

ProjectWeb as Practice

On the Relevance of Radical Localism for
Information Systems Development Research

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English summary

This thesis places itself in the research field that addresses information systems development in organizations. The objective of the thesis is to problematize and expand existing understandings of and approaches to systems development.

What is information systems development? Most of the literature describes systems development as the process through which a new information system is created. The term information system (as opposed to information technology) is used in the research field as a comprehensive term that can include several integrated information technologies as well as organizational use and maintenance practices that collectively comprise a socio-technical phenomenon – an ‘information system’. This socio-technical perspective is characteristic of the systems development research tradition and emphasizes the fact that systems development is far more than technical construction of information technology.

The process through which a new information system is created is furthermore described in the literature as an extremely complex and uncertain process, one in which a multitude of social, technical, and political factors interplay. The literature is characterized by a normative and prescriptive approach that seeks to uncover the underlying causes of the uncertainty of the process. The approach works toward reducing the complexity of the development process in order to improve support for production of new and better information systems that can function optimally in relation to the identified objective. The objective can be multifaceted but often pertains to increasing effectiveness of work processes, offering new services, changing forms of organization, or improving employee working conditions in organizations with the help of information technology. Systems development research commits itself at several levels to generating ‘improvement’: improvement of specific technologies and organizational work processes, improvement of support for an unspecified systems developer/user, and improvement of best practice guidelines for systems development.

In spite of more than twenty years of research and a wealth of books, articles, manuals, models, and guidelines focusing on how systems development projects can and should be carried out, the goal of ordering and controlling the systems development process remains far from realized. Systems development initiatives continue to encounter new and unforeseen complications, often take longer than planned, and regularly turn out differently than intended. Similarly, implementation (the last phase of systems development in which new technologies and change plans are introduced in organizations) often yields results other than those intended. Systems development and its results – implementation of new technologies and altered work processes – have repeatedly revealed themselves as challenging to control and difficult to reduce to a general model or set of methodological guidelines. In fact, several of the systems that we regard as successful Internet applications have arisen as a result of fairly random use and broad experimentation over time.

Bearing these factors in mind, I seek to develop an analytical alternative to the normative focus on method that characterizes current systems development research. Rather than advance additional recommendations on and overviews of how systems development can and should be organized and carried out, this thesis has as its point of departure the field of science and technology studies and an open, descriptive, and non-normative approach.

The thesis presents an empirical study of the development and use of a web-based collaboration system in the pharmaceutical company Novo and the development company Novo Nordisk Information Technology. The system is entitled ProjectWeb, and its objective is to support work in long-term, globally distributed pharmaceutical development projects.

Through this study of development and use practices, I illustrate the relevance of an alternative analytical/theoretical approach to the study of systems development, thereby seeking to open for new considerations on why systems development rarely unfolds as planned, why a given system becomes a success or a failure, or perhaps both at the same time in different locations. The thesis brings forth aspects of systems development that are usually overlooked and opens up for new critical questions. The thesis thus focuses on:

- - How is the complexity of systems development handled in practice by the actors involved?
- - How can systems development researchers improve systems development in organizations without assuming a normative and prescriptive position?

The thesis offers empirical answers to these questions and presents (via the case and detailed analyses of selected practice situations) a set of analytical tools for further study of systems development in practice. I refer to the approach and the tools as radical localism, a term that covers a focus on local practice, the specific times and places in which information systems are created and incorporated.

Radical localism is developed in the first part of the thesis via three steps: a critical review of prevailing conceptions of systems development and existing alternatives, a presentation of an open and problematizing research approach inspired by science and technology studies, and a theoretical discussion of two process- and practice-oriented approaches to the study of technological phenomena. Subsequently, this approach is exemplified in three analytical chapters. Together, the analyses shed light on the localities and actors involved in systems development, but not reflected in the conventional image of the development process as a temporally and spatially delimited professional project. Ensuing from the varied development localities and use contexts, ProjectWeb becomes a difficult phenomenon to delimit. The analyses describe a series of use and development practices and offer an optic for the study of and intervention in these practices.

The practice situations illustrated include:

- - a design workshop in which different delimitations (framing) of ProjectWeb enter into its construction as decisive elements,
- - use situations in which collections of heterogeneous elements (assemblies) bind ProjectWeb together in use, rendering the system workable and relevant in specific situations,
- - disruptions (interferences) through which my own research practice creates the possibility of a series of unforeseen interventions.

The thesis thereby makes material available that collectively paves the way for a new understanding of ProjectWeb as an emergent phenomenon that is continuously framed, assembled, and interfered with in practice. The analyses and the concepts that arise thereby question the current understanding of where systems development takes place and who is involved in the development. Furthermore they incorporate forms of practice that have not previously figured prominently on the systems development research agenda.

Finally, the character of contributions of this kind is discussed along with the implications of the request for moving away from the normative focus on method and toward focus on local practice and specificity. The conclusion encourages further research and development of research tools that can open up for an empirical understanding of information systems and systems development processes.

Danish summary

Denne afhandling placerer sig i forskningsfeltet der omhandler systemudvikling i organisationer. Afhandlingens formål er at problematisere og udbygge eksisterende forståelser af og tilgange til studiet systemudvikling.

Hvad er systemudvikling? I hovedparten af litteraturen beskrives systemudvikling som processen hvorigennem et nyt informationssystem bliver skabt. Begrebet informationssystem (frem for informationsteknologi) bruges i forskningsfeltet som et bredt begreb der kan inkludere flere integrerede informationsteknologier såvel som organisatoriske brugs- og vedligeholdelsespraksisser der tilsammen udgør et socio-teknisk fænomen - et 'informationssystem'. Dette socio-tekniske blik karakteriserer systemudvikling som forskningstradition og slår fast at systemudvikling omhandler mere end ren teknisk konstruktion af informationsteknologi.

Processen hvorigennem et nyt informationssystem skabes, beskrives endvidere i litteraturen som en yderst kompleks og usikker proces, hvor et hav af sociale, tekniske og politiske faktorer spiller ind. Litteraturen er præget af et normativt og handlingsanvisende islæt der søger at lokalisere årsager til processens usikkerheder og stræber mod at reducere udviklingsprocessens kompleksitet for bedre at understøtte en produktion af nye og bedre informationssystemer der kan fungere optimalt ud fra den tiltænkte hensigt. Den tiltænkte hensigt kan være mangesidig, men handler ofte om at effektivisere arbejdsprocesser, tilbyde nye services, ændre på organisationsformer eller forbedre medarbejdernes arbejdsvilkår i organisationer ved hjælp af informationsteknologi. På flere niveauer forpligter systemudviklingsforskning sig på 'forbedring': forbedring af specifikke teknologier og organisatoriske arbejdsgange, af støtte til en uspecificeret systemudvikler/praktiker, og af eksisterende anvisninger for god systemudvikling.

På trods af mere end tyve års forskning og stakkevis af bøger, artikler, manualer, modeller og anvisninger for hvordan systemudviklingsprojekter kan og bør udføres, er målet om at skabe orden i og kontrol over systemudviklingsprocessen langt fra realiseret. Systemudviklingsinitiativer møder fortsat nye og uforudsete komplikationer, varer ofte længere end planlagt og falder anderledes ud end tiltænkt. Ligeledes fører implementering (den sidste del af systemudvikling hvor nye teknologier og forandringsplaner indføres i organisationer) ofte til andre resultater end forventet. Systemudvikling samt resultaterne heraf – indføring af nye teknologier og forandrede arbejdsformer – har gang på gang vist sig at være svære at styre eller koge ned til en generel model eller et sæt metodiske anvisninger. Tværtimod er flere af de systemer vi anskuer som succesfulde såsom Internet-applikationer, opstået af forholdsvis tilfældig brug og bred eksperimentering over tid.

Med dette forhold in mente søger jeg i denne afhandling at udvikle et analytisk alternativ til det normative metodefokus der præger den nuværende forskning i systemudvikling. I stedet for at fremføre flere anbefalinger og oversigter over hvordan systemudvikling kan og bør organiseres og udføres, tager denne afhandling afsæt i feltet videnskabs- og teknologistudier og en åben, deskriptiv og ikke normativ tilgang.

Afhandlingen præsenterer en empirisk undersøgelse af udviklingen og anvendelsen af et web-baseret samarbejdssystem i medicinalfirmaet Novo Nordisk. Systemet kaldes ProjectWeb og har til formål at understøtte arbejde i længerevarende og globalt distribuerede farmaceutiske udviklingsprojekter. Via denne undersøgelse af udviklings- og anvendelsespraksisser illustrerer jeg i afhandlingen relevansen af en alternativ analytisk/teoretisk tilgang til studiet af systemudvikling og søger derved at åbne for nye overvejelser om hvorfor systemudvikling sjældent udfolder sig som planlagt, hvorfor et givet

system bliver en succes eller mislykkes, eller måske begge dele samtidigt på forskellige steder. Afhandlingen trækker oversete aspekter af systemudvikling frem i lyset og åbner for nye problematiserende spørgsmål. Afhandlingen fokuserer således på:

- - Hvordan håndteres systemudviklingens kompleksitet i praksis af de involverede aktører?
- - Hvordan kan man som systemudviklingsforsker forbedre systemudvikling i organisationer uden at indtage en normativ handlingsanvisende rolle?

