors early works.[72] Although Langefors conceived *infology* as the distinct area of problems regarding the relationship between technology and the organization, the human user was seen as a "source of validity of the system", rather than active participants.[73] Based on his writings from the 1970s the critics made by Langefors can be interpreted as a technocratic theorist that agreed with a wholly functionalist and rationalist view of technology and organizations. In *Essays on Infology* Langefors expressed disapproval of this representation of his theories.[74]

Langefors perceived the problem of information to be divided into two distinct areas: datalogical and infological problems. The datalogical problem pertained to the internal workings of computers. The infological problem was rooted in the relationship between technology and the human users. As the infological problem occupied more of his concern with information systems, questions of user participation in information systems development also took a more prominent role in his writings.[75] In *Essays on Infology,* Langefors' alluded to the criticisms he received from advocates of the "trade-unionist" approach of Norwegian systems theorist Kristen Nygaard, and asserts that his theories were meant to be non-normative with respect to the goals of organizations.[76] In Langefors view, the theories he had formulated, based on the foundations in *Theoretical Analysis of Information Systems,* were to be understood as open to different objectives, rather than serving a particular ideological or political position.[77]

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70 Janis Bubenko & Ingemar Dahlstrand, "An Interview with Börje Langefors, From SARA to TAIS", *History of Nordic Computing, IFIP International Federation for Information Processing*, 174 (2005), p. 13.

71 Iivari & Lyytinen, "Research on Information Systems Development in Scandinavia", 1998.

72 Ibid., pp. 144-145.

73 Ibid., p. 164.

74 Börje Langefors, *Essays on Infology,* 1993, p. 71.

75 A good example of Langefors' concrete discussions of user participation in information systems development is Börje Langefors, *ADB-utvecklingen och arbetslivet,* Management Press, 1981.

76 Adherents to the trade-unionist approach saw the socio-technical approaches of information sytems development as "a form of manipulation to reduce worker resistance to systems which served mostly the interests of managers". Hirschheim, Klein & Lyytinen, *Information Systems Development and Data Modeling*, p. 38.

77 Börje Langefors, *Essays on Infology,* 1993, p. 90.

The first essay in *Essays on Infology* opens with a statement that at first glance may seem trivial: "My view of science and technology has always been that they offer opportunities for improving human life"[78]. However, the question of how these should be handled would be a task for "other areas of human endeavor"[79] In this short quotation Langefors attitude towards technology is summarized. We can see the optimism towards science and technology characteristic of western societies after World War II, and the Scandinavian countries in particular. Science and technology were, or were supposed to be, neutral servants to the will of society. Langefors was not denying possible negative effects of technology but written in in the context of the early 1990s it can very well be interpreted as a reiteration of an optimistic attitude towards science and technology against a perceived current of viewing technology as a threat to freedom or emancipation. This can also be read as an implied reference to the criticisms against Langefors' own theories as serving the goals of employers and investors, rather than workers.

Langefors' information systems thinking was fundamentally connected to the function the information systems development discipline fulfilled in society. For Langefors, the purpose of information systems development was providing the skill and (scientific) knowledge required by government institutions and big industrial and corporate organizations for implementing information systems and computer technology. Langefors pointed out that the need for computerization of information systems in organization had to be *created*.[80] The government demand for computers only marginally existed before the technology was available. However, the growth of industrial and bureaucratic organizations along with the advent of the Swedish welfare state, corresponded to the need for more effective and qualitative information systems.[81] In the decade after the World War II the need for computers was perceived to be limited. It was not a matter of course that the need for organizational rationalization would be accomplished by way of implementing computerized information systems. This process, in which Langefors played a central part, was motivated in large part by the internal development of computer science and technology itself. It was supported by a potential market for that technology in the growing government institutions. Langefors took on a driving role in convincing decision-makers of the advantages and need of computers. In the late eighties the situation was very different. The computerization of

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78 Ibid., p. 27.

79 Ibid.

80 Börje Langefors, *Essays on Infology,* 1993, p. 28.

81 Hans De Geer, *På väg till datasamhället,* 1992, pp. 45-59.

institutions was a fact, not a question, and other questions than that of the efficiency of information technology were prominent.

Langefors and the cybernetic paradigm

The cybernetic paradigm can be summed up in two main ideas. The idea that humans and machines can be understood on the same conceptual level, and the idea that the purpose of computer technology is *control*. "Control" can have different connotations depending on the context, but in cybernetics the word "control" means the ability to make something, whether it is a computer, a human being or an organization behave in the intended way.

In *System för Företagsstyrning* Langefors argued against the idea of the "total" control of organizations. This idea set the goal of information systems development to be to optimize the organization in correspondence to a "ultimate" goal for the organization that would define all other goals. The problem with this idea, and what made any approach based on it set out to fail, was for Langefors the impossibility to define one or a set of non-contradictory goals for an organization.[82] Langefors saw this at as a problem for the rationalization of organizations by way of information systems. Instead of aiming at an optimal solution to ultimate goals, information systems should be designed by following preliminary operative goals that could be changed over time. From the conclusion that the goals of organizations were often unknown or ill defined, Langefors of the definition of goals as one possible function of the information systems.[83]

Langefors did not perceive himself as part of the cybernetics tradition. He Identified either with the discipline of information systems development, and its theorists. In his writings in the 1970s he drew inspiration from both analytical philosophy and cognitive science, and saw his theory of information as similar to the theories of for example Russell and Carnap.[84] Paul N. Edwards has pointed out the close connection between cognitive science and cybernetics. However, Langefors later would become more interested in hermeneutics, and view his theories outside the context of cognitive science.

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82 Börje Langefors, *System för Företagsstyrning,* 1970, pp. 13-14.

83 Börje Langefors, *Essays on Infology,* 1993, p. 57.

84 Börje Langefors, "Infological Models and Information User Views", 1979, p. 17.

Langefors and Humanist Thinking

Alison Adam has argued that the focus on measuring and metrics, and the attachment to positivism, in information systems development, has prevented the discipline from taking an "ethical turn".[85] Langefors certainly fits into this analysis. His early focus was on achieving an objective analysis of the information system so that the systems developer could take on the task with clearly defined goals. In that way the systems development process would minimize the problems emerging from the practice of starting to program applications before an analysis of the information system was present.[86] However, Langefors' theory of information systems does not conform easily to the division between humanism and cybernetics. Although it clearly originated in a cybernetic paradigm, its view of the relationship between humans and machines did not univocally conform to the ideas of the cybernetics. The ontological status of the human users and the machine elements in information systems remained ambiguous in Langefors' writings. On the level of analysis he saw both users and machine components as "necessary components of information systems."[87] Conversely he saw information systems as extensions of human intelligence, in conformity with the cybernetic paradigm.[88] As such it can be interpreted as a part of a cybernetic discourse. Langefors drew different conclusions than the cyberneticians from the experiences with information technology. This is especially evident in his later writings.

Langefors may be understood mainly as a thinker within a cybernetic paradigm, but there is evidence that he also saw his own theories in relation to the AI research program. In the early 1960s Langefors was involved in a project for the automation of information processing and vessel design at Saab. In a 2005 interview Langefors states that he saw this project as a "contribution to artificial intelligence, but really an alternative to artificial intelligence, in which one could begin with what one already had [...] by way of human knowledge".[89]

Langefors emphasized the information systems role as a subsystem of a larger sub-system, that again was a subsystem of a larger system.[90] In studying or designing an information system, one would need to understand that the information system indeed was connected to an external

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85 Alison Adam, "IS and its agenda", *Journal of Information Technology,* 27 (2012), pp. 102-103.

86 Börje Langefors, *Essays on Infology,* 1993, p. 87.

87 For example: Börje Langefors, *Essays on Infology*, 1993, p. 95.

88 Börje Langefors, interview from 2005 by Janis Bubenko, Anita Kollerbaur and Tomas Ohlin, p. 10.

89 Ibid. Original quote in Swedish: "...bidrag till artificiell intelligens, men egentligen ett alternativ till artificiell intelligens, där man redan kunde starta med allt det man redan hade, [...] genom den kunskap man hade mänskligt".

90 Börje Langefors, *Essays on Infology*, 1993, p. 41.

environment, for example an organization, or a business, that itself, already functioned as an information system. Floyd et al. see this feature of Langefors thought as a prerequisite of the "humanistic" tendency in Scandinavian system-thinking, meaning more specifically, that the emphasis on the interconnection with an external already existing information system warranted a greater amount of user involvement and democratization in information systems development.[91] However, several writers have pointed out that in the early versions of his information systems theory, the strict methodology proposed implicitly "excluded the context or the environment [of the system]."[92]

Dahlbom - Modernity and Postmodernity

In "From Systems Thinking to Networking", published in *The Infological Equation,* the *festschrift* in honor of Börje Langefors' 80th birthday, Dahlbom approached the question of postmodernism in information systems development.[93] Dahlbom saw the introduction of "postmodernism" in informatics as a series of transitions in ways of thinking: (1) from focusing on systems to taking the *object* as the basic unit of analysis, (2) from the control-centered cybernetics to the goals of empowerment and emancipation, (3) from *information* connected to management to the *knowledge* required for work, and (4) from the *construction* of systems to the *intervention* in an already existing situation.

The explicit purpose of the essay was to formulate a call to "give up systems thinking", with its hierarchical holism in favor of a network model. Dahlbom associated the traditional systems thinking to the Cartesian paradigm of science with its rational, holistic model of the world. Dahlbom understood the "postmodern" as the rejection of the Cartesian paradigm, and in its place a drive towards deconstruction of the whole into atoms. Dahlbom was positive to this atomism. However, Dahlbom noted that even within the holism of systems thinking, in which he alludes to Langefors' information systems theory, signs of atomism could be found.

> Atomism is something to strive for, and even within systems thinking we see this exemplified in the way systems thinking invites you to define your system and then forget about its context, forget about the larger systems of which it is a part.[94]

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91 Floyd et al., "Out of Scandinavia", 1989, p. 279.

92 Pertti Järvinen, "On Some Constructs and Ideas Introduced by Börje Langefors", in Bo Dahlbom (ed.) *The Infological Equation,* 1995, pp. 58-59.

93 Bo Dahlbom, "From Systems Thinking to Networking", in Bo Dahlbom (ed.) *The Infological Equation*, 1995.

94 Ibid., p. 137.

Although he did not specifically refer to Langefors, it does not seem far-fetched to say that Dahlbom's argument was directed towards Langefors' theories. These were rigidly formulated in concordance with a Cartesian paradigm in *Theoretical Analysis of Information Systems,* and the complexities and the inherent contradictions in the theory were explored in *Essays on Infology.* It is possible that "From Systems Thinking to Networking" is an example of an intellectual operation that is specific to Dahlbom's relation to his intellectual influences. While taking on a position, which on the surface seems to be diametrically opposed to Langefors', Dahlbom took care to not reject the theory he saw as obsolete, but dialectically find the core of the theory worth bringing into a new synthesis. Here, we can draw parallels to Dahlbom's relation to Daniel Dennett. In both the cases of Langefors and Dennett, Dahlbom cited them as inspirations, and maintained a positive view of them as theorists, whereas at the same time taking stances that are in fundamental disagreement with their positions.