Afhandlingen tilbyder empiriske svar på disse spørgsmål og præsenterer (via casen og detaljerede analyser af udvalgte praksissituationer) et sæt analytiske redskaber for videre undersøgelser af systemudvikling i praksis. Tilgangen og redskaberne kalder jeg for *radical localism* en betegnelse der dækker over et fokus på lokal praksis, de specifikke tider og steder hvori informationssystemer bliver til og indgår.

Radical localism udvikles i første del af afhandlingen via tre led: en kritisk gennemgang af gængse forståelser af systemudvikling og eksisterende alternativer, en præsentation af en åben og problematiserende forskningstilgang inspireret af videnskabs- og teknologistudier, og en teoretisk diskussion af to processuelle og praksis-orienterede tilgange til studiet af teknologiske fænomener. Herefter eksemplificeres denne tilgang i tre analysekapitler. Relevansen af en radikal praksistilgang som et alternativ til gængse normative og handlingsanvisende tilgange bringes frem i studiet. Tilsammen belyser analyserne lokaliteter og aktører der er involveret i systemudvikling, som ikke indfanges i billedet af udviklingsprocessen som en temporalt og rumligt afgrænset del af det professionelle systemudviklingsprojekt. Som følge af ProjectWebs forskelligartede udviklingslokaliteter og brugssammenhænge bliver ProjectWeb som fænomen vanskelig at afgrænse. Analyserne beskriver en række brugs- og udviklingspraksisser og tilbyder en optik til studiet af og intervention i disse praksiser.

Praksissituationerne der belyses er:

- - en design workshop hvor forskellige afgrænsninger (*framing*) af ProjectWeb indgår som afgørende element i konstruktionen af ProjectWeb,
- - brugssituationer hvor samlinger af heterogene elementer (*assemblies*) holder ProjectWeb sammen i brug, gør systemet anvendeligt og relevant i specifikke situationer,
- - forstyrrelser (*interferences*) gennem hvilke egen forskningspraksis åbner muligheden for en række uforudsete interventioner.

Derved stiller afhandlingen materiale til rådighed, der tilsammen baner vej for en ny forståelse af ProjectWebs som emergent fænomen der i praksis kontinuerligt 'afgrænses', 'samles' og 'forstyrres'. Analyserne og de begreber der fremkommer problematiserer derved gængse forståelser af hvor systemudvikling foregår, hvem der er involveret i udviklingen, og inddrager praksisformer der ikke hidtil har været fremhævet på systemudviklingens forskningsagenda.

Afslutningsvis diskuteres karakteren af bidrag af denne art og implikationerne der kan være forbundet med afhandlingens opfordring til at søge væk fra det normative metodefokus til fordel for lokal praksis og specificitet. Konklusionen opfordrer til videre forskning og udvikling af analytiske redskaber, der kan åbne for en empirisk forståelse af informationssystemer og systemudviklingsprocesser.

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1. Introduction

This study pertains to the field of research on information systems development. What is information systems development or ISD? In research on the topic, ISD is described as the process through which a new information system is brought into being. The term information system (as different from information technology) is applied in research as a broad concept that can encompass a conglomerate of integrated technologies and organizational practices that together form a sociotechnical phenomenon - an information system. This sociotechnical perspective characterizes the field of ISD and emphasizes that information systems and their development imply more than technical construction.¹

ISD, the process through which information systems are brought into being, is furthermore depicted in literature as a problematic and highly uncertain process in which a myriad of technical, social, and political factors play a part. Much research on ISD is normative and marked by a quest for clearly mapping out these factors and locating the causes of uncertainty. Methodologies and guidelines for the professional developer (or practitioner) who is educated and trained to carry out ISD work is a main focus of the field. Much research thus aims to provide recommendations for this somewhat unspecified practitioner, and thereby to reduce the complexity of the process and to facilitate control of the outcome. That is, to ensure the production of better information systems that work optimally and in accordance with intended goals. Intended goals of ISD are often related to making work practices more efficient, changing organizational forms, enabling new services, or making employee working conditions easier or otherwise better. At several levels, the field of ISD research is thus obliged toward 'improvement' – by informing the design of new information systems, through general recommendations concerning how to go about systems development, and by providing models, methods, and guidelines that can bring order to the uncertainties of the process.

¹ For reviews of different approaches to information systems and information systems development see, for example, Fitzgerald, Russo, and Stolterman (2002) or Checkland and Howell (1998). Differences between different approaches will be elaborated in the literature review in chapter two to illustrate how 'the field' spans diverse practices and is overlapping with another 'field', that of Information Systems Research (ISR).

Despite over twenty years of research on the topic, piles of books, articles, manuals, models, and best practice guidelines for how systems development can and should be carried out, the goal of order and final solutions is still far from realized. Development initiatives continue to be characterized by unforeseen complications, often take longer than planned, and tend to fall out differently than intended. Likewise, implementation (the last part of systems development processes where new technologies and organizational ways of working are deployed in organizations) often leads to other results than those planned or expected. The systems development process and its results – new technologies and ways of working – have again and again proved to be difficult to control in practice or condense theoretically into one universal model or methodology. On the contrary, many strategic applications of IT that we think of as great successes have paradoxically grown out of somewhat unplanned and experimental use practices unfolding over time.²

Thesis objectives

In reworking this unsolved quest for order and control, this study seeks to develop an analytical alternative to the normative focus on methodology, models, and guidelines that characterizes existing research on systems development. Rather than present additional suggestions and overviews of how systems development can and should be carried out, this thesis seeks out an alternative offset in an open, descriptive, and non-normative approach. This work momentarily brackets out this traditional way of informing systems development (through methods and recommendations), and instead I approach systems development as an empirical matter. Instead of providing further explanations for why things do not go as planned, or suggest how ISD might be done better by the professional practitioner, I have circumvented this line of inquiry and asked in a more open-ended and exploratory manner:

- - *How does an information system come to work at all?*
- - *What practices can be identified as playing a part in such a process?*
- - *How are complexities of the systems development process handled by the actors involved?*

² Ciborra discusses the Internet and other strategic applications of IT in organizations as ‘successes’ that have grown out of use rather than out of controlled settings of systems development (1989). I discuss his work and similar approaches to ISD as involving use in chapter two.

This open-ended and empirical approach has been applied to the study of a particular development initiative in a particular organization. Or more precisely, specific episodes, situations, and practices related to the development of a web-based information system in the multinational pharmaceutical company Novo and the development company Novo Nordisk Information Technology (NNIT). The system is called ProjectWeb and has been developed and deployed to support work practices in long term and globally distributed pharmaceutical development projects.

With this open-ended study of ProjectWeb, its related design and use practices, I have focused on local practice and applied a radical practice perspective, or, what I will call *radical localism*. In this thesis I aim to illustrate the relevance of this analytical approach to the field of information systems development research. And I thereby seek to open for new considerations of the systems development process, how it rarely unfolds as intended, how an information system comes to succeed or fail, or perhaps may do both at different times and places. The thesis contribution therefore consists of a set of case stories and analytical constructs as tools for studying local practices involved in ISD. The cases are presented as an alternative way of conceptualizing systems development that differs and extends the orderly story about development as well as existing ways of informing ISD. The cases also address the question of how the systems developer researcher can contribute to the field of ISD research without taking up a position of recommendation and providing solutions.

The foundations for radical localism are inspired by work in the field of Science and Technology Studies (STS).³ The word ‘radical’ implies a drastic deviation from established ways of informing ISD (through methods, models, and guidelines) and localism contrasts with the universalizing tendencies of ISD research by always attending to the local practices and specificities through which particular information systems come into being. I suggest that the stories and concepts presented in this thesis open up for other kinds of discoveries: discoveries that come from inside unique and situated

³ The term radical localism is borrowed from Lettinga (2000). She draws, as I do, on the work of Callon (e.g. 1986), Law (e.g. 1987), and Latour (e.g. 1988) whose work also often is referred to as *actor-network theory*. In the light of a line of critiques of and discussions on actor-network theory and ‘after’ (in particular Strathern 1996, Latour 1999b, Law 1999), I have chosen to use the term science and technology studies instead of actor-network theory. This term is broader and is applied to include the influences of feminist theory (in particular Haraway 1991, 1994, Star 1991) upon studies in the ‘after’ actor-network tradition (Mol 2002, Law 2002).

practices rather than from a generalizing model.

The thesis thereby aims to problematize and extend existing understandings of the systems development process in Information Systems Development Research by advancing a research approach referred to as radical localism.

Radical localism

This research approach, radical localism, is advanced in three steps (the first three sections of the thesis) and in three illustrative analysis chapters. The first three sections unfold radical localism through:

- - a critical review of established understandings of systems development and some alternative approaches to systems development as made up of local practices,
- - a presentation of an open-ended research strategy of juxtaposing different practices applied in my own empirical investigations of ProjectWeb, and
- - a theoretical discussion of two different analytical frameworks for the study of a technological phenomenon as an integral part of practice.

These three steps build up the notion of radical localism not so much as a set of prescriptions, but more as an orientation and commitment towards always attending to local practice and specificity. Instead of seeking universal explanations for what guides and shapes the ISD, or any general suggestions as to how it might be done better, radical localism works empirically by analyzing the particular places and situations in which an information system appears and comes into being.

STS studies provide the main analytical resource as a field comprising various studies and approaches that take *as topic* the production of scientific facts and technologies (e.g. Latour 1999a).⁴ STS studies have analyzed scientific and technological practices

⁴ Latour's study of a group of scientists, a botanist, a pedologist (a soil scientist), and a geographer, that set out to study the Brazilian rainforest is an excellent example of how the production of facts, entities, and knowledge can be approached as topic of inquiry. The group seeks to clarify whether the rain forest is advancing on the savanna or the savanna is taking land from the forest. Latour traces the way in which knowledge about the boundary between forest and savanna cannot be watched or contemplated, but must be manipulated in particular ways in order to be known. Instead of finding explanations or the under- and over determination of nature versus the social (causal interferences of economy and funding, political influences, the technology and tools, or hegemony of scientific theory and paradigms that might explain outcomes) Latour scrutinizes the mundane details of their activities. Scientific knowledge is thus

empirically, and have, based on empirical investigations, worked towards re-specifying a set of commonsense understandings of sociological categories such as individuals, technology, organizations, agency, and society. Whereas more traditional sociology (and likewise studies within ISD research) take these as basic units of analysis, STS applies a methodological principle where the analyst refrains from presupposing the inherent characteristics of entities and actors beforehand, and instead explores their nature as ongoing effects. Focus is on the processes, practices, and specific circumstances through which facts and technologies come into being and are sustained as true facts or working technologies. These studies are in turn inspired by ethnomethodology and the notion of taking the production of social order as topic of study (Garfinkel 1967).

“Social order, the ethnomethodologists argue, is not a given but the result of an ongoing practice through which actors, in the course of their interaction, elaborate ad hoc rules to coordinate activities. The actors are helped of course by precedents, but *those precedents are not in themselves sufficient to cause behavior*, and they are translated, adjusted, reconfigured, invented (in part) to make do in shifting and unexpected circumstances. We collectively elaborate an emerging and historical event which was not planned by any participant and which is not explainable by what happened before the event or what happens elsewhere.” (Latour 1994, p. 50)

This line of research starts with the particular event not the precedents. This approach abandons searching for drivers, determinants, or explanations of the phenomenon under study (this being social order, the production of scientific facts, or the development of information systems) and instead works empirically, learning from details of situations and events, the specific actors, materials, and their relations. Rather than provide an extensive review of the field STS, I have chosen in the literature review to present selected studies that, like my own, draw STS resources into the field of ISD. In the chapters on research design, the theoretical chapters, and in the analysis I introduce additional concepts along the way.

Three analysis chapters illustrate what radical localism as a research approach brings into focus. The cases provide snapshots or glimpses of a technology, and working practices of development and use. In unraveling selected events, I refrain from relying on explanatory

approached as fabricated out of particular circumstances and material practices. By studying scientific practice in this way Latour opens up the intricate assemblages of nature, technologies, skills, and scientific debates that collectively produce new knowledge about the boundary between forest and savanna in Brazil. (Latour 1999a)

factors and determinants and suspend judgment on what is good or bad about the particular technology, the development, and the implementation process. I suggest that this strategy provides valuable leads for furthering current debates and conceptualizations of systems development and thereby illustrates the relevance radical localism.

Problematizing and extending the essence of ISD

The thesis emphasizes the relevance of radical localism by bringing forth aspects of development that tend to be overlooked and under-examined in the quest for improvement and focus on methodologies as the essence of ISD. Consider the following quote on the essence of development taken from a recent information systems development textbook written by Fitzgerald, Russo, and Stolterman:

“Information systems development is the fundamental process performed when engaging information technology to achieve a specific purpose in a specific context. It is an activity that is fundamental in that it is stable over time even though the context in which it is performed changes... The development of information systems is still, and will probably always be, a core process with its own essential set of activities...” (Fitzgerald, Russo, and Stolterman 2002, p. 2)

These authors describe a set of primary activities and goals that make up an intentional compositional process (ibid., pp. 2f). These primary activities include the investigation, the analysis, and the design of an information system’s purpose, function, structure, appearance, behavior, cost, and efficiency. The professional developer or practitioner educated and trained to do information systems development work carries out these activities, for example by examining the area of work in question and deciding on how IT best can provide support. This process is contained spatially and temporally within the boundaries of a professional project team, where the professional developer may work together with work analysts, software engineers, programmers, and graphic designers. The project includes these people as central actors, these essential activities, and the process of planning and regulating this collaborative work to ensure that development does not take too long, does not cost too much, and that the result corresponds to the goal - based on the time, resources, and software and hardware options available. Systems development is in this version bounded in space and time by the development project and the activities of the professional development team. What goes on within the project and team is seen as the essence of development and is the locus of interest around which most information systems development research revolves.

In contrast, the empirical material on ProjectWeb's design and use presented in this thesis illustrates aspects of development that take place 'outside' the boundaries of a formal development project, outside what Fitzgerald et al. (2002) find to be fundamental and essential. Thereby I (by way of radical localism) question the notion of project and method as the most appropriate way of thinking, studying, and knowing ISD and put additional practices and situations onto the research agenda. The thesis investigates disorderly 'extra-method' activities of designers, design-in-use practices, and unintended research interferences, topics that have been secondary and under-exposed in ISD research. The analyses thereby serve to problematize existing understandings of where development takes place and who is involved.

Disorderly 'extra-method' activities: The first case analyzes a pre-development workshop, not as a moment before or outside development, but as an event where the very circumstances and interdependencies for development of a version 4 of ProjectWeb are negotiated and framed. With this analysis I bring into focus the contextual practices and messiness of formal development that a focus on methodology and the development project tends to marginalize.

Design-in-use: The second case illustrates that use practices should not be viewed as moments outside of development, but as situations where ProjectWeb is assembled in order to work in particular ways for the task and situation at hand. With the analysis I problematize the notion of ProjectWeb as a fixed, finished, and bounded entity and the assumption that user practices are secondary to or outside ISD.

Unintended research interferences: The third case reflects on my own practices of research and ways in which these interfere in the process of development in subtle and unanticipated ways. This chapter opens for rethinking existing ISD research strategies in ways that may encompass our interference in that which we study and for thinking about how our notions of improvement mesh with other notions of improvement circulating in the field.

The cases thus together question the boundaries of development in space and in time: All three cases disturb the assumption that the essence of ISD lies within the boundaries of a development project and the process can be adequately understood by focusing on the methodology and professional settings of design. All three cases disturb the assumption that development has a beginning and an end. The stories thereby provide alternative versions of where and when development can be located – and studied.

Furthermore, the case studies question the possibility and benefits of over-viewing, condensing, and thereby controlling the ISD process. As alternatives, the cases provide insights into slices of local practice in a complex and indeterminate process without reducing these to one overall picture or model. I suggest that exploring the process from within selected events opens for new kinds of questioning and illustrates how we can gain novel understandings of development “from within” local practices and situations.⁵

The empirical case studies

The empirical case studies comprise different locations and practices in the companies Novo and NNIT in which a web-based information system, ProjectWeb, was present, designed, used, discussed, made visible, or otherwise could be encountered by me as researcher. The thesis builds on this empirical data gathered during the fall of 2000 and all of 2001 through interviews and observations at different locations and through document analysis of reports and systems descriptions of ProjectWeb. As part of my research, I also produced data by setting up meetings and presentations with informants to invoke discussions of ProjectWeb. In the next pages, I will provide an introduction to the pharmaceutical setting and ProjectWeb and then present the collaborative context within which my research has been carried out.

Novo A/S

The company web site, www.novonordisk.com, presents Novo as a large multinational pharmaceutical company engaged in the discovery and production of new medicines and pharmaceutical devices. The page tells us that Novo’s two most important products are insulin for the treatment of diabetes and human growth hormones for the treatment of patients unable to produce sufficient quantities themselves. These pharmaceuticals are developed through long term and cost expensive research and development activities. The pages depict this complicated process of bringing a new medicament or device to the world market and the many steps involved, from the earliest research efforts to pre-clinical testing, clinical trials, pilot fabrication, larger scale production, marketing, and global distribution. This work brings together many professions and research methodologies and relies on collaborations with diverse partner firms, universities and research centers, hospitals and medical practices geographically dispersed across the

⁵ The notion of developing analysis from within situations is particularly inspired by Haraway (1991) and Michael (2000) and discussed in more detail in chapter three.

world. Novo's staff numbers over 18,000 employees dispersed over 68 countries. My study was conducted in various departments at four company locations in the Copenhagen area, Bagsværd, Hillerød, Gentofte, and Måløv, and at NNIT's sites in Bagsværd and Lyngby.