Bo Dahlbom - Exception to the Division between Analytical and Continental Philosophy

The history of 20th century western philosophy is dominated by two traditions: the analytical tradition instigated by Ludwig Wittgenstein and the continental tradition after Martin Heidegger. Although other currents were significant, such as American pragmatism, and critical Marxism of the Frankfurt school, the dominance of continental phenomenology and Anglo-American analytical philosophy laid the framework for the main philosophical debates. Even though there were definitive points of convergence between the two traditions, for much of the 20th century there seemed to be an almost absolute separation between the analytical and continental discourses of philosophy.[95] This divide could be seen emphatically in well-reported debates, such as the one between Derrida and Searle, but also in university curricula.

Dahlbom's PhD thesis *Structure Mind and Meaning* was written within the tradition of analytical philosophy. Heavily referencing philosophers such as Daniel Dennett, W. V. O. Quine, and Noam Chomsky, it's references to what may be termed the continental tradition were limited to Martin Heidegger's *Being and Time,* and Albert Camus' *The Myth of Sisyphus*. Later on Bo Dahlbom drew from both analytical and continental philosophy in his writings. Examples of this can be found in *Computers in Context* and *En Artificiell Värld.*

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95 For an overview of the different traditions of 20th century western philosophy see: Tom Rockmore, *In Kant's Wake, Philosophy in the Twentieth Century*, Blackwell, 2006.

Dahlbom and information systems development

Bo Dahlbom was in many ways a collaborator in the 1980s and early 1990s. His major work, *Computers in Context,* was a collaboration with systems developer Lars Mathiassen. He collaborated with Lars-Erik Janlert on the book *En Artificiell Värld,* as well as several articles. Examples of this tendency were also *Essays on Infology* with Langefors, as well as *Dennett and his Critics* with Daniel Dennett. These publications can be divided into two sections, based on the relation Dahlbom had to his collaborators. In the cases of the collaborations with Mathiassen and Janlert, the publications are co-authored. They stand as expressions of the views of both Dahlbom and his collaborators. In the cases of Dennett and Langefors on the other hand, Dahlbom adopts the function of editor, critic and commentator. In his PhD thesis *Structure, Mind and Meaning* Dahlbom wrote:

> This is, of course, the only way one can really show philosophical appreciation: to accept the fundamental framework, insights and and attitude towards the subject matter, and then single out a particular theory developed within this framework for close scrutiny, doing ones best to isolate its weak points.[96]

Describing the writings of Dahlbom as part of a context requires in part understanding of his collaborators. Both *En Artificiell Värld* and *Computers in Context* are presented as collaborations that do not distinguish between the writers with regard to who wrote which section. In 1987 Lars-Erik Janlert wrote an article proposing to view the computer as a *person* rather than as a tool or information factory.[97] Notable among his conclusions was that "*Only* with the person view do we also put an ethical perspective on the system."[98] Lars Mathiassen, Dahlbom's collaborator in *Computers in Context,* was on the other hand responsible for introducing the "professional work practice approach" to information systems development.[99] This approach to information systems development focused on the actual practice of systems development and on ways to change work practices through systems development.[100]

I have used the broad distinction between "soft" and "hard" approaches to information systems development to describe the context, which Langefors and Dahlbom were part of. These

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96 Bo Dahlbom, *Stucture, Mind and Meaning,* 1977, p. iv.

97 Lars-Erik Janlert, "The Computer as a Person", *Journal for the Theory of Social Behaviour,* 17 (1987), pp. 321-341.

98 Ibid., p. 330.

99 Hirschheim, Klein & Lyytinen, *Information Systems Development and Data Modeling*, pp. 128-129.

100 Iivari & Lyytinen, " Research on Information Systems Development in Scandinavia", 1998, p. 154.

terms have been useful, because they distinguish between tendencies rather than defined theories and methodologies. However, for Dahlbom this was a dichotomy that Dahlbom himself wanted to transcend. Dahlbom viewed both "hard" and "soft" approaches to information systems development as essentially linked to its foundations in the idea of the *system*. In "From Systems Thinking to Networking" Dahlbom argued that systems thinking had significant shortcomings that were caused by the foundational metaphor of the system. "Once you have begun thinking about an organization as a system, it becomes very difficult to see it as a process."[101] Implicitly, Dahlbom criticizes central aspects of Langefors' theory of information systems analysis: that the goal of the analysis of information systems was to define systems as clearly as possible so that they could be understood clearly - which meant conceptualizing context as "outside" the system. Dahlbom argued that:

> It does not really matter how much one stresses that systems are always enclosed in larger systems, or that they are "open", when the whole idea of systems thinking is to view an entity in isolation, to avoid having to consider a complex context.[102]

Professional Work Practice Approach

Hirschheim and Klein describes a "third era" of information systems development, beginning in the mid-1980s, as characterized by a change in the structure of profession as well as changes in the technology.[103] It was a period characterized by decentralization of the information systems departments in organizations, which was made possible by the new technology, but was also in line with the ideology of economic liberalism rising at the time. This development "led to new problems of data incompatibility, connectivity, and integrity across functional departments."[104] This, in turn, led to the establishment of information systems departments in charge of developing systems for the whole organization. However, while systems developers were in demand, the question of the value of information systems development was taken into question. Studies on the value of investment in information systems "found little correlation between IS [Information Systems] investment and improved performance".[105] The increase in demand for information systems developers as a result of rapid changes in technology and increasing complexity of the information systems required by

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101 Bo Dahlbom, "From Systems Thinking to Networking", in Bo Dahlbom (ed.), *The Infological Equation*, 1995, p. 149.

102 Ibid., p. 150.

103 Hirschheim & Klein, "History of the Information Systems Field", 2012.

104 Ibid., p. 209.

105 Ibid.

organizations, followed by increasing doubts about the value of investing in in-house information systems departments, led some companies to explore outsourcing of information systems tasks.[106]

With this background Dahlbom's emphasis on the systems developer, being tasked with intervention in a situation of chaos, rather than an engineer or architect starting with a blank slate seemed to be predicated on a new situation in the professional reality of information systems development as much as on technological and theoretical concerns. The approach to information systems development in *Computers in Context, developed by* Dahlbom together with Mathiassen, was in large part inspired by the "professional work practice" Mathiassen had developed in the 1980s. This approach, inspired by Donald Schön's notion of the reflective practitioner, was in part an answer to the decentralization of organizations. They described the new situation like this:

> Professional systems developers must master a wide spectrum of methods and technologies related to their profession and they must have the energy and skill to frequently evaluate new trends and to modify and extend their repertoire for action. They must be able to cope with unstructured situations, understanding and appreciating the unique and specific characteristics of the problematic situations involved in their daily work.[107]

This approach emphasized the importance for the practitioner to be able to reflect critically on the fundamental aspects of practice. The ability to change along with an unpredictable and rapidly changing situation was seen as necessary for being a successful systems developer. Dahlbom understood this reflection as "philosophizing", or doing philosophy. The motivation for *Computers in Context* was partly to teach information systems developers to make the methods of this practical philosophy explicit, so that the philosophy itself could be object for reflection.[108]

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106 Ibid., p. 210.

107 Bo Dahlbom & Lars Mathiassen, "Systems Development Philosophy", *Computers & Society*, 22:1-4 (1992), p. 12.

108 Ibid.

Postmodernity and Cyborg Discourse

When studying Langefors' and Dahlbom´s writings in the 1980s and 1990s we are dealing with ideas that were formulated at the brink of what can be called a postmodern cultural shift in western society, and in academia in particular. "Postmodern" can be defined for the present context as a shift towards a skepticism towards universal claims to truth for the sciences, and a critical attitude towards legitimizing narratives and models such as empiricism in science. Zygmunt Bauman has argued that postmodernity must be seen as a phase of modernity, or the most accomplished state of modernity:

> Postmodern condition can be therefore described, on the one hand, as modernity emancipated from false consciousness; on the other, as a new type of social condition marked by the overt institutionalization of the characteristics which modernity - in its designs and managerial practices - set about to eliminate and, failing that, tried to conceal.[109]

Paul N. Edwards develops his thesis on "cyborg discourse" as a technology-based language game that developed after World War II in the militarized USA.[110] Edwards takes the word cyborg as an ambivalent concept, noting both the cybernetic conflation of human and machine and Donna Haraway's emancipatory vision of the cyborg condition. However Haraway's interest lies in the possibilities the image of the cyborg presented for the embodied subject, allowing for play with the categories of human, gender and sexuality. Edwards' notion of cyborg *discourse* implies that the implementation of new technology infuses *language* with a system of metaphors that are also systems of power. In this sense, the way we talk about things like computer technology or information technology, are political, because the words, metaphors and systems of thought, we express, are connected to interest conflicts in society, emphasizing some aspects of reality and occluding others.

In Langefors' writings we can see a clear difference dependent on what level of analysis he is dealing with. On the level of systems analysis, Langefors can be seen as a cybernetician, conceptualizing the human as as well as machine as subsystems of information systems. He did not, however, go far in terms of behaviorist psychological assumptions about the human mind. His *infological problem* was rather a problem that recognized the inherent problems of cybernetic thinking for systems thinking.

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109 Zygmunt Bauman, "A Sociological Theory of Postmodernity", *Thesis Eleven*, 29 (1991), p. 33.

110 Paul N. Edwards, *The Closed World*, 1996.

On the level of understanding computer technology Langefors was early on influenced by cybernetics thinking, but also related to the idea of artificial intelligence. However, in developing his idea of the infological problem towards a hermeneutical conception of the relation between humans and information technology, he implicitly assumed a fundamental division between the human sphere of meaning and the logical sphere of machines. This is, however, complicated by indications that Langefors saw his infological equation, seeing information as a function of time and the receivers' pre-knowledge, to hold even between subsystems of a computerized information system.

The old and the new informatics

Bo Dahlbom and Börje Langefors met for the first time in 1991 in Gothenburg.[111] Two years later, *Essays on Infology* was published, and two years after that Dahlbom edited *The Infological Equation,* the *festschrift* for Langefors' 80th birthday. The question I ask in this section is why Dahlbom chose to approach the retired professor Langefors with the request to publish a collection of new essays on information systems development.

Thanous Magoulas and Kalevi Pessi summarize the respective positions Dahlbom and Langefors had in the history of the information systems development discipline (which they call informatics), like this: "While the foundations of the old Informatics is based on the ideas of Professor Langefors, the New informatics represents the intentions and ideas of Professor Dahlbom."[112] As such they see the two figures as representing a major shift in the discipline, one that overshadows other developments. This is a common view expressed in *Informatics in the Next Millennium.*[113] Other accounts of the information systems development discipline do not conform to this narrative and do not present Langefors and Dahlbom as representatives of a shift between a "before" and "after" of information systems development.[114] However we can see how both Langefors and Dahlbom perceived themselves this way. In his introduction to *Essays on Infology,* Dahlbom stressed Langefors' position as the founder of the information systems development discipline, but also his relevance for the field in the 1990s.[115] Dahlbom himself thought that the major shift in computer technology towards networked solutions rather than mainframe systems, and not the least the prevalence of the internet, required a corresponding shift in the information systems development discipline. So much that the discipline should be re-named to *informatics* instead of information systems development, to mark the commitment to being "the *avant garde* of the Internet era."[116]

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111 Bo Dahlbom, "Introduction", in Börje Langefors, *Essays on Infology*, 1993, p. 11.