Figure 1: Corporate headquarters in Bagsværd, Denmark (source www.novonordisk.com)

The process of pharmaceutical development is depicted as a long and complicated process marked by uncertainties of product efficacy, intense market competition, constant time pressures, and a dependency upon inter-organizational alliances and governmental regulatory agencies.⁶ On the company web page, as well as in company documents (such as materials available in the company headquarters reception or the official development project manual), the complex production process is ordered in terms of projects living through predefined trajectories broken down into phases. One brochure, for example, describes the process of “how a new drug is developed”. A timeline depicts phases labeled *conceptual*, *pre-clinical*, *clinical*, and *regulatory*. Each phase includes a list of the main activities and goals that have to be achieved in order for a project to move on to a subsequent phase. Such projects may last up to ten years, comprise several hundreds of people from many different professions, and extend across geographical distances and various time zones. A project manager, a project assistant, and a management group typically consisting of 10-12 group leaders, also called the ‘core group’, ensure that a project progresses according to plans and the allocated budget.

⁶ This picture corresponds to that provided in other literature on the pharmaceutical industry. See, for example, Ciborra (1996), van der Geest, Whyte, and Hardon (1996), and Pisano (1997) that I drew on as part of an initial literature review on the industry and pharmaceutical setting.

My study has focused on three development projects, each at different stages in this overall trajectory: two projects developing new insulin delivery systems for diabetes patients and a third developing a growth hormone product. At the time of my investigation, these projects were at the following stages: one in the pre-clinical phase, another in the clinical phase, and one in the final phase of registration and product 'launch'.

During the study I was presented with the diagram of phases, but also met additional images of pharmaceutical projects and local strategies for seeing the project as a whole. During an interview, Mark, a Preclinical Coordinator, explained the company structure, a project, and his location in it.⁷ For Mark, the project was something constantly shifting and activating different places and specialists. I will present this here to provide another local overview of pharmaceutical projects in Novo.

"I conceive of the company as the usual pyramid structure with managers at the top and all the departments underneath. And a project is something that rolls across the pyramid, you know, and activates whatever is necessary in the given project phase. When we make a drug, then it's all the chemists that are involved. And then when we test it on people, then it's not us. We are still in on the project, but others are the ones that are activated... I am preclinical coordinator, so I manage the people that sit up here in Glostrup (town name). I have a taxonomist, a geneticist, and a metabolism analyst. I make sure their things are collected and sent up to the project, and then, of course, I pick up on orders from up there and get them out." (Interview, Mark, Preclinical Coordinator)

As Mark explains, a project is something that rolls across departments and activates whoever and whatever is necessary. Who (defined by organizational and geographical location and professional identity) is "in", "out", or "active" is thus continuously shifting, and a lot of work goes into making the project - coordinating back and forth between a given group, others elsewhere, and the project "up there" from where Mark picks up orders. So in addition to the project being dispersed across a large number of people, professional identities, organizational units, and organizations in Denmark and elsewhere, projects seemed to be continuously shifting with regard to the specific departments and experts involved. Project work was constantly marked by competition between projects and by the possibility of being closed down if the desired results were

⁷ Names in all interview quotes and field note fragments have been made up.

not achieved. For Mark, as well as other people I met, the project work was also about sorting out current status and shifts, determining who was activated and doing what at which time. Button and Sharrock (1996) and Callon and Law (1995) have helped me to think about the pharmaceutical project and the neat depiction of phases and timelines as an ‘ordering device’, an arrangement for coordinating distributed work, making it visible, mutually accountable, and coherent. Timelines and phases illustrating where a project is, along with images provided by people involved, spatial ideas of the project up here and out there can be seen as ordering devices for establishing overviews that are useful for those engaged in the field (as well as for the researcher). Attaining coherence and overview of the pharmaceutical project in practice was something that required continuous coordination, as noted by Mark. This was also in part why ProjectWeb was developed.

ProjectWeb and Novo Nordisk Information Technology

ProjectWeb is a web-based application developed by Novo Nordisk Information Technology (NNIT) for a number of purposes, one of which is to support work within the large, long term, and geographically distributed research and development projects in Novo. The application is based on Internet standards and accessed through a web browser. Hence the name, project and web. The main IT developer of ProjectWeb recalls the needs of pharmaceutical development projects when he first got involved in building early versions of ProjectWeb. According to this developer, ProjectWeb was conceived as something that might tie research and development projects together across the time span of a project, as it moves through phases, or rolls across the company, and as different people enter or become active in relation to the project:

“... It was a meeting point for a project. Not just geographically, but also so that everyone in the project could follow – when a project starts over in the research lab and they have the research results, they go into the system. And when the research lab is done, when they have something that might become a product, the whole batch moves over into the development department. And then the whole batch moves on into marketing. You can look back and find all the documents without having to walk over to the laboratory to find a researcher and a folder that is placed on some shelf or something. Those were the kind of thoughts we had about it then, and those are the things we could tell that they needed.” (Interview, Neal, Systems Developer)

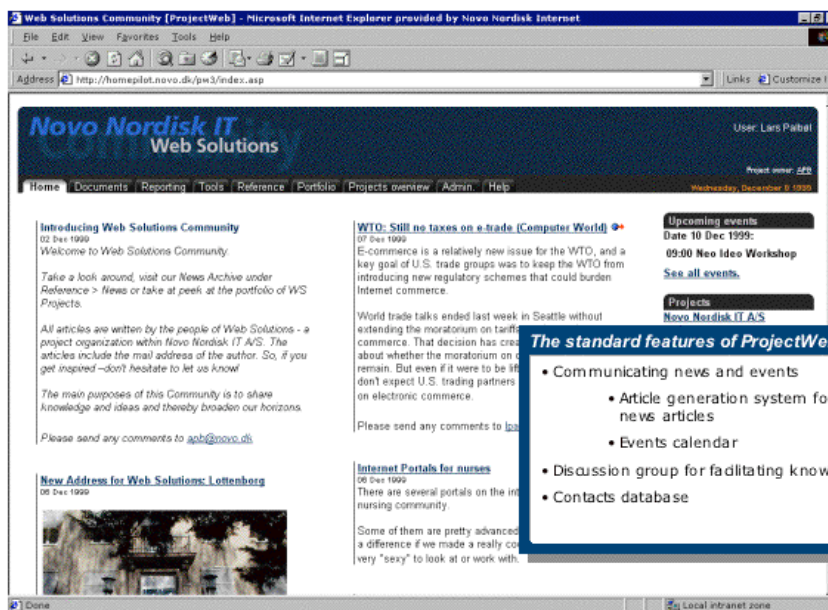
According to Neal, ProjectWeb is a additional device for collecting and storing all project

information to make it accessible and independent of the people and places involved in the production of, for example, research results and/or development strategies. Neal implies that ProjectWeb might alleviate or stabilize the chaos and complexity of projects that are spread out all over the world, constantly moving and shifting.

A sales presentation from NNIT (created by an employee in charge of ProjectWeb's sales and marketing) describes ProjectWeb through three main features. I will replay these to provide more information on ProjectWeb's look and feel. ProjectWeb is, according to the first slide, a *project home page* displaying project news and events to project members distributed across many departments, subsidiaries, and perhaps partner firms that collaborate to develop, produce, and market new pharmaceutical products. Secondly, it is a *document-sharing tool* where project members can store, organize, and easily retrieve relevant document files and meeting summaries. And lastly, ProjectWeb is a tool that is *customizable and easy-to-use*, in the sense that it allows users to alter the graphic interface, create news articles, upload documents, and maintain user groups and access rights in a self-explanatory manner and without having to learn html code.

The developers at NNIT tended to compare ProjectWeb to other project web sites on the company Intranet, to other publishing tools, document databases in use, and new strategies for knowledge management. Also, they explained its features as evolving through experiences from use in the pharmaceutical development projects. ProjectWeb was first introduced in 1998 and has since been redesigned in four versions. The slides above are from version 3, which was in use during my study. With each version, new functionalities as well as new features have been added to increase the possibilities for customization of menus and graphics. These suggestions for new features have in part derived from experiences in the pharmaceutical development projects and especially from a group of project assistants in the Project Portfolio Department (assistants to project managers). As such, ProjectWeb has evolved as an integrated part of work practices. Lastly, ProjectWeb was often described as a non-critical and peripheral system in comparison to, for example, accounting systems and databases for documentation of clinical trials for regulatory purposes.

project home page with news articles



ProjectWeb used in the Web Solutions department of Novo Nordisk IT

The standard features of ProjectWeb:

- Communicating news and events
 - Article generation system for creating and displaying news articles
 - Events calendar
- Discussion group for facilitating knowledge sharing
- Contacts database

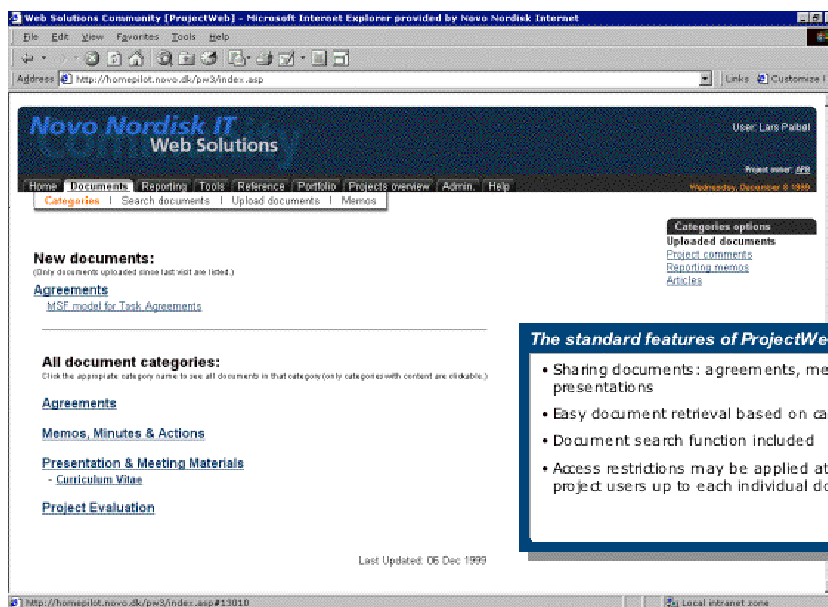
Novo Nordisk IT - Project Web - 56/03 (Ashl)

*ProjectWeb is developed by Novo Nordisk IT

Novo Nordisk



document sharing



The standard features of ProjectWeb:

- Sharing documents: agreements, memos, minutes, presentations
- Easy document retrieval based on categories or keywords
- Document search function included
- Access restrictions may be applied at different levels, from project users up to each individual document

Novo Nordisk IT - Project Web - 56/03 (Ashl)

Novo Nordisk



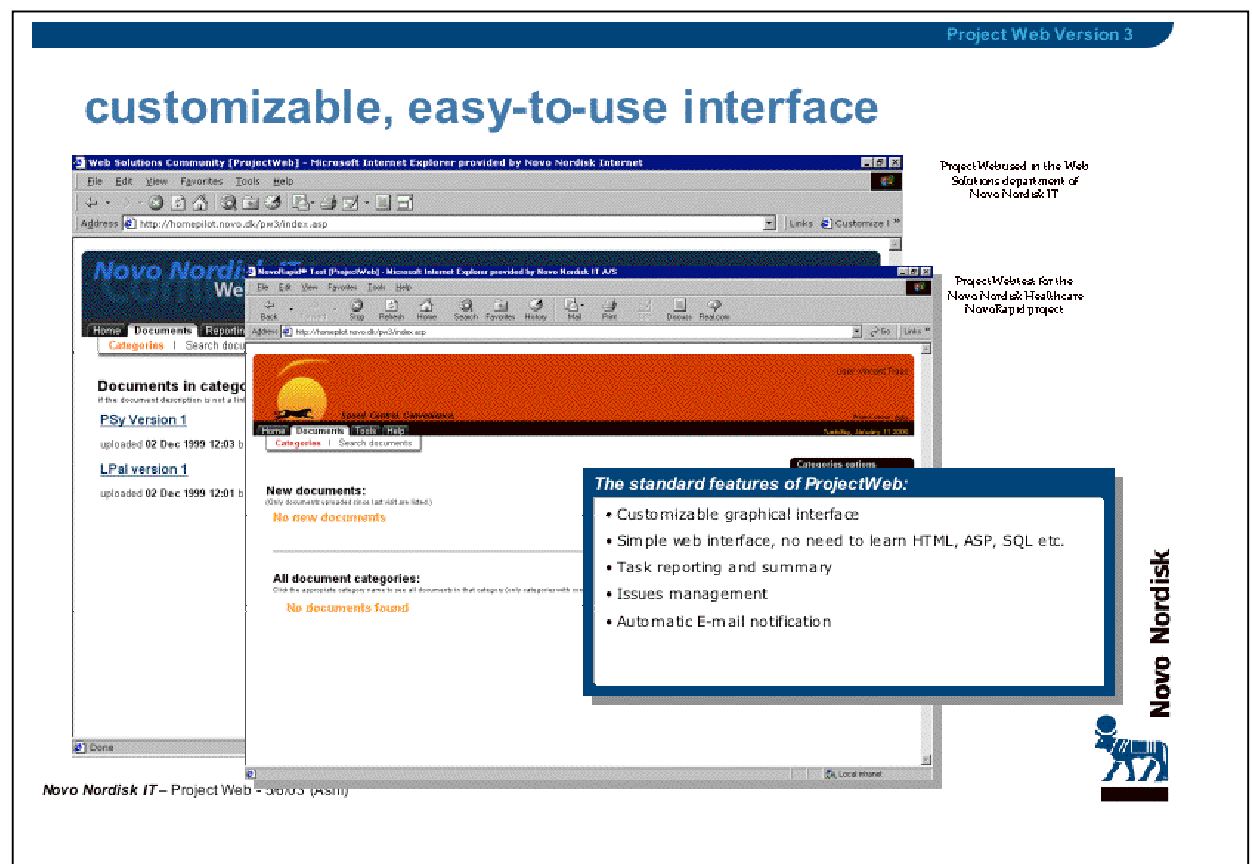


Figure 2: ProjectWeb presentation slides (source NNIT)

When asking project members about ProjectWeb, and about the role it plays in project work, an array of additional metaphors have come into play. Some speak of a shared archive or repository for project relevant information. Others see ProjectWeb as a dynamic workspace or place for collaborating on working documents across geographical distances and obstacles of time zone differences. Also, some mention that because projects are large and dispersed and different members are involved or active at different times, or perhaps working in several projects at once, ProjectWeb provides a way of seeing and following project progress, gaining an overview of current status, and identifying active project members. And one project assistant was also particularly thrilled about being able to publish a digital picture from an operating theatre in Singapore, where the hormone under development was successfully tested on a patient for the first time. By publishing this picture immediately, she said, all project members could see and share what was going on.

Besides use in research and development projects, ProjectWeb has more recently been used as a home page portal for various Novo departments and has also been sold and implemented in other companies such as a large cleaning services firm and a public transport corporation. The two latest versions, version 3 and the subsequent version 4, shift ProjectWeb towards an increasingly generic application. Generic in the sense that parts may be sold, combined, and customized according to the needs of diverse user settings.⁸ This move towards the generic reflects the particular situation of NNIT, which in 2000 became an independent firm competing for contracts with Novo alongside other development companies. Novo was in 2000 split into the three separate companies, Novo A/S, NovoZymes A/S, and Novo Nordisk Information Technology, loosely affiliated as the Novo Group. For NNIT this organizational restructuring has implied new goals of developing products and services for a wider market. NNIT presently has about 600 employees of which approximately nine people have been involved in the development of ProjectWeb. These are developers, programmers, graphic designers, usability consultants, and support staff.

A collaborative context of research

A collaborative research program entitled *Design and Use of Interactive Web Applications* forms the immediate context for the study (see www.diwa.dk). The program is interdisciplinary and comprises 17 researchers from four Danish Universities: the Technical University of Denmark, the University of Copenhagen, Roskilde University, and the IT-University of Copenhagen. The project encompasses information systems researchers, computer scientists, media researchers, sociologists, and ethnographers who have contributed with different perspectives on how an interactive web application (IWA) should be defined and studied. The research program thus bridges a range of theoretical frameworks and approaches to the study of IWAs that have been carried out in a number of Danish private and public organizations. A uniting theme of the research program has been to investigate how the design, management, and use of IWAs in different work settings may change the practice of information systems development.

ProjectWeb has thus been approached and examined as a case of an IWA. IWAs are defined technically as a basic platform based on Internet protocols and standards (such

⁸ For a discussion on in-house development and development of generic information systems as different kinds of development contexts see Grudin (1991) and Bansler and Havn (1994).

as http, html, cgi) that in new ways may tie together and integrate different systems and thereby support diverse aspects of communication, coordination, cooperative work, and distributed knowledge sharing, inside an organization as well as between organizations (Bøving et al. 2000). IWAs have also been referred to as web-based information systems, intranets, extranets, and they have also sometimes been referred to as middleware that tie other systems together across operating systems, in a common portal or user interface.⁹ These are seen as being relatively simple and inexpensive to design and redesign (compared to conventional computational technologies), and studies inspiring DIWA work have suggested that this type of technology tends to evolve through use and as the result of unplanned and uncoordinated activities (CACM 1998, Lamb and Davidson 2000). The term interactive is used to stress that the technology mediates interactions between human actors rather than in the sense of interaction between individual users and computer systems (Braa, Sørensen, and Dahlbom 2000). Through reciprocal interaction, users modify the application, for example by contributing documents and document structures and thus altering the state and structure of the technology over time (Schmidt 2002). As such, IWAs come into being across multiple sites and challenge conventional ways of thinking about development as located within the professional realm and within the spatial and temporal boundaries of a development project. Thus, IWAs render a straightforward distinction between design and use conceptually problematic. The focus of my study and the approach illustrated in this thesis, radical localism, targets these issues in particular.

The DIWA research program has addressed a variety of questions, all related to the new and different character of web technologies and their potentials and consequences: In what ways are web technologies really a new and different type of IT? How are web technologies shaped in new ways in use, for example through the distributed work in networked organizations? How are web technologies developed, and what particular skills are involved? Which theoretical frameworks and methodologies are appropriate for understanding and informing the design, use, and management of web technologies?