112 Thanous Magoulas & Kalevi Pessi, "The Old and the New Informatics, Implications for the future of IT management", in Fredrik Ljungberg (ed.), *Informatics in the Next Millennium,* 1999, p. 58.

113 For example: Fredrik Ljungeberg, "Introduction", in Fredrik Ljungeberg (ed.), *Informatics in the Next Millennium*, 1999, pp. 1-2.

114 For example: Hirschheim & Klein, "History of the Information Systems Field", 2012; Gordon B. Davis, "Information Systems as an Academic Discipline", *IFIP International Federation for Information Processing*, 214 (2006), pp. 11-25.

115 Bo Dahlbom, "Introduction", in Börje Langefors, *Essays on Infology*, 1993, pp. 11-14.

116 Bo Dahlbom, "The New Informatics", *Scandinavian Journal of Information Systems*, 8:2 (1996), p. 34.

Dahlbom, Langefors and the politics of power in the Scandinavian Welfare state

One of Dahlbom's motivations for taking the initiative for *Essays on Infology,* was to "rehabilitate" Langefors as a theoretically relevant figure in the information systems field.[117] Dahlbom viewed the absence of Langefors' theories from the educational literature as an unfortunate case of forgetting the foundations of the discipline. Dahlbom saw this forgetting of Langefors as partly politically motivated, and specifically cites Markku Nurminen and Jørgen Bansler as proponents of, in Dahlbom's eyes wrongfully, a politically hostile attitude towards Langefors. Dahlbom's wants with the publication of *Essays on Infology,* partly revitalize Langefors' ideas, and partly correct the perceived misunderstandings in the general attitude in information systems. Bansler certainly was critical to Langefors:

> Langefors considered information technology to be a control technology, and consequently he treated organizations as cybernetic systems. [...] The systems theoretical tradition is clearly linked to corporate interests. The theory of information systems and for instance the ISAC method deal with questions concerning 'rationalization', 'efficiency' and 'control', while questions concern- ing health and safety, working conditions or the 'quality of working life' are ignored. [The ISAC method was an attempt to refine Langefors' theories into a applicable set of methods and practices which was used in practice in the 1970s.][118]

Bansler goes a long way in connecting Langefors with a Tayloristic tradition of corporate administration, representing a hinderance to user involvement in information systems development and emancipation of the workers in the workplace.[119] Iivari & Lyytinen partly shares Dahlbom's criticism of Bansler's assessment of Langefors. However they state: "[...] it is obvious that Langefors' [...] treatment of organizations is predominantly 'rational-structuralistic' [...] resembling the machine metaphor [...]."[120] Bjerknes and Bratteteig views Dahlbom as a proponent of a shift from emancipation as the main goal of systems development, to professionalism.[121] It is not difficult to see how Dahlbom and Bansler fit into this schematic. We can see Dahlbom's and

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117 To what degree Langefors actually was "forgotten" from the scandinavian IS literature in this period, the 1980s, is not within the scope of this essay to assert. Langefors was certainly still cited in 1980s IS literature, but maybe not used as a exemplar for systems theory.

118 Jørgen Bansler, "Systems development in Scandinavia: three theoretical schools", *Information Technology & People*, 4:2 (1988), p. 122.

119 The sharpest attacks and allegations by Bansler against Langefors can be found in Jørgen Bansler, *Systemudvikling, teori og historie i skandinavisk perspektiv*, Studentlitteratur Lund, 1987. References to the continental tradition of philosophy are used extensively in Dahlbom & Mathiassen, *Computers in Context*, 1993.

120 Iivari & Lyytinen, "Research on Information Systems Development in Scandinavia", 1998, p. 142.

121 Gro Bjerknes & Tone Bratteteig, "User Participation and Democracy: A Discussion of Scandinavian Research on System Development", *Scandinavian Journal of Information Systems*, 7:1 (1995), p. 85.

Bansler's respective accounts of Langefors as a struggle over the legacy of information systems theory, as well as a struggle for the future of the discipline.

While we have operated with a basic distinction between two main approaches to information systems thinking, the "hard" approach and the "soft" approach, these categorizations are broad, and other classifications appear inside the information systems field throughout its history. Such classification systems of theories carries with them their own rhetorics. Where Dahlbom, as noted, operates with a classification system based on the distinction between the mechanistic and romantic world-views, and his own dialectical, interventionist approach, we can see that Bansler and Nurminen's classification schemes are different both in wording but also in the values connected to the different approaches described. Nurminen presents three classes in much the same way that Dahlbom does in *Computers in Context,* presenting two competing approaches that have had varying degrees of dominance since the birth of information systems.[122] He frames these two over-arching approaches in terms of Kuhnian paradigms or Weberian ideal types, and does not propose that they correspond in detail to reality. The two main approaches, Nurminen calls the "Systems-Theoretical Perspective" and the "Socio-Technical Perspective". Like Dahlbom, Nurminen views both these approaches as insufficient for dealing with the technological and societal changes of the late 1980s, and presents a third alternative to follow and possibly incorporate the two preceding movements. Unlike Dahlbom however, who proposes an interventionist model for information systems work, Nurminen sees the development of a "Humanistic Perspective" as the way forward for informations systems theory.

Jørgen Bansler has a classification system for currents in information systems theory that is similar to that of Nurminen, viewing the systems-theoretical and socio-technical as the main "schools" of systems development, but with the addition of a "critical" school.[123] Another difference is Bansler's distinctive materialist perspective on theory, that emphasizes that "the basic theoretical differences between the schools reflect their different interpretations of the relationship between capital and labour."[124] Bansler seems to champion the "critical" school of information systems thinking, for its emancipatory goals, as opposed to the systems-theoretical and socio-technical schools that are connected to the interests of capital, or the harmonic equilibrium of the organizations. In some aspects, Bansler's notion of a critical school in information systems is

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122 Markku I. Nurminen, *People or Computers, Three Ways of Looking at Information Systems*, Studentlitteratur Lund, 1988.

123 Jørgen Bansler, "Systems development in Scandinavia", 1988.

124 Ibid., p. 117.

similar to Dahlbom's interventionism, with focus on conflict as an unavoidable process, that has to be dealt with. However it seems that in Bansler's version the possibilities for emancipation are much larger than in Dahlbom's version where the most a systems developer can hope for is change, not necessarily to something better, but different.

Competing classification systems in information systems development

While Bansler's classification system was the goal for Dahlbom's most pointed critique, he was also criticized by others for being blinded by politics, and thus misrepresenting Langefors and his theories.[125] In this context, Nurminen's classification system remains less controversial. Dahlbom primarily criticizes Nurminen's system on other grounds than he does with Bansler. According to Dahlbom, "Nurminen's [...] categorization, systems-theoretical, socio-technical, humanistic, is a categorization of artifact use in terms of the power relation between the individual user and her computer."[126] For Dahlbom these categories really are just versions of the old division between romantic and mechanistic relations to technology. When thinking in relation to computer artifacts, things are not so simple. Without developing a definitive alternative, Dahlbom in his discussion of cybernetics and AI-research uses a classification scheme connected to epistemology, where the main distinction is between rationalism and empiricism, and a possible third approach called connectionism.[127]

Dahlbom's concern with rationalism in *En Artificiell Värld* is relevant to the present discussion. For Dahlbom the "system-theoretical" tradition in information systems development, that Langefors instigated, was responsible for infusing systems theory with a rationalistic touch, willingly or not. It was in this context that Dahlbom mentioned Langefors, and the debate with Nurminen and Bansler. He saw the abandon of Langefors as an important figure as the abandon of the construction of theories. We can here get a glimpse of what Dahlbom's motivation for bringing back Langefors was. The choice of either rationalism *or* empiricism, seemed for Dahlbom to be a bad one. Dahlbom saw the current state of information systems development as in need of, and at the same time open to, change. What was needed, was a vision of rationalism with the addition of empiricism. As early cybernetic thinking tended towards centralized control systems, the "hardware" problems of modern computing tended to produce the opposite: decentralization.

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125 Iivari & Lyytinen, "Research on Information Systems Development in Scandinavia", 1998.

126 Dahlbom & Janlert, "An Artificial World", 1990, pp. 4-5.

127 Dahlbom & Janlert, *En Artificiell Värld*, 1988.

Langefors, incidentally, had in the last decades also developed a leaning in favor of decentralized practices in information systems development.[128]

The motivations for *Essays on Infology*

Dahlbom had several motivations for taking the initiative to publish Langefors' writings in *Essays on Infology.* First we must take Dahlboms admiration of Langefors seriously. We may interpret Dahlboms decision to reach out to Langefors as a wish to collaborate with the person who had been most influential in the field for the past 40 years. Langefors was widely recognized as a founding figure for Scandinavian information systems development, and as such warranted interest from a systems theorist in search of a subject to write about. However, Dahlbom was not the average systems theorist. He had ventured from philosophy to information systems in the late 1980s, and had a provocative view on the information systems field.[129] He had a philosophers approach to the information systems discipline, and argued that "the future was more interesting than the past."[130] As such it does it was not obvious that one of Dahlbom's first big projects in the information systems discipline would be a collaboration with a veteran who some theorists viewed as outdated.

Dahlbom's project was to redefine the purpose of information systems development, from one of analysis and construction to a discipline focused on design and intervention. He perceived the technological changes taking place in the 1980s and 1990s as requiring a corresponding shift in the information systems discipline, and saw it as his role to instigate the debate around the future of the discipline. A second motivation for Dahlbom was to present Langefors as a still relevant theorist for the information systems discipline. While Dahlbom's and Langefors' theories were evidently very different from each other, it seems that for Dahlbom this was all the more reason to study Langefors closely. For Dahlbom, forcefully criticizing the theories that inspired him was both a method for developing his own theories, but also an expression of appreciation. Third, we can see that Dahlbom found a common adversary with Langefors in his politically motivated critics. As I will argue later on, both Dahlbom and Langefors were *philosophically oriented* theorists. The criticism against Langefors was interpreted as misguided and unfair by Dahlbom. Perhaps because he viewed the conclusions drawn by Bansler and Nurminen as not reading Langefors as *theory,* but as ideology.

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128 Börje Langefors, *The Infological Equation and Decentralization,* Chalmers University of Technology, 1984.

129 Fredrik Ljungeberg, "Introduction", in Fredrik Ljungeberg (ed.), *Informatics in the Next Millennium*, 1999, pp. 1-2.

130 Ibid.

Dahlbom's focus was on the practice of information systems development, rather than on the information systems themselves. If we compare with Langefors' early work we can easily see the difference: For Langefors, the fundamentals for constructing information systems were not yet in place, and needed to be worked out. His project was to a large extent to explain to information systems developers what a system, and specifically a computerized information system, *was*. For Dahlbom, in the late 1980s and early 1990s, these systems were already existing. Information systems were integral parts of most large organizations and companies in Sweden. The personal computer was not yet widespread, although it was gaining popularity in Swedish private homes.[131] The publication of *Computers in Context,* coincided with the beginning of a boom in computer use in Sweden, both professionally and privately.[132]

Many of Dahlbom's texts were oriented towards instigating or directing debate in the community of information systems design. For example, and this has already been pointed out, *Computers in Context* was a book with the aim to introduce information systems students to philosophy. There are other texts where Dahlbom more clearly formulates his position. One of the most pointed, which is also aimed at Langefors, is the essay "From Systems Thinking to Networking".[133] In contrast to other articles, for instance those published in the *Scandinavian Journal of Information Systems*, where he often positions himself as a moderator or leader of debate, this essay stands out as a statement of Dahlbom's view of what was to come in the future, and what *should* be done in the field of information systems. He claimed that "When information technology begins to form the infrastructure of society, the industrial organizations will start to crumble. Their borders will dissolve and the systems will be replaced by networks."[134]

Dahlboms main point is that what was known as systems thinking, was well on its way to becoming obsolete. Systems thinking, meaning the tradition from Langefors' *Theoretical Analysis of Information Systems*, constituted the bulk of the theoretical framework for the information systems discipline until then. In *Computers in Context,* Dahlbom identified the tradition of "hard" systems thinking in the tradition of Langefors with a mechanistic world-view, and the "soft" approach with a "romantic" world-view. In "From Systems Thinking to Networking" Dahlbom expressed the aim to break out of this dichotomy, referring to the change from an industrialized

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131 In 1994 about a quarter of the swedish population in the ages 16-84 had access to a computer in their home. Statistics Sweden, *Indicators Reflecting what is New in the Economy*, 2003, p. 14.

132 Ibid., p. 26. Cf. the rapid increase in courses in computer use for employees in private companies around 1993.

133 Bo Dahlbom, "From Systems Thinking to Networking", in Bo Dahlbom (ed.), *The Infological Equation,* 1995.

134 Ibid., p. 135.

society that has the mechanistic world-view as its dominant metaphor, and romanticism as its instinctual reaction. This dichotomy becomes in Dahlbom's view obsolete when the organizations of industrial modernity dissolve into a postmodern, postindustrial society.

Dahlbom and Langefors - Philosophy and practice

In this section I ask the question whether the writings of Langefors and Dahlbom can be considered philosophy, and if so in what sense. Are they practicing philosophy in the sense of constructing new concepts and creating new worlds of meaning, or are they drawing lines of demarcation for what is to be regarded as science, as opposed to ideology? Both writers considered themselves as in some way participating in a philosophical discourse. However what one writer considers a philosophical question the other may view as a question that is internal to information systems development.

This section starts with a study of the two writers own philosophical projects. For Dahlbom this can be said to be a philosophy of *artificiality*, a recurring theme in his writings. Langefors' philosophy can in turn be framed by his own term *infology,* the conception of the meeting of human actors and technology as posing a distinct set of problems. Following this I will discuss in what ways the two differ philosophically from each other, and on what points we can see that they agree.

Dahlbom, Artificial Intelligence and Cybernetics - An Artificial World

In 1988 Bo Dahlbom and Lars-Erik Janlert wrote a report in Swedish for the state funded research program "Människor-Datateknik-Arbetsliv" (Humans-Computer Technology-Working Life), titled *En Artificiell Värld.* Two years later they published an article in English titled "An Artificial World".[135] In these publications we can find in condensed form much of Dahlbom's views on the relationship between computer artifacts and theory. Maybe more importantly the two publications present Dahlbom positioning himself in relation to the history of AI and cybernetics, the two dominant traditions in postwar computer science and theory. Dahlbom conceived of cybernetics and AI, not only as research programs in modern science, but also as constituting different world-views, partially created by technology and society.

Although the report is framed as a survey of the current state of research in the field of computer technology, it just as much is a display of Dahlbom and Janlert taking a position towards the traditions of cybernetics and AI. More concretely we can in these publications find indications of Dahlbom's project being to rehabilitate key points in the cybernetics and AI research programs that had fallen out of fashion in the 1980s.

En Artificiell Värld deals mainly with the classical question of the relationship between the human being and technology and Dahlbom and Janlert looks to the development of computer technology and its associated academic disciplines to gain access to the relationship between

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135 Dahlbom & Janlert, *En Artificiell Värld,* 1988; Dahlbom & Janlert, "An Artificial World", 1990.

technological artifacts and the emergence of world-views. We can see how Dahlbom and Janlert's views partly coincides with those of Paul N. Edwards in their emphasis on the computer as a metaphor, as well as physical artifact. On the other hand, we can clearly see the difference between the American cold-war paranoia Edwards describes in *The Closed World,* and the much less explicitly politically charged survey in *En Artificiell Värld.*

In "An Artificial World" as well as in *En Artificiell Värld,* Dahlbom and Janlert analyzes cybernetics and AI research from a historical and philosophical perspective. We can find here much of the analytical framework used later in *Computers in Context.* However in these publications Dahlbom and Janlert focuses on what can be seen as the foundations of the broader field of informatics, not focusing on information systems development exclusively. They sees both the cybernetic tradition and the AI research program as valuable, and attempts to both give a positive exposition of their respective goals as well as the critique against them.

In some ways the AI research program can be seen as a sub-discipline or successor of cybernetics, focusing as cybernetics did on the relationship between human beings and computer technology. One could argue that the difference between the two was mainly manifest in the difference in technology available. However, in Dahlbom's view the difference between cybernetics and AI was a profound difference in fundamental assumptions about truth and knowledge. Cybernetics and AI corresponded to the two currents in scientific thought and philosophy called rationalism and empiricism. According to Dahlbom cybernetics had as its goal to simulate the human mind on an atomic level. This was motivated by the goal to integrate humans and computing machines in the most efficient way. Cybernetics was inspired by behaviorist psychology, and perceived the human as a biological organism, and its nervous system as a passive system. This passive system could be conditioned by repeated learning experiences to react to stimuli from the outside world.[136] Both the computer and the brain were seen as information machines, and the initial research programs in cybernetics aimed at simulating the brain with computer technology. However cybernetics as a research program "failed" and gave way to the AI research program in the late 1950s and early 1960s.[137] Dahlbom saw this as a consequence of the development of "powerful programming languages which liberated the idea of the human as information processor from the binding to computer hardware", as well as of the decline of behaviorist psychology at the expense

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136 Dahlbom & Janlert, *En Artificiell Värld*, 1988, p. 20.

137 Ibid., p. 21.

of cognitive psychology.[138] Although cybernetics in a way ended as a unified research program in the 1950s and 1960s we can still see cybernetics as a way of thinking about computers and human beings.

Artificial intelligence or AI started as a sub-discipline to cybernetics, but one that rejected several basic tenets of cybernetic research program. While cybernetics saw the human mind as a passive information processing system, AI conceived of the mind as a rational manipulator of symbols. Dahlbom saw AI as an expression of a rationalist view of knowledge, opposed to the empiricism of cybernetics. Dahlbom referred to rationalism as the tradition after René Descartes, which had as its basic tenet that certain knowledge came from the use of reason alone, and the use of the senses was frowned upon as source of knowledge. The empiricism of cybernetics on the other hand can be seen in the emphasis on correspondence, meaning that for the cyberneticians it was important to develop a model in which the computer and the human mind corresponded to each other on a level of smallest part to smallest part.

Dahlbom and Artificiality

A core concept in Dahlbom's philosophy is that of artificiality and artifacts. He did not see objects and ideas as *either* natural objects *or* as tools. Dahlbom's view was that the distinction between natural and man-made made even less sense after the emergence of computer technology than before. Rather, the world humans live in is man-made in its essence, but not necessarily controlled by man. In *En Artificiell Värld,* and the articles "An Artificial World" and "Mind is Artificial", Dahlbom proposed to replace the mechanistic and romantic world-views that had dominated the discourse on technology, with an *artificial* world-view, that saw both the world as well as the human mind as artifacts, rather than either natural or mechanical.[139] Dahlbom saw the world as becoming increasingly characterized by its artificiality, and the prime example of this was the computer as constructor of artificial worlds.

Instead of viewing the human mind and the tools with which it is extended as separate substances, Dahlbom argued that "thinking can be viewed as a craft, as a kind of tool use relying on culturally supplied, cognitive, or intellectual artifacts."[140] Central to Dahlbom's notion of

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138 Ibid., p. 21. Quote in original Swedish: "...kraftfulla programspråk vilka befriade idén om människan som informationsbehandlare från bindingen till datorernas hårdvara".

139 Dahlbom & Janlert, *En Artificiell Värld*, 1988; Dahlbom & Janlert, "An Artificial World", 1990; Bo Dahlbom, "Mind is Artificial", in Bo Dahlbom (ed.) *Dennett and his Critics*, 1993.

140 Bo Dahlbom, "Mind is Artificial", in Bo Dahlbom (ed.), *Dennett and his Critics*, 1993, p. 163.

artificiality is that in his theory artifacts can be both concrete and abstract.[141] Abstract artifacts, such as for example the multiplication table, are no less man-made than physical artifacts. The abstract artifacts relate to concrete artifacts in that the former can be realized in concrete artifacts, which include physical objects, humans and organizations.[142]

Against the idea of "natural" intelligence Dahlbom argued that human thought was essentially artificial, because what distinguished human thought was the use of abstract artifacts. Dahlbom rejected both the behaviorist and phenomenological conceptions of thought. While behaviorism conceives humans primarily as a biological organism, and phenomenology focused on the human as subject, they both viewed thought as a "natural", non-artificial process.[143] However, rather than adopting the view of the AI research program of the individual mind as analogous to the individual computer, Dahlbom saw the artificiality of mind as being inherently social, and rejected the dichotomy of mind and society.[144] As human intellectual activities becomes increasingly externalized into concrete artifacts like books or calculators, or intellectual artifacts such as mathematics or languages, human subjectivity also changes as a result. Dahlbom writes:

> When a person's identity is made up of external artifacts she can only learn to know herself through these artifacts and they are as easily accessible to other people. The self is no longer private. It becomes public and objective, social or cultural rather than natural.[145]

Dahlbom's point is reminiscent of the view historian of technology Sherry Turkle has of computer technology as constituting a "second" self.[146] While Dahlbom mentions the implications of computer technology use for the identity of individuals, he does not develop this theme further in his writings in the 1980s and 1990s.

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141 Dahlbom & Janlert, *En Artificiell Värld*, 1988, p. 36.

142 Ibid.

143 Ibid., p. 38.

144 Bo Dahlbom, "Mind is Artificial", in Bo Dahlbom (ed.), *Dennett and his Critics*, 1993, p. 173.

145 Dahlbom & Janlert, "An Artificial World", 1990, p. 94.

146 Sherry Turkle, *The Second Self, Computers and the Human Spirit*, Simon & Schuster, 1984.

Dahlbom and philosophical practice

Computers in Context can be seen as the most extensive expression of Dahlbom's views on the information systems development discipline. The book was intended as a textbook for information systems development students, and its expressed goal is to introduce systems developers to philosophical practice.[147] It constitutes a statement of the importance of philosophy for systems development in practice, and a vision for the information systems field that was perceived as "radical" at the time of publishing. Moreover, *Computers in Context* proved to have a lasting impact on the information systems field in Sweden throughout the 1990s.[148]

The book is framed as an introduction for new students of informatics to the philosophy of information systems development. However, it can be seen as an expression of Dahlbom's distinct focus and thought on information systems and philosophy. In it he suggests a theory for the practice of developing information systems that contrasts with the traditional "soft" and "hard" models. As opposed to the "hard" models focus on rationality, abstraction and construction, and the "soft" model´s focus on evolution and incorporating "human perspectives" and user views, Dahlbom proposes a dialectical model of intervention. Dahlbom sees the system that the systems developer meets as characterized by conflicts of interest, struggle and change. While the "hard systems" theorist thinks she can construct a rational system from the outside, and the "soft" system theorist thinks that the best way is to be in continuous conversation with the users of the system, the dialectical approach has as its premise that the systems developer enters into a situation characterized by conflict and contradictions. Importantly, the systems developer herself becomes a non-neutral part of the situation, a "political agent".