⁹ The work of Lyytinen, Rose, and Welke (1998) and a special issue of CACM (1998) on web-based information systems provides an introduction to this type of technology and the challenges it poses to the field of information systems development. This work has inspired the initial research proposals of the DIWA program (www.diwa.dk).

My work refrains from answering the question of whether or not web-technologies are new or not.¹⁰ Instead I have reframed these issues to query in a more open-ended manner how an IWA, ProjectWeb, comes into being in situations of design and use, as well as in research.

The thesis thus pertains to discussions concerning the nature of contemporary information systems development in organizations and in ISD research that seek to rework the relationship between design and use and to question the location of development. This research is further reviewed in the next chapter. In contributing to these academic debates, I have throughout the study, as previously mentioned, also drawn upon literature from the field of Science and Technology Studies as well as from the Sociology of IT, Organizations Theory, and work in the field of Computer Supported Cooperative Work (CSCW). The empirical and analytical contributions of the study are also thought of as relevant and of benefit to these fields

Thesis outline

The thesis consists of eight chapters. Together these chapters argue for the relevance of radical localism for information systems development research. In this introductory chapter I have outlined my research project as one of exploring an alternative path for studying and improving ISD. The foundations for this path are inspired by discussions web-technologies and the nature of systems development and by empirical approaches from the field of Science and Technology Studies. The following chapters illustrate what radical localism entails and how the field of ISD can benefit from my contribution.

Chapter two presents a critical view of some of the established ways of understanding information systems development in organizations. I present three understandings of ISD that are common to the field of ISD research, some critiques that resonate with my own dissatisfaction with the focus on methodology and universalizing models, and some recent works that provide new openings for how we might go about understanding and improving ISD without claiming to order the process in any universalizing manner.

Chapter three introduces the empirical basis of the thesis: the field study of ProjectWeb

¹⁰ Indications of the new or different proved difficult to trace empirically in the case studied. Partly because it relies on the notion of how things were previously (which I did not study) and because this line of questioning albeit dubiously implies that traditional systems development followed a certain pattern and model before.

in Novo and NNIT. Here I present a general discussion of qualitative studies of contemporary design and use practices and outline the open-ended and multi-sited research design of my own field study. This chapter furthermore serves as an introduction to the research setting and ProjectWeb, and thereby also sets the scene for the analysis chapters.

Chapter four depicts an analytical strategy for focusing on local practice and for countering the tendency to view IT artifacts (the objects of ISD) as single, stable, and constant at all times and in all places once constructed. This strategy is based on the assumption that both my study (and new modes of ISD research) will benefit from a more local engagement with the technological artifacts and their specificity and consists of analyzing technology as always part of particular practices. I have placed this theoretical discussion after the presentation of the field study to underline that these theoretical considerations have been developed in parallel to empirical research.

The analysis chapters, five, six, and seven each present an empirical proposition and illustrate an analytical concept. In the analyses I seek to bring out the local and open-ended character of ProjectWeb's development that a methods focus in ISD research tends to overlook and to illustrate the analytical concepts *framing*, *assembly*, and *interference* as useful for viewing systems development from a local practice perspective.

Chapter five presents an analysis of a workshop event held in June 2001, organized by NNIT, preceding the development of a new version (version 4) of ProjectWeb. Based on an analysis of this event, the chapter proposes that the development of ProjectWeb is a messy practice concerned with handling complex interdependencies in local here and now situations. The concept of framing is borrowed from the STS researcher Callon (1998, 1999), who uses the concept to discuss the way in which relations between different actors and entities are cut in order to avoid certain constraints and responsibilities. I suggest that the concept of framing is useful for studying and understanding how the disorder and mess of development is handled in local practice and how the same information system, ProjectWeb, may be framed in more than one way.

Chapter six presents an analysis of use situations in the offices of the Project Portfolio Management department in Novo. In this chapter I propose that use practices are part of the process through which ProjectWeb comes into being. I illustrate the concept of assembly as an analytical tool that enables us to see information technologies as an

outcome of use, rather than pre-existing it. The concept of assembly is inspired by the work of Büscher et al. (2001) and Aanestad (2003), researchers that similarly to my self draw upon STS (in particular the actor-network tradition) as a resource for rethinking about how information systems are made to work in local practice and through relations to other heterogeneous elements.

Chapter seven reflects upon my own research practices. Through the analysis of selected interviews and research situations, I propose that it is impossible for researchers to entirely avoid intervention and that one cannot always determine how one interferes or what will ensue from this interference. This chapter provides an opening for thinking about research that can incorporate the open-ended outcomes of our own research practices. Intervention, a familiar concept in ISD, is rethought in this chapter by drawing on Markussen (1994) and Zuiderent (2002), two researchers that have addressed the question of located politics and interventions in ISD processes by drawing on an STS perspective.

In drawing the case stories together, the closing chapter looks back to the point of departure of my research and assesses the thesis contributions. The chapter pins out the propositions and analytical constructs the analyses bring forth and discusses what viewing ISD process from within local situations and practices involves. The discussion moves beyond the present study and touches upon the way in which ISD research is obliged toward 'improvement'. In conclusion, I call for further work that obsesses for some time with the local as an antidote to the longstanding preoccupations with methodology and generalized models.

2. Surveying the field and related research

Research on information systems makes up a fragmented field that is difficult to structure and of which it is difficult to provide an overview. As a field ISD spans a wide array of research agendas related to the development and use of information technology. In doing so, ISD draws upon and combines insights from a range of other disciplines such as computer science, organization and management studies, sociology, and anthropology, all providing a conglomerate of inspiration as to how one can and should conceptualize, theorize, and go about making better technology, organizations, and worlds. To describe the complexity and ambiguities of IS research, Checkland and Holwell depict the field as a “confused tangle of intertwined strands which characterize a briar patch: both boundary and content are unclear” (1998, p. 61). This chapter provides an introduction to this briar patch and untangles some specific strands that the thesis seeks to extend. To do so I will present and discuss selected texts: one providing a map and classification of established ISD research repertoires, two texts that analyze and critique some of the fundamental assumptions and patterns of these research repertoires, and three texts that theorize and approach ISD in alternative ways. This overview, the critique, and the alternative suggestions lay out the grounds for the argument of the thesis.

Established ways of doing and informing ISD

In a paper published in 1989, Hirschheim and Klein provide an introduction to established ways of doing ISD and ISD research (1989, later expanded in Hirschheim, Klein, and Lyytinen 1995). Hirschheim and Klein delineate and map out four different stories about Information Systems Development: revolving around functionalism, social relativism, radical structuralism, and neohumanism (1989). Of these I will only review the first three, since the latter is less developed in the ISD field and beyond the scope of this thesis.¹¹ Hirschheim and Klein present these as archetypical stories of systems

¹¹ The fourth story that Hirschheim and Klein describe, named neohumanism, the analyst is an emancipator or social therapist (1989). Systems development in this version revolves around social criticism and the ideal of freeing humanity from dominating ideologies. This approach is inspired by Habermas’ theory of communicative action (1984). Less research draws on this

development and seek to call attention to the differences that exist in various approaches to and conceptions of systems development. The stories convey different versions of who the key actors of the story are, what the key features and activities comprise, why the action takes place as it does, and the fundamental assumptions and beliefs involved (ibid., p. 1201f). These stories thus provide different narratives for thinking about how things transpire in ISD as well as how such processes might be informed by ISD research.¹² In order to compliment Hirschheim and Klein's map I will outline some additional examples of research (some of which has been written after their paper appeared).

Functionalism: ISD as a technical process

In the first story presented by Hirschheim and Klein, functionalism, systems development is a technical process of production (ibid.). It is about modeling work practices and a social reality in an objective manner in order to build useful tools that may assist management in achieving goals of efficiency, productivity, and, ideally, profit gain. Managers are the actors who order a new system, and they are responsible for clearly defining the objectives of a system. And the systems analyst is the expert on technology, tools, and methods of systems design that can realize these aims. Fixing requirement specifications – a detailed list of functional demands that the system must meet – is the central device that enables managers to clearly specify what they want the system to do and subsequently allows the technical experts to develop a technical solution that fulfills these requirements in a neutral and objective manner. This story rests upon a positivistic notion of an organizational reality made up of objects,

neohumanist story, and it is less developed or common as a theoretical and political foundation for ISD (see e.g. Klein and Hirschheim 1993, Button and Sharrock 1997).

¹² Hirschheim and Klein speak of stories and paradigms intermittently (1989). They define a paradigm as a set of assumptions about knowledge and how to acquire it (epistemology) and about the social and technical world in which developers, systems analysts, and researchers intervene in the world (ontology). They build on Burrell and Morgan's work on paradigms in organization studies (1979). In my review I have downplayed the term paradigm and use the term stories. Hirschheim and Klein (as well as Burrell and Morgan) tend to write about the paradigms as being there to be discovered and represented, rather than emphasizing how these are created and continuously re-created through practice. By foregrounding the term story, I want to stress that these ways of thinking and doing ISD research always are acted out and embodied in material practices (in circulating books and articles, educational practices, research projects, conference discussions etcetera) and as such they continue to serve as resources for our present work as ISD researchers. Stories are thus very real material practices with very real material effects (Law 1994, p. 19).

properties, and orderly goal-oriented patterns that are directly observable and predictable. The world can (and should) be engineered and mathematically modeled in a rational and scientific manner.