Artificiality in Computers in Context

The notion of the artifact and artificiality is central also in *Computers in Context*. Rather than being elaborated as a philosophical concept, Dahlbom's concept of artifact is here being applied to the practice of systems development, as a basis for a discussion of how to evaluate *quality* in information systems development. Dahlbom's notion of the artifact, as elaborated in *En Artificiell Värld,* is a fundamentally social concept.[149] The emphasis on the computer as a *social* artifact

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147 Dahlbom & Mathiassen, *Computers in Context*, 1993, p. viii.

148 Fredrik Ljungeberg, "Introduction", in Fredrik Ljungeberg (ed.) *Informatics in the Next Millennium,* 1999, p. 1. "Computers in Context is the most quoted piece of research in our community the last decade[...]".

149 Dahlbom & Janlert, *En Artificiell Värld*, 1988.

demands that its quality be evaluated not only on the level of functionality but also on a aesthetic and symbolic level.[150] In *Computers in Context,* this has consequences for which considerations systems developers should take into account when evaluating the artifacts they are dealing with, whether these are software, hardware, documents or plans. Rather than just evaluating the functional aspect of an information systems as the fulfillment of formally specified goals, aspects that relate to culture and power should also be taken into consideration. While acknowledging the importance of the functional aspect of the artifact, Dahlbom did not give this aspect primacy when it comes to analysis and evaluation, especially because in the case of the systems developer this analysis is performed before the artifact has taken form, either in theory or physical reality. "To predict the functionality in actual use of a newly designed computer system, it may very well be important to first evaluate its symbolic and aesthetic qualities."[151]

This call for different perspectives on the quality of artifacts is rooted in Dahlbom's view of the dichotomy of the mechanical and romantic world-views as structuring the way we relate to the world. For Dahlbom none of these world-views are superior. Although the mechanical world-view dominates in software design and systems development, the romantic world world-view is its necessary counterpart. Dahlboms view is that these world-views are deeply rooted in our culture, and as such are hard to escape from, but that they should not be adopted as models.[152] In the discussion on quality, both the rationalistic, mechanical and functional way of thinking about systems development are acknowledged as essential for success, but so is the romantic approach oriented towards human users and the cultural meanings of information systems and computer artifacts. Thus, Dahlbom rejects neither of the two world-views. What Dahlbom proposes as a strategy for systems developers is a process of "playing with perspectives", that is, alternating world-views dialectically.[153] Like in the case of the different roles of the systems developer in organizations, where Dahlbom arrives dialectically at what he calls an interventionist approach to systems development, the overall purpose of playing with perspectives seems to be to implement this activity as a continuous aspect of the practice of systems development. For Dahlbom the activity of alternating perspectives is something humans do day to day without thinking about it. What needs to be done is to make it an explicit part of the scientific process of systems design.

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150 Dahlbom & Mathiassen, *Computers in Context*, 1993, p. 147.

151 Ibid., p. 149.

152 Ibid., pp. 251-255.

153 Ibid., p. 266-268.

Intervention and dialectics in information systems development

In Dahlbom's approach it is assumed that the developer enters into a situation of crisis. As opposed to Langefors' theory of "total systems", where the developer is assumed to construct the system from top to bottom, Dahlbom assumes an already existing system. A well working system does not need a systems developer, only in a situation with "sufficient" dissatisfaction with the status quo, will a systems developer be called in. In order to explain the relationship between a normal state of things, and the crisis that necessitates change, and intervention, Dahlbom invokes Thomas Kuhns theory of paradigms as a model. In the context of a crisis, the developers purpose is to facilitate and make possible the transition from an unsatisfactory state to a different, and hopefully more satisfactory state.

Dahlbom arrives at two interesting conclusions from his discussion of the dialectical approach to the practice of systems development. The first is that any harmonious or "perfect" system is impossible since every system has inherent contradictions that are impossible to resolve within the system itself. This leads to a crisis where the contradictions inherent in the system are brought to the forefront. This engenders the view (at least in some of the actors) that the system needs to be changed and a systems developer is brought in. However, the developer is never in service of "the system" itself, but always caters to some of the actors in the system. For example a certain part of the management structure in conflict with other parts and so on.

The other interesting point that Dahlbom makes is that the best outcome of successfully changed information systems is a system that is more "satisfactory". That is, the new system is bound to have its own contradictions, engendering new problems. Dahlbom seems to model his dialectical theory of systems development on Thomas Kuhns conception of paradigms and revolutions in the development in science. Dahlbom sees philosophical practice as a "play with metaphors and role models."[154] In addition to being a problem-solver the systems developer should also be able to widen the perspective of what an organization needs. This is a similar argument to that which is made in *En Artificiell Värld,* where the alternative proposed to the mechanistic world-view of computer science is the dialectical alternation of world-views.

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154 Ibid., p. 202.

Bo Dahlbom and Daniel Dennett

Dahlbom's relationship to Daniel Dennett can be traced to when he studied under and lived with Dennett in Boston.[155] Later on, in his doctoral dissertation *Structure, Mind and Meaning,* he drew heavily on Dennett's naturalized philosophy of mind for inspiration. Naturalized philosophy can be summarized as a philosophical system where the natural sciences are considered to inform philosophy on matters of epistemology, ontology and psychology. Dennett's position is connected to empiricism and behaviorism, and as such uses the language of cognitive science to legitimize philosophical claims. However, Dahlbom warns, "Don't mistake Dennett's interest in science for a *belief* in science."[156] In 1993, the same year as *Essays on Infology* and *Computers in Context* were published, Dahlbom edited the book *Dennett and his Critics,* where we can find the essay "Mind is Artificial" in which Dahlbom detailed his stance towards Dennett's philosophy, and developed his own position.[157] Dahlbom's attitude towards Dennett seems in many ways to be similar to the attitude he holds towards Langefors. As with Langefors, Dahlbom thought Dennett had been misunderstood and misrepresented. It is clear from Dahlbom's contribution to *Dennett and his Critics,* that Dahlbom himself is in many ways a critic of Dennett. In a manner that seems analogous to Dahlbom's relationship with Börje Langefors, Dahlbom did not ask whether Dennett was "right", but rather what aspects could be used as inspiration for his own philosophy.

Dahlbom's vision for the future of informatics

Paul N. Edwards states, writing about cybernetics and the AI research program, that in the dissemination of thought from science and technology. ideas are manifested in language by way of metaphor. Metaphor is also the way scientists themselves make sense of what they are researching. Or rather, the cyberneticians "...wanted to see how far the analogies between computers and machines could be pushed."[158] The notion of analogy is significant, because as opposed to metaphor, analogies goes both ways, that is the computer would be explained in terms of the human mind, and the human mind would be explained in terms of computer technology.[159] In *En Artificiell Värld,* Dahlbom deals with the metaphors used to explain or understand computers. At the same

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155 Bo Dahlbom, "Editor's Introduction", in Bo Dahlbom (ed.), *Dennett and his Critics*, 1993, pp. 11-12.

156 Ibid., p. 10.

157 Bo Dahlbom, "Mind is Artificial", in Bo Dahlbom (ed.), *Dennett and his Critics*, 1993.

158 Paul N. Edwards, *The Closed World*, 1996, p. 191.

159 This point is taken from Wendy Hui Kyong Chun, *Programmed Visions*, 2011.

time the authors are conscious of the power of metaphor, not oblivious to the fact that they are speaking to power, on how to use metaphor.

Dahlbom and Janlert argued that innovations in computer-technology, as well as changes in society at large make the ushering in of a new world-view for understanding the relationship between humans and computer technology necessary, if not inevitable. Decentralization of computers and organizations, networked computing and parallel processing are cited as such innovations, making necessary a change in world-view. While Dahlbom and Janlert were positive to aspects of both cybernetics and AI, they argued that these were insufficient to the needs of both society and technology of the 1990s. Dahlbom summarizes it:

> Still, more than forty years since the birth of the computer, people either view the computer from a pre-industrial tool perspective or as a sort of clockwork ticking zeroes and ones rather than cogs. They go on thinking and talking of the computer as a "data machine", of the typical computer application as an "information system". Today it is necessary to develop many different new, untested perspectives, and consider the consequences of these different viewpoints.[160]

For Dahlbom, the central ideas of both cybernetics and AI lingered on in the discourse of computer technology in the 1980s. What he sees as its probable successor, he calls "the new connectionism". The "new" in this context, refers to the fact that early cybernetic thought was characterized by a form of "connectionism" with its focus on networks in the case of information. The new connectionism, represented by Douglas Hofstadter, differed from earlier models of cybernetic and AI approaches, in its view of both the mind and the computer as essentially decentralized processes.[161] What was common to the cybernetic approach and the AI approach was that their model of both the mind and the computer adhered to the same basic architecture, even though the epistemological stances taken, and the goals pursued by the two differed. Dahlbom viewed the advent of the new connectionism, and the classical AI researchers reluctance to the new approach, as the result of the development of computers that did not assume the classical Von Neumann architecture of a processor, central memory, and programs.[162] The advent of parallel processing machines, that operate without central memory, and also the development towards smaller, more personal computers corresponded to "a development from rationalism to empiricism, and can

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160 Dahlbom & Janlert, "An Artificial World", 1990, p. 93.

161 Douglas Hofstadter is an American professor of cognitive science, with focus on artificial intelligence. Dahlbom and Janlert reference this work: Douglas R. Hofstadter, *Artificial Intelligence: Subcognition as Computation,* I. Machlup & Mansfield, 1983; Dahlbom & Janlert, *En Artificiell Värld*, 1990, p. 31.

162 John von Neumann, a Hungarian-American mathematician, was, alongside Alan Turing, crucial in formulating the mathematical basis of the modern computer.

explain an equivalent change in AI research."[163] However, one could see it the other way around. It could be that what really changed, was rationalism itself, being formulated inside "an "anarchistic" management and business philosophy"[164]

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163 Dahlbom & Janlert, *En Artificiell Värld*, 1988, p. 31. Quote in original Swedish: "...en utveckling från rationalism til empirism och kanske förklara motsvarande förändring inom AI-forskningen.".

164 Ibid.

Börje Langefors and philosophy

Reading Langefors' writings as philosophy rather than just theories to be applied in information systems development, poses some challenges. Langefors seldom separated these two aspects of his thought. He would combine arguments directed towards the practice of information systems development with reflections on fundamental questions about the nature of systems, the human mind and information. Langefors argued that a theory of information systems needed to pay attention to the fundamental concepts and principles of the discipline.

On one hand Langefors' writings are normative with respect to the practice of systems development, advocating an approach focused on formal analysis of the information system and explicit formulation of the needs and goals of the organization that is to implement the system. On the other hand Langefors' theories, although directed towards the specific discipline of information systems development, are formulated as *general* theories with the purpose of being valid also outside the discipline. As such, Langefors' theory of information systems carries with it implicit ontological and epistemological stances. Pertti Järvinen summarizes these:

> Langefors did not explicitly present the ontological assumptions of his model, but they can be identified to follow the dominant line [...]: The view of information/data is considered as descriptive facts, an information system as a technical artifact with social implications, a view of technology as a matter of human choice and predominantly a structural view of organizations.[165]

In *Essays on Infology* some of these positions are given an explicit formulation. Langefors' essays complicate the view of him as a univocally rationalistic systems thinker in accordance with the cybernetic paradigm. Langefors' motivation for publishing these essays was that in his opinion, the theories he developed in the 1960s and 1970s still held water, but had been either been misunderstood or not been applied to practice. The attention to fundamental concepts, and "the defining of ultimate desires and objectives" had been met with either hesitation or negative sentiments, based on either technical objections or political ones.[166]

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165 Pertti Järvinen, "On Some Constructs and Ideas Introduced by Börje Langefors", in Bo Dahlbom (ed.), *The Infological Equation*, 1995, p. 58.

166 Börje Langefors, *Essays on Infology*, 1993, pp. 32-33.

New Possibilities, New Visions

In the first essay in *Essays on Infology,* "New Possibilities, New Visions", Langefors argued that information systems theory, and furthermore the "principles of information systems" still had significance for people other than "owners and managers".[167] He viewed the term *information* in particular, in the strict sense that he formulated in his own theory of information systems, as a concept worth salvaging. He saw it as a concept with which one could both "widen the perspective, as well as deepening it."[168] One could encompass more with the concept of information than with the terms of traditional data processing or computer science.

One way to read Langefors' concept of information is to see it as a bridging of the gap between the artifacts of computers and the meaning-imbued construct that is human life and organization. Langefors' project was not to develop a distinct philosophy of mind or psychology. His thinking focused on the objectives of the information systems development discipline, serving the needs of organizations. Langefors' theories operate on the level of the social. The systems theory he describes in this essay is not essentially a theory of individual humans, as was the objective of the cybernetics movement, but of humans and machines interacting in organizations. However, for Langefors, the theory of information systems should not be limited to one kind of system. It seems that Langefors has for his theory the double aspiration of *usefulness* and *universality.* "Of course, systems theory holds for all information systems, even the smallest, such as for example, the thermostat, (which doesn't require a computer)."[169]

Complex System Design

In the essay "Complex System Design" Langefors deals with several issues, some of them concerning concrete problems pertaining to the practice of systems design and some questions that have a more general and philosophical character. The central question is how to deal with the problems of complexity when analyzing and designing systems. As auxiliary arguments Langefors presents his positions on questions of the nature of language, knowledge and cognition

Langefors' argument is structured around the question of whether to use a "top-down" or a "bottom-up" approach to designing information systems. It can be read as a defense against those who would interpret his exposition in *Theoretical Analysis of Information Systems* as a system for

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167 Ibid.

168 Ibid., p. 29.

169 Ibid., p. 32.

top-down, goal-oriented, design.[170] This approach to information systems design had fallen into disfavor in Scandinavian information systems development, largely for political reasons. It was associated with the needs of capitalists for profit-maximization and control.[171] Langefors saw this view as a misconception of his theory. In his view this misconception was based on a fallacious dichotomy between a top-down, "control" model, and a bottom-up, "democratic" model. For Langefors, the "bottom-up" approach most often meant the ambition to let the people at "the bottom" of the information system participate in its design. Langefors viewed his theories not as normative, but as general tools for analysis. "The theory of information systems is not concerned with how the power should be distributed in the organization."[172]

In "Complex Systems Design" we are given a formulation of a core thesis of Langefors' theories, that may well be understood as philosophical:

> As a consequence of our limited capacity for overview, we can only perceive a small fragment of reality at a time. Hence our world, as conceived by us, appears as a conglomerate of world-pieces. But we know, of course, that these pieces are interrelated so that what happens in one of them affects the other ones. This we express by saying that the world pieces we overview appear as subsystems that form the world as a system.[173]

Two aspects of this quote are of special interest. The first is the emphasis on our limitations as humans both in our cognitive capacities, and in our limited and always situated perspective towards the world. We can only perceive "world-pieces". This points to Langefors' own conception of infology as a hermeneutics of information technology. The second aspect of interest is the last sentence, where the terminology for studying information systems is effectively applied to the phenomenal worlds of human actors.

This leads us to another central point in this essay with regard to the philosophical grounds of Langefors' thinking. Fundamental for Langefors' theory of information and information systems is the distinction between data and information. Here he relates this distinction to the difference between natural language and (logical) data language. The question of this relation has a central place in the history of logic and the philosophy of language. In this section Langefors rejects Ludwig Wittgenstein's famous thesis: "Everything that can be thought at all can be thought clearly.

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170 Ibid., p. 73.

171 Jørgen Bansler, *Systemudvikling, teori og historie i skandinavisk perspektiv*, 1987.

172 Börje Langefors, *Essays on Infology*, 1993, p. 69.

173 Ibid., p.74.

Everything that can be said can be said clearly."[174] Langefors thought that rather than seeking ever better methods for formalizing natural language to make it conform with the logical structure of data, the inconsistencies of natural language should be made explicit.[175]

What is interesting in this essay, is how Langefors' philosophical positions are legitimized. Earlier Langefors had cited hermeneutics as an inspiration for his own infological theory.[176] Here however, it is rather the biological limitations of the human organism that is implied as legitimizing his present position. Given an interpretation of Langefors as a thinker that came from the tradition of cybernetics, we can see a partial turn towards an acceptance of human limitations, not in absolute metaphysical terms, but biological.

> There was a time, in the early, visionary days, when I, myself, thought that after some years of communicating with computers, we would develop our way of talking so as to be logical and unambiguous. Later, it became clear to me that this is biologically out of reach. The reason is our limited capacity for perception, the central problem with all systems thinking, I came to conclude.[177]

Systemeering Studies

According to Dahlbom, one should not read Langefors' theories as normative theories about the management of organizations. Rather one should understand Langefors as not implying the uncritical application of his theory as an ideal model. For Dahlbom, Bansler's reading of Langefors as a proponent of the program of F. W. Taylor, amounts to the same fallacy as those who would blame Karl Marx for Stalinism.[178]

Langefors did indeed use terms such as control, efficiency and goal-orientation in his theories. He also wrote in economical terms, and sometimes took as a given that profit was a factor in the organizations in which information systems were to be implemented. For Dahlbom the crucial point is not to take the automatic leap from theorizing to application. We can see that Dahlbom argues for the importance of Langefors' ideas, despite their uncomfortable associations to suppression of labour rights. Langefors, in *System för företagsstyrning,* goes to lengths not to tie the term "styrning", which can be roughly translated to the term control as it is used in cybernetics*,* to

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174 Ludwig Wittgenstein, *Tractatus Logico-Philosophicus*, in *Major Works*, HarperCollins Publishers, 2009, p. 28.

175 Börje Langefors, *Essays on Infology*, 1993, p. 80.

176 Börje Langefors, *Hermeneutics, Infology and Information Systems*, 1977.

177 Börje Langefors, *Essays on Infology*, 1993, p. 76.

178 Bo Dahlbom, "Introduction", in Börje Langefors, *Essays on Infology,* 1993, pp. 21-22.

any one specific type of organization.[179] Rather, he puts the goals of companies and organizations as matters of fact that systems developers must take into account. That profit is a goal in many organizations is a fact, but it is not the only conceivable goal of an organization.[180]

It does not seem that Langefors' theory should exclude democratization of the workplace or organization. Dahlbom agreed in part with Langefors' critics when he pointed out that the language and concepts used by Langefors in *Theoretical Analysis of Information Systems* and *System för företagsstyrning,* with frequent uses of terms like "control" and "goal-orientation" did not lend itself to the democratic discourse of the later decades.[181] However, one important feature of Langefors that seems to be consistent with the critique of Bansler and Nurminen, is the tendency to emphasize the harmonious and well-designed system, and be somewhat blind to the possibility that conflict may be an unavoidable feature of an organization, or indeed of reality itself. Neither does Langefors at all appear to take a position in the "politics" of systems development. The political aspect of systems development was from the 1970s onwards closely related to what interests the implementation of information systems should serve in organizations. Specifically it was a debate between those who saw the implementation of information systems as a vehicle for the integration of organizations as wholes, and those who saw them as tools for control serving the interests of the managers and owners. This debate also revolved around what the future development of information systems should serve. Some saw it as a possibility of making organizations harmonious, resolving conflicts in the workplace, while others wanted information systems to be another site for worker emancipation. With reference to Jørgen Bansler's accusations against Langefors of promoting a "Tayloristic" model of systems development, Langefors explicitly opposed the belief that the goals of profit and efficiency on the one side and worker well being and security on the other hand are incompatible goals.[182]

Even more than the English term "control" the Swedish word "styrning" is etymologically connected to cybernetics, which roots can be found in the Greek word for helmsman or steersman.[183] In the same vein Langefors introduced a field of study called "systemeering", a neologism composed of the words "system" and "steering". For Langefors "steering" means

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179 Börje Langefors, *System för företagsstyrning*, Studentlitteratur Lund, 1970.

180 Ibid., pp. 63-65.

181 Bo Dahlbom, "Introduction", in Börje Langefors, *Essays on Infology*, 1993, pp. 21-22.

182 Börje Langefors, *System för företagsstyrning*, 1970, p. 65.

183 Charles François, "Systemics and Cybernetics in a Historical Perspective", *Systems Research and Behavioral Science*, 16 (1999), p. 203.

directing design towards an overarching goal, and simultaneously, the activity of defining these goals. "[...] in systemeering studies, the specification of goals and objectives is, itself, recognized as a problematic undertaking.[184] In a possible allusion to this critique, Langefors himself, in a footnote in the article "Systemeering Studies", states this:

> The common so-called models of systems development should not be classified on the same level as our systemeering studies. [...] The systemeering studies are concerned with such basic problems as are relevant to all systems methods, regardless of their ideological outlook or the contingency in which they are to be applied. One might say that the systemeering studies are concerned with the "(meta)methodology" of systems work.[185]

Information Elements

One way to interpret Langefors distinction between information and data is that data is the medium by which information is conveyed. Information in turn must always be *interpreted*. In the essay "Information Elements" Langefors connects the information/data distinction to the larger question of knowledge and how to acquire it, that is epistemology. Langefors puts forward a strong point that seems to divorce information from language: "...we must regard language as data and data as language."[186] This leaves the question, what is information? Langefors recognizes this paradox: "There is a problem when discussing information as distinguished from data since, in order to describe the information one wants to discuss, one cannot avoid representing it by data."[187] The term "e-message", or elementary message, is presented here as a solution to this problem.

Langefors' solution to the problem of natural language in information systems development can be found in his concepts of elementary messages and elementary sentences in information systems analysis. These were essentially tools for breaking down information into the smallest meaningful parts, that could easily conform to the structure of a computer-based information system.