This story is foundational for the ISD discipline and embedded in many software engineering approaches and research projects, for example Structured Analysis (e.g. DeMarco 1978). Structured analysis provides a set of standardized procedures for reducing and modeling an organization as a set of rules and data flows. In this way, a set of detailed and functional descriptions of the essential work processes can be mapped as objects and structures that, once well-defined and made explicit, can be rationalized and rendered efficient by way of new technology.¹³ Research in this functionalistic vein is guided by hypotheses and by testing and advancing formal models, methods, and techniques. Research thus seeks to capture the natural laws and patterns of reality and subsequently to mechanize these to ensure predictable results and to resolve issues of quality, efficiency, safety, and delays of ISD projects.

A long line of critiques has been targeted at this positivistic and technology-centered tradition and the lack of reference to the specific situations and people involved (e.g. Winograd and Flores 1986, Suchman 1987, Floyd 1987). These critiques, together with insights drawn from sociology, anthropology, and organizational studies, have formed a very different story about ISD as a social sense-making process with focus on human actors and the social side of development.

Social relativism: ISD as a social process

In this second story, social relativism, systems development is conceived as a process of sense making (Hirschheim and Klein 1989). Management and work practice cannot be mapped as objective and rational processes, but are complex, confusing, and constantly evolving realities upon which we impose different perspectives and therefore only know as parts. According to this approach, systems development is a process of imputing order and making sense out of this reality. The developer interacts with management and users to create new meaning and to help them understand a new system and how it can introduce beneficial changes in organizational practice. The process is evolutionary, since

¹³ See Bansler and Bødker for a further analysis of the assumptions embedded in structured analysis approaches and an empirical study of the actual use of structured analysis in development practice (1993).

system objectives and requirements may change as managers and users learn, reflect, and gain new experiences. Experiments and prototyping provide mechanisms for trying out ideas and partial implementation, which in turn may lead to new problems and solutions. This story is anti-positivist in the sense that it does not treat reality as pre-existing and abandons a search for general causal explanations. Reality is always viewed as socially constructed through knowledgeable human interaction and creative sense-making processes. Ideally, the systems developer engages in and facilitates sense-making processes to produce system objectives and organizational changes that are desirable and feasible for both management and users.

A growing body of research initiatives plays out this story. Among these are ethnographically based systems development (e.g. Hughes et al. 1994, Beyer and Holzblatt 1997, Bødker, Kensing, and Simonsen 2002), work practice approaches (e.g. Mathiassen 1981), and soft systems methodology (Checkland and Holwell 1998). These approaches are, in part, reactions to the functionalist story above and an acknowledgement that describing and defining objects, properties, and patterns of organizations and work practices is a problematic process of negotiation. Research drawing on this story often applies change oriented experiments (or action-research) to set up a situation of collaborative learning through which lessons learned and guidelines for 'good practices' may accumulate (see e.g. Baskerville and Wood-Harper 1996).

Radical structuralism: ISD as a political process

A third story, radical structuralism, views systems development as a conflict of interests between classes: those who own the sources of production (company shareholders) and workers (Hirschheim and Klein 1989). The systems analyst and researcher must choose sides and either strengthen the economic interests of management (who are agents of shareholders) and thus risk causing workers to loose their jobs, intensifying their work burdens, or deskilling the nature of their tasks (Braverman 1974). Alternately, the systems analyst may side with workers and help to design systems that may enhance workers' skills, their quality of life, and improve their working conditions. This class conflict is endemic to society, and system objectives will always reflect and strengthen the interests of either shareholders or workers. The systems analyst has the possibility for actively intervening in the world for the better by involving and siding with workers.

This story has been prominent in ISD research projects in Scandinavia since the 70's. A number of projects were initiated in close collaboration with trade unions in order to

establish knowledge and resources through which workers could strengthen and develop their position and interests.¹⁴ The development that came out of these initial projects has since been reworked in a worker- and user-oriented niche of ISD research and education often referred to as the Scandinavian Approach, Cooperative Design, or Participatory Design (see e.g. Bjerknes, Ehn, and Kyng 1987, Greenbaum and Kyng 1991, Kensing and Blomberg 1998). Participatory design conferences are held yearly where researchers share experiences with practical methods and tools and techniques for involving workers and users, discuss how to organize and manage participatory projects, and debate the political implications and consequences of IT development (e.g. Cherkasky 2000).¹⁵

Working in and out of different stories

In a discussion of the differences and similarities between these stories, Hirschheim and Klein note that research on information systems development often may be influenced by assumptions from more than one of these stories (1989). Traditions, concerns, and problems overlap and do not tend to separate out quite as neatly as they map out in their paper. Hirschheim and Klein suggest that the discipline of information systems development might be advanced through more explicitly pointing out and documenting the hidden assumptions that different approaches rely upon, their strengths and weaknesses. For the systems developer practitioner, a “better understanding of the conceptual foundations of their [systems developers’] beliefs including the recognition of other belief alternatives can lead developers to seek creative solutions using the strengths of each paradigm” (ibid., p. 1214). And for the researcher, they state that these paradigms might be refined and developed further by, for example, incorporating social theory and insights from other disciplines to explore the nature, purpose, and problems related to information systems development (ibid., p. 1214).¹⁶

¹⁴ Examples of such trade union projects are the DEMOS project, an acronym for democratic control and planning in working life, initiated in 1975 (Carlson et al. 1978), the Utopia project (Bødker et al. 1987, Ehn 1988), and the Florence project (Bjerknes and Bratteteig 1987).

¹⁵ For a recent discussion of Participatory Design and contemporary circumstances for political activism, see Beck (2002).

¹⁶ As an example of such work, Hirschheim and Klein reference Winograd and Flores’ book *Understanding Computers and Cognition* that brings hermeneutics and phenomenology to bear on systems development issues (1986). Another important contribution in reworking the assumptions of the ISD field is Suchman’s book *Plans and Situated Actions* that argues for the relevance of anthropological and sociological understandings of situated action (1987).

In extending their analysis, I suggest that this kind of depiction is useful not only in uncovering assumptions and refining our ways of doing research, but can also assist in reflecting upon the conceptions of ISD that we draw upon in research and empirical engagements. I can, for example, recall that these stories all came up in discussions in the DIWA research program and were drawn upon as resources in different discussions and empirical initiatives. My co-researchers and I acted intermittently as systems experts, facilitators, and labor (or user) partisans. And we shifted between these different stories with surprising ease considering how inconsistent they are when scrutinizing their underlying assumptions, as Hirschheim and Klein do. These stories can thus be thought of as different ways of bringing order to the process of ISD and laying out possible paths an ISD researcher can take up and combine to discuss, inform, and improve ISD.

I will turn to another text that, similarly to Hirschheim and Klein, reflects upon the foundational discourses that shape research within the field. Whereas Hirschheim and Klein distinguish different stories, Truex, Baskerville, and Travis (2000) apply another strategy, that of zooming in on a single concept that runs through and joins together all of the stories described above – the concept of methodology. Their article, written ten years after that of Hirschheim and Klein, provides another picture of how systems development progresses and what currently shapes and limits our investigations of such processes.

Methods and methodology as *the way*

“The method is not only our way of thinking about systems development, it is our way of thinking about ‘thinking about systems development’.” (Truex, Baskerville, and Travis 2000, p. 74)

In their article, Truex, Baskerville, and Travis analyze the method and notion of methodology as constitutive for the systems development discipline. Whereas Hirschheim and Klein apply a discursive analysis of paradigms, Truex et al. draw upon postmodern theory and Derrida’s concept of ‘différance’ (1982) to explore underlying assumptions of the field. Their analysis is based upon the notion that texts (and thus fields of research and practice based on texts) comprise a privileged or dominant narrative. Such a dominant narrative always refers – and defers – another hidden subtext and set of marginalized concepts. This deferred text recursively (and through endless cycles of reference) provides the privileged text with meaning. A technique of textual deconstruction consists of opening up and scrutinizing the hidden and underlying

concepts. Truex et al. deconstruct methodology as *the* meta-narrative of the information systems discipline, exploring the ways in which a methodological view has been privileged historically, in research and in practice. And how, simultaneously, this privileged status of methods involves the deferral of other aspects of - or alternative narratives about - systems development. (Truex et al. 2000)

Methods provide a concept and picture of the systems development process as an orderly, predictable set of sequential steps. Hundreds of systems development methods offer different prescriptive advice as to how practitioners can go about organizing and carrying out ISD, how to analyze, design a new system's purpose, function, structure, appearance, cost, and efficiency. Different methods, of course, rely on very different techniques and sequences, different steps and procedures, as well as different recommendations as to how closely these should be followed or adapted to particular situations and problems.