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184 Börje Langefors, *Essays on Infology*, 1993, p. 89.

185 Ibid., p. 89, note 3.

186 Ibid., p.114.

187 Ibid.

External Properties and Emergence

Certain concepts discussed in Langefors' texts are of special interest because they not only pertain to the specifics of systems theory, but also bear philosophical implications. The essay titled "External Properties and Emergence" is a good example. It discusses the relationship between the concept of external properties that Langefors first developed in *Theoretical Analysis of Information Systems*, and the philosophical concept of emergence. Langefors initially takes the concept from the systems thinker Peter Checkland, known as the originator of the "soft" approach to information systems development.[188]

A key element in Langefors' conception of external properties is that an object, or a subsystem as it is sometimes called, is in most cases opaque to the users of the system. That is, what for the designer of the system will be "visible" as internal properties of an object will not be so for the person who will herself be part of the information system. The external properties of an object are the properties that are available to the user, or more specifically, to other object in the information system. For Langefors, a key problem when successfully implementing information systems is the fundamental divide between the concepts of the technical language used by designers and ordinary language. It seems that for Langefors, external properties are somewhat synonymous with "meaning". That is, in introducing new information system to an organization the whole system will be "closed off" to the future user and the information systems designer will have to convey the "meaning" of the system. This meaning is contrasted to what an engineer or systems designer will spend most of her time thinking about: the internal workings of the system and its parts, the details and intricacies. These are, according to Langefors, near impossible to translate in a meaningful way to the layperson. The external properties are found by taking on a "holistic" view, that is viewing the system primarily as a whole.

Langefors has a twofold elaboration on external properties in this essay, one which is directed towards practice, which is the one mentioned above, and one that is directed towards a theoretically stringent concept. This theoretical conception is also conceived from the standpoint of a system design situation. The concept of external properties may at first sight seem trivial, but Langefors makes it clear that it is not. One counterintuitive element in Langefors definition is that external properties must be derived from internal ones. That is, the external properties of an object cannot be known by experiencing it from the "outside", as phenomena. "The typical aspect of external properties is that when an object exists, its external properties are the ones that make

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188 Ibid., p. 36.

themselves known,[...]. However, it may be difficult or even impossible to determine all the external properties, by looking at, or interacting with, the object."[189]

We can specify the problem in systems thinking that caused Langefors to emphasize the importance of the external properties concept thus: For Langefors, systems thinking was to view the system holistically. However, it is not necessarily possible to translate the language used to describe one level of the system to the language used on another level. Furthermore, different parts of the system, on the same level, may utilize different languages.[190] In practice, this is solved by a part of each language being shared between the parts that need to communicate. That is, this part constitutes a shared external property of the parts.

The Infological Equation

The infological equation was Langefors' way of formulating the central thesis of his infological theory in mathematical language. The main novelty presented in the equation compared to other theories of information was the emphasis on the importance of the users preexisting knowledge and understanding for the success of an information system. The formulation of the infological equation originated in his own theories developed in *Theoretical Analysis of Information Systems*. Notably this can be seen in the equation being dependent on the distinction between the concepts of data and information. Before gaining its name it was formulated in *Theoretical Analysis of Information Systems* thus: $I=i(D, S, t)$[191] Langefors would later also acknowledge the importance of hermeneutics for his understanding of infology and the formulation of the infological equation.[192] In its original formulation Langefors explained the equation thus: "...the information "I" that is communicated by a set of data (symbols) is a function "i" of the data "D" the receiving structure "S", and of the time interval "t" during which the communication is to take place".[193] The infological equation proved to be a lasting figure in the information systems design, appearing in articles both in Scandinavia and internationally until today, being both used as a still relevant conceptual scheme and as a point of debate.[194]

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189 Ibid., p. 39.

190 Ibid., p. 42.

191 Börje Langefors, *Theoretical Analysis of Information Systems*, 1973, p. 248.

192 Börje Langefors, *Hermeneutics, Infology and Information Systems*, 1977.

193 Börje Langefors, *Theoretical Analysis of Information Systems,* 1973, p. 248.

194 One current example is William J. Kettinger & Yuan Li, "The infological equation extended: towards conceptual clarity in the relationship between data, information and knowledge", *European Journal of Information Systems*, 19 (2010), pp. 409-421.

Information systems theory as philosophy?

Both Dahlbom and Langefors operated in an intellectual discourse as well as a political and economical one. However, one reason for my interest in these two writers is their idiosyncratic aspirations to thinking that transcends the purposes of practical use for theory. Opinions differ still today on whether philosophy can really produce "universal" statements. It is not within the scope of this essay to take a definitive stand on this point. However we can say that the concept of philosophy, as used by Dahlbom and Langefors, stands for the idea of a thought and practice that is not limited to the configurations and needs of a particular historical moment. For instance, Langefors intentionally moved from theoretical writings intimately connected to the problems of memory, word-length and CPU-time in the computers of the 1940s and 1950s, towards an abstracted systems theory precisely because he saw that the technology was changing faster and faster.[195]

Dahlbom on the other hand wanted to take the insights of his philosophical background and put them to practice. In doing so he also attempted to put this practice into context. He wanted the systems developer to unite theory and practice. In a way we can say that Langefors and Dahlbom related to philosophy in opposite ways, although not necessarily contradictory. Langefors wanted to *make* philosophy from practice. That is, he wanted to distill a general theory of systems from the practice of computer engineering and systems design. Dahlbom wanted to take philosophy to practice. But that also means that their ideas of what philosophy was supposed to be, differed. We should take this distinction seriously. The most obvious difference is that Dahlbom and Langefors had different influences, and that Dahlbom, naturally, had a broader conception of what philosophy was than Langefors. While Langefors in his early writings mainly drew on logicians and analytical philosophy, Dahlbom cites a broader range of philosophical influences in his works. Although Dahlbom was clearly inspired by Daniel Dennett, he also cites Nietzsche and Hegel as well as Foucault in his writings.[196] The important difference, however, is in the view of *where* philosophy should happen. While Langefors had the view that that a theory should be changed if it did not conform to reality, Dahlbom held the position that philosophy *was* the continuous relation between theoretical reflection and practice. However their relation to philosophy might be distinguished by *not* being, at least not dominantly, philosophies of technology.

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195 Börje Langefors, *Essays on Infology*, 1993.

196 Dahlbom's relation to Dennett is expressed both in his doctoral dissertation Bo Dahlbom, *Structure, Mind and Meaning*, 1977, and in Bo Dahlbom, "Editor's Introduction", in Bo Dahlbom (ed.), *Dennett and his Critics*, 1993.

From an epistemological perspective we can place Langefors in the conceptual scheme presented by Hirschheim et al.[197] I have argued that Langefors was in large part active in a discipline that in its early period was marked by what we can call a cybernetic paradigm, that while not conforming completely to, still by and large adhered to the ideals of positivism and empiricism. Hirschheim et al. place Langefors in what they call the social relativist paradigm, although in a side-note. In my view, while I agree with Hirschheim in their pointing to Langefors as inspired by hermeneutics, it serves as an example of why the conceptual scheme in question needs to be complicated and maybe appended.

These perspectives are useful for understanding Langefors in an academic context. However, Langefors had also been a public figure, and as much a driving force in the technological and societal development as a distanced observer from the academy. Paul N. Edwards and Wendy Chun give us alternative perspectives enabling us to widen our understanding of Langefors, and hopefully complicating the picture.[198]

While Edwards describes the cybernetic paradigm, and what he calls the cyborg discourse as ways of simultaneously making sense of machine-human interaction as well as satisfying the need for control and rationalization in the cold-war paradigm, Wendy Chun focuses on the inherent instability of the processes the cybernetic paradigm tries to think in terms of binary logic. Important in both accounts is the transition from analog computing to digital computing understood as both technological change and paradigm shift. While Edwards argues that the digital propositional logic "won" in that it became the dominant language in the techno-science discourse after the war, Chun points out that this was in a large part due to a theoretical axiomatic being imposed on technology itself. That is, technology had to be made to behave digitally to conform to logic, not the other way around. These two perspectives are not exclusive but rather two sides of the same coin. What they show us is that the language and discourse of power stands in a complicated relationship with technology, that is far from univocal. Edwards writes of metaphor as a crucial function, in the sense of the digital computer as metaphor structuring the scientific discourse in post-war America. Chun on the other hand emphasizes the role of analogy, that is, a function that is not limited to the relationship between language and reality. Again, these differences do not exclude each other, but show us different things.

Langefors emphasized the information systems role as a subsystem of a larger subsystem. In studying or designing an information system, one would need to understand that the information

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197 Hirschheim, Klein & Lyytinen, *Information Systems Development and Data Modeling*, 1995, p. 64.

198 Paul N. Edwards, *The Closed World*, 1997; Wendy Hui Kyong Chun, *Programmed Visions*, 2011.

system indeed was connected to an external environment, for example a organization or a business, that itself already functioned as an information system. Floyd et al. see this feature of Langefors' thought as a prerequisite for the "humanistic" tendency in Scandinavian systems thinking. "Humanistic" meaning more specifically that the emphasis on the interconnection with an external already existing information system warranted a greater amount of user involvement and democratization in information systems development.[199]

Dahlbom and Langefors - Philosophical Differences

The differences between Dahlbom and Langefors, if we read their theories as philosophy, are dominated by a difference in themes. While I have argued that Dahlbom was seeking to develop a philosophy of artificiality, Langefors' main concern was with the fundamental question of the concepts of information and system. However, difference in interest and focus does not mean that the two writers did not deal with some of the same questions.

The theme of the relationship between computer technology and human beings is tackled by both Dahlbom and Langefors, although from different angles. As a philosopher, Dahlbom saw it as his project to develop a theory of artificiality, that shows that not only is the mind extended by use of artifacts but is in large part artificial itself.[200] Langefors' view on the mind focused on the limitations of the human mind, and the consequences this had for information systems theory.[201] Langefors and Dahlbom can be understood as different on the issue of the ontological status of the human mind in relation to computer artifacts, in that Dahlbom in some ways proposes a more radical interpretation of the theses of cybernetics and AI than Langefors. Langefors understood the human mind as limited by it biology.[202] At the same time he adopted a hermeneutical view of how human users related to information systems, with emphasis on the importance of the users pre-knowledge for the success of an information system.[203] We can thus see how Langefors employed a conception of the human user and of the human mind, that in Dahlbom's terms would be labeled as natural or non-artificial.[204] One could, however, argue that Langefors' infological theory, in its

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199 Floyd et al., "Out of Scandinavia", 1989, p. 279.

200 Bo Dahlbom, "Mind is Artificial", in Bo Dahlbom (ed.), *Dennett and his Critics,* 1993.

201 Börje Langefors, *Essays on Infology*, 1993, ch. 4.

202 Ibid.

203 Börje Langefors, *Essays on Infology*, 1993, ch. 9; Börje Langefors, *Hermeneutics, Infology and Information Systems*, 1977.

204 Dahlbom & Janlert, *En Artificiell Värld,* 1988, p. 38.

intended use, did not univocally imply such a distinction between a natural human brain and an artificial computer. Langefors' use of examples show that the infological theory of pre-knowledge and interpretation was meant to apply to non-human elements in the information system as well as to the human users.[205]

Langefors' and Dahlbom's approaches to the practice of information systems development differ on the question of application of theory. Langefors emphasized the importance of the formal analysis of the system, whether already existing or in the planning stage. Dahlbom did not reject this, but his emphasis was rather on the chaotic and conflicted situation that meets the systems developer, and the impossibility of perfection of the system.

For Dahlbom, technology determined the direction of scientific and philosophical thought. New technologies opened up new areas of research and closed off others.[206] The computer constituted such a development, as it reconfigured the space of possibilities for science and philosophy. Dahlbom's view of the relationship between technology and thought seems in this formulation to be almost unilateral, leaving science and philosophy only the choice of how to relate to the already existing reality created by new technology.

Similarities between Dahlbom and Langefors

We have seen that both Langefors and Dahlbom view artifacts as essentially social. Langefors makes this evident in his discussions on the concept of information as fundamentally distinct from data. Information for Langefors is not a concept inherent in the workings of a single component, but a function of the system of machines and humans together. Data was the way in which information was conveyed for the machine. But data in itself was meaningless. As such the purpose of the information system was inherently connected to the social character of the organizations in which they were implemented and the users that were to send and receive information.

For Dahlbom the social character of the artifact is radicalized in his idea that the mind itself is artificial, and essentially social. This meant for Dahlbom that psychology and sociology were inherently compatible, and that a mind-society dualism was fallacious.[207] Dahlbom takes his position against that of the "traditional" AI and cybernetics research paradigms, that focused on different ways modeling or simulating the individual mind or brain with a computer. What Dahlbom

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205 One such example is found in Börje Langefors, *Essays on Infology*, 1993, p. 165.

206 Ibid., p. 49.

207 Bo Dahlbom, "Mind is Artificial", in Bo Dahlbom (ed.), *Dennett and his Critics,* 1993, pp. 172-73.

proposes rather than to make the computer imitate the intelligence of the intelligence of the individual brain, was to make computers serve as "social intelligence, fulfilling the tasks of offices and organizations rather than individuals.[208] As we know, this has in large part become an actuality today.

A crucial feature of Langefors' thought is the distinction between the concepts of information and data. This seems to have been one of the most influential aspects of his theories, and that is reflected in Dahlbom and Mathiassen's explanation of information in *Computers in Context*.[209]

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208 Ibid.

209 Dahlbom & Mathiassen, *Computers in Context*, 1993, pp. 25-29.

Conclusions

Paul N. Edwards and Wendy Chun give us alternative perspectives that enable us to both widen our understanding of Langefors, and also complicate the picture of him as a cybernetic technocrat.[210] Edwards describes the cybernetic paradigm, and what he calls the cyborg discourse as ways of simultaneously making sense of machine-human interaction as well as satisfying the need for control and rationalization in the cold-war paradigm. Chun focuses on the inherent instability of the processes the cybernetic paradigm tries to think in terms of binary logic. Important in both accounts is the transition from analog computing to digital computing as technological changes and paradigm shifts. Edwards argues that the digital propositional logic "won" over an analog paradigm by becoming dominant language in the techno-science discourse after the war. Wendy Chun points out that this is in large part due to a theoretical axiomatic being imposed on technology itself. That is, technology had to be made to behave digitally to conform to logic, not the other way around. These two perspectives are not exclusive, but rather two sides of the same coin. They show us that the language and discourse of power are in a complicated relationship with technology, which is far from univocal. Edwards describes metaphor as a crucial function, in the sense of the digital computer as a metaphor structuring the scientific discourse in post-war America. Chun, on the other hand, emphasizes the role of analogy, that is, a function that is not limited to the relation language-reality.

For Katherine Hayles emphasis on information and control in cybernetic thinking pave the ground for post-humanist thought. It is especially the notion of the feedback loop in information theory that, in Hayles' view, breaks down the boundaries of the human organism. In a more general formulation Hayles defines the feedback loops of cybernetics in terms of reflexivity: "Reflexivity is the movement whereby that which has been used to generate a system is made, through a changed perspective, to become part of the system it generates."[211] Hayles concept of reflexivity can be used to understand Langefors' information systems theory, an analytical theory capable of implicitly breaking with the conception of the human as an individual *either* as an individual, *or* as a functional part of the social machinery. The notion of reflexivity as a rejection or reconciliation of the division between social and individual being would also be important for Dahlbom's notion of the artificial world.

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210 Paul N. Edwards, *The Closed World,* 1997; Wendy Hui Kyong Chun, *Programmed Visions*, 2011.

211 Katherine Hayles, *How We Became Posthuman*, 1999, p. 8.

Rather than viewing Langefors as a cybernetician and a product of Swedish post-war modernity and Dahlbom as a "deconstructionist" and a product of the postmodernity of the 1980s, we can use the framework sketched out above to understand the two authors in a different light. If we understand the cybernetic paradigm as encompassing both the cybernetics tradition and the AI research program, as well as the ideas that emanated from these movements, the cybernetic paradigm can be understood as rooted in scientific modernity. It was firmly positivist and empiricist, with a view of science and technology as vehicles for human progress. However, this paradigm and its associated technological developments also constitute a central component in what Lyotard calls the post-modern condition.

In my view the cybernetic paradigm can be seen as a site for the transition, or struggle, between modernity and post-modernity. Post-modernity has been defined as the phase of modernity in which modernity becomes self-aware. The cybernetic paradigm, as defined here, includes a transition from descriptive science towards a science of design.

I have argued that Langefors fits ambiguously into the cybernetic paradigm, and that his theories maintained many aspects that pertains to modernity and its ideals for science. His initial theories of information systems development were indeed focused on accurate and objective descriptive analysis of reality. The view of information systems as planned hierarchical wholes correspond to a modernist cybernetic vision of reality. However, this impression is complicated by the conclusions Langefors drew from his infological equation. In his later writings the problems of infology led him to emphasize user participation and decentralization as necessary for the functioning of information systems. I view Dahlbom as being part of the cybernetic paradigm, as much as Langefors was. However, while Langefors can be seen as a product of a "modernist" version of cybernetics, Dahlbom represented shift towards post-modernity. This shift had already happened on the level of technology and politics in the 1980s. Dahlbom saw the information-systems discipline as not keeping up with the times. He wanted a transition towards a "new informatics" that focused on information systems development as a discipline that should focus on design and intervention, rather than analysis and construction.

In addition to interpreting Dahlbom and Langefors in the context of a shift from modernity to a condition I have tried to locate the two writers on the axis humanism/post-humanism. In this framework both authors can be seen to exhibit aspects of both humanism and post-humanism in their writings. Langefors can be seen as being a theoretical post-humanist, blurring the lines between computer technology and humans in his analysis of information systems. However, his focus on hermeneutics and the limitations of human cognition may is evidence of a strong humanist

conception of the relationship between humans and technology on a practical level. I see Dahlbom's concept of artificiality as inherently post-humanist, stressing the non-natural character of the mind. Also, Dahlbom's notions of the human mind as extended by computer artifacts, and the notion of the mind as inherently artificial and social can be seen as in conformity to the breaking down of the humanist notion of the rational individual. However, what is characteristic of both Langefors' and Dahlbom's theories is their univocal focus on *mind* and *rationality.* The central theme of the post-humanism of Donna Haraway for example, is the destabilizing of the human *body*. The human body is almost absent from both Langefors' and Dahlbom's theories. In this way they maintain the central point of Cartesian humanism, the notion of the human as a rationality without a body.

Essays on Infology, which has been the focal point of this paper, marks the meeting of these two perspectives inside the cybernetic paradigm. I found that this collaboration was partly motivated by Dahlbom's recognition of Langefors' importance in the information systems discipline. In my view this was connected to Dahlbom's project to change the information systems discipline radically. Dahlbom's approach to his sources of inspiration was a clue in this context, as is evident in his relationship with the philosopher Daniel Dennett. In Dahlbom's view the best way of showing appreciation was to attempt to disprove a central thesis made by the person in question.

Moreover Dahlbom and Langefors can be seen as having common adversaries in some of Langefors' critics in the 1980s. The criticism against Langefors came most strongly from Jørgen Bansler, who accused Langefors' theories of serving the owners and managers of companies and being designed to "control" the workers. Other critics perceived Langefors' theories as lacking in terms of user-participation and organizational democracy.

Taking my cue from Louis Althusser's notion of "the spontaneous philosophy of scientists" I have argued that Langefors and Dahlbom, although operating within the information systems development discipline, both approached philosophy from different perspectives. I argued that Dahlbom's writings about information systems theory, in particular in *Computers in Context,* were attempts at applying philosophy to the *practice* of information systems development. Furthermore I argued that Langefors to a large extent followed the opposite path. He took his cue from the practical problems of early information systems development and saw it as necessary to develop a philosophically informed general theory of information systems.

Further Research

In my opinion, although I have focused on Dahlbom and Langefors as relating to each in the period spanning from the 1980s to the early 1990s, further study of the influence of Dahlbom in Scandinavian informatics is warranted. The shift towards a focus on the individual user rather than organizations, and decentralized networks rather than hierarchical systems in the theoretical discourse on information technology, seems to me to warrant a broader perspective than the one taken by actors within the field of informatics today.

In my study I have analyzed the writings of Dahlbom and Langefors in the framework of humanism/post-humanism understood as as a broad shift in thinking in the 20th century. Recently, a group of philosophers, sometimes called speculative realists or speculative materialists, have argued that what the continental and analytical traditions have in common, is that "their primary interest lies not in objects, but in human access to them."[212] These philosophers display a renewed interest in scientific knowledge as knowledge about objects as they really are, but without any affiliation with positivism.[213] These philosophers can be viewed as attempting to give a philosophical expression to a post-human condition, in a way that rather differs from the performative transcending of the human that is central to Katherine Hayles conception of post-humanism. They rather express a wish to dispose with the human as condition for thought, and as such maintain a form of philosophical anti-humanism. Moreover they express a renewed interest in science and technology and their importance for philosophy, as can be seen in Graham Harman's project of "object-oriented philosophy". It has not been within the scope of this study, but my view is that Dahlbom, and to a certain extent Langefors can be seen as early precursors to such developments in philosophy. They took the consequences of the developments of computer technology and applying those to philosophy, and in some areas took the first steps towards post-humanist philosophy. Speculative realism presents the possibility of post-humanist thought that is not primarily inspired by post-modernist or post-structuralist philosophy. In my view these recent developments could well inspire further research on Langefors and Dahlbom as instances of a shift towards a post-humanist current in contemporary philosophy.

Furthermore, taking the framework of post-humanism, artificiality and cyborg discourse as starting points, a historical study of the Scandinavian field of information systems development from a gender perspective would open up for valuable insights. As I have noted earlier in this study,

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212 Graham Harman, *Guerilla Metaphysics, Phenomenology and the Carpentry of Things*, Open Court, 2005, p.1.

213 For a survey of the speculative realist movement see: Levi Bryant, Nick Srnicek and Graham Harman (eds.), *The Speculative Turn: Continental Materialism and Realism*, Re:Press, 2011.

both Dahlbom and Langefors' theories are centered on the rational mind in relation to information technology. Questions regarding identity and embodiment are nearly absent from their theories. It would be interesting to study their theories as in light of possible gendered assumptions, applying methods from masculinity studies for example.

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