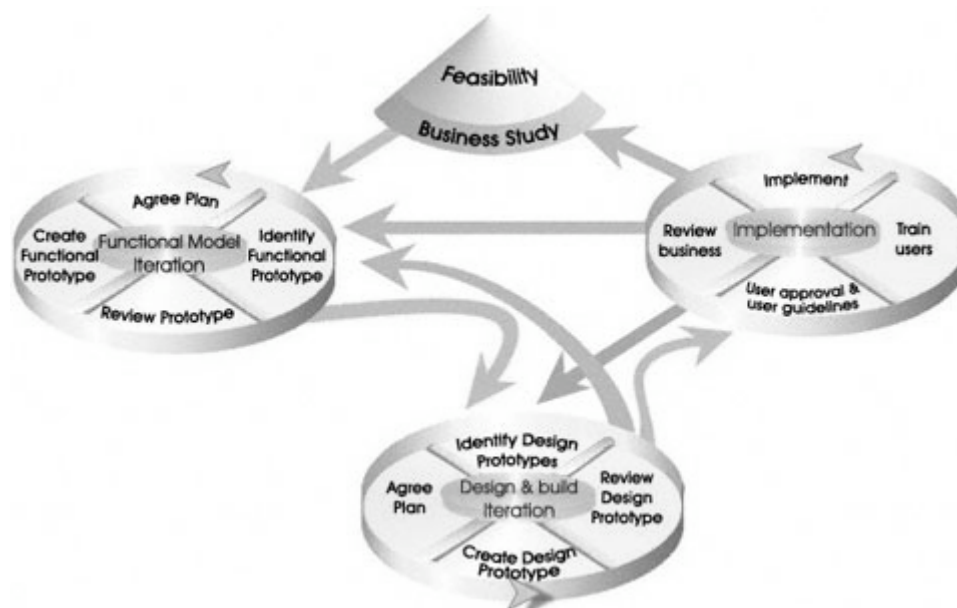


Figure 3: The DSDM life cycle (source www.dsdm.org)

Methods are usually thoroughly documented in manuals and embodied in software tools or application development environments. Examples of methods are Structured Systems Analysis and Design Method (SSADM), a variant of structured analysis mentioned above under Hirschheim and Klein's rational story on systems development, Soft Systems Methodology (SSM), mentioned under the sense-making section, or Dynamic Systems Development Method (DSDM). Methods are often depicted in models of phases and

prescription steps forming a *system life cycle*. DSDM is, for example, a method consisting of five phases: ‘feasibility study’, ‘business study’, ‘functional model iteration’, ‘design and build iteration’ and ‘implementation’. These phases follow an iterative or spiral life cycle as illustrated on the previous page.¹⁷

Despite the many different methods and research on methodology, empirical studies have again and again illustrated that, paradoxically, these prescriptions are often not followed by developers, and if so, very inconsistently. An early example of this is the Danish MARS research project that explored the everyday work of professional developers and their use of methods (Kensing, Mathiassen, and Munk-Madsen 1984, Andersen et al. 1990).¹⁸ Other studies include Bansler and Bødker on the non-use of structured analysis methods: developers claimed to use structured analysis methods but did not follow the procedures at all when studied (1993). Or, Parnas and Clements on the ‘faked’ use of methods: that methods do other things (such as provide later documentation) rather than organize and rationalize the process while it goes on (1986). More recently, the textbook *Methods in Action* (quoted in the introduction) summarizes a line of studies on developers’ use of methods (Fitzgerald et al. 2002). Fitzgerald et al. distinguish between formalized methods and methods-in-action (ibid., p. 14). Their work likewise illustrates that methods may play diverse roles in development, such as reducing complex process into coherent steps, facilitating managements and control, and allowing for the separation and delegation of tasks. Also, methods-related documentation can assist in storing up experiences for future development or ensure that ‘proper practices’ are followed, for example for a development company to achieve ISO-certification of the products sold. Investigations within the DIWA program similarly have studied how methods were applied in the development of web technologies in particular (e.g. Carstensen and Vogelsang 2001). These studies all bring out mismatches between the sequential, controlled, and orderly rationality of textbook methods and the highly unplanned, ad hoc, and creative ways in which developers work: there is a glaring gap between theory and practice.

¹⁷ See Fitzgerald et al. for a historical introduction to different development methods and for a further description of structured analysis, soft systems methodologies and DSDM (2002, p. 19-80).

¹⁸ MARS is a Danish acronym for methodological working practices in systems development.

Truex et al. look at how the field of ISD – despite these insights – continues to be characterized in terms of methods and how this quest for better methods continues to guide research (2000). They suggest that the method frames most of the ways in which we think about systems development. And not only is it a problem that there is a gap between theory about ISD and actual practice, but they argue that ‘methods thinking’ systematically *hides* the messy and inconsistent aspects of ISD practice and marginalizes certain kind of ISD research. This focus on methods thus casts shadows upon the ‘amethodological’ aspects of systems development:

“When the idea of method frames all of our perceptions about systems development, then it becomes very difficult to grasp its non-methodical aspects. It limits not only our understanding, but also our empirical observations of how the development of information systems will unfold in a human organization. In other words, our obsession with method can cause us to ignore activities that do not fit within a methodical frame” (ibid., p. 74).

Aspects of practice that do not fit into the methodological narrative get pushed to the margins of our thinking and theorizing. And entirely excluded is, for example, an alternative notion of development without any methods at all (ibid., p. 58). Thinking with Derrida, they suggest that it is precisely this deferral that sustains the dominant narrative.

The deferral of amethodological ISD

So what precisely is ignored? Truex et al. outline four assumptions that characterize the way we conceptualize ISD in order to unfold a deferred story about ISD as amethodological and to locate gaps in our thinking about ways of doing and informing ISD.

ISD as random and out of control: The first assumption concerns ISD as a process effectively controlled and managed by professional developers. A method here is a mechanism for achieving and ensuring this control. Methods make use of decompositional techniques by which complex problems can be reduced into smaller sets of problems that can be overviewed, tackled one at a time, and thus controlled. This first assumption, according to Truex et al., marginalizes a story about systems development as the outcome of a “complex, multivariate setting affected by many uncontrolled events” (ibid., p. 61). They introduce the idea that that systems development might *actually* happen in the ‘extra-method’ stages and activities – in the improvisations that occur between the sequences of actions prescribed and documented by a method. Any random, opportunistic, and

accidental aspects of development are systematically pushed aside by our focus on methods.

ISD as parallel and fragmented activities: The second assumption in methods thinking is that of linear sequence. Methods depict and model ISD as a set of ordered phases and grouped activities bounded by predefined events and intermediary products. The picture is one of order and regularity. This linearity is perhaps disturbed by iterations and feedback loops (as in the DSDM model above). Yet Truex et al. note that such correctives to the linearity of methods only relax a picture of a causal chain of sequential processes (ibid., p. 62). The deferred picture is, in contrast, one of a myriad of fragmented and partly disconnected activities that unfold in many places and in parallel. Excluded from the picture are also personal preferences and preliminary experience of developers, availability of development tools and platforms, and access to and availability of users, as well as other contingencies that might lead developers to skip around in phases and improvise over the linearity of a method. Referencing Coad and Yourdon's study of developers, they provide an example:

“Many co-dependent activities continue simultaneously with varying degrees of communication. Stages get skipped when project schedules slip and hard deadlines approach. Some events are felt to be very critical and will be performed as soon as the opportunity arises rather than in the idealized sequence. A particular information systems development project, or some of its activities, may stop altogether for possibly lengthy periods. Interruptions and changing developer expertise lead to unexpected revisions and features. It is possible that the systems development process will produce an entirely different system with totally different purposes than those originally intended. The systems development process may also fade away without anyone taking particular notice that it failed to achieve any closure. Not only must the rationality of the development process be faked, but the original intentions must also be revised to conform to whatever the outcomes must be. In retrospect, the work progressed in a manner that was partial, incomplete and indeed filled with missteps, dead-ends and backtracking.” (Coad and Yourdon 1990, in Truex et al. 2000, p. 63)

ISD as particular and situated: The third ideal of the methods view is that of universality. Many methods, texts, and discussions recognize that methods must be adapted and configured to particular situations. However, if the basic framework is robust, it should in similar ways lead to dependable predictable solutions across different organizational settings. The adapted method-in-practice is thus always a recognizable descendent of the original. This notion of replicability marginalizes what Truex et al. call *local logics*, the

singularity, and situated nature of any development process. This view excludes the notion that every system might emerge in its own specific and unpredictable way. They note the lack of research and understanding of such particularity (ibid., p. 67).

ISD as shifting goals pasted together on the fly: The last assumption taken up by Truex et al. is that of ISD as a rational and goal-driven process. The starting point of any development process here is defining objectives and establishing a plan for realizing these objectives. This assumes that one can and should determine clear goals, that motives and goals drive any activity, and that developers will adhere to the plan. This narrative obscures the way in which goals are often unclear, contested, and changing throughout the development process, that people's own experiences and personal goals might be involved, and that the process of ISD might be 'pasted together on-the-fly' in a negotiated and moment-by-moment way. This narrative also obscures organizational actors and environments involved in development that lie 'outside' the boundaries of the ISD process (ibid., p. 69f).

Shrinking down methods to one 'coping mechanism' out of many

Truex et al. conclude their deconstruction of methodology by suggesting a view of methods as a coping mechanism, one way (among many) of dealing with the fluidity of social organization and the contingencies involved in any development initiative. Methods are thus only one part of development, one aspect of a complex practice, one resource establishing an initial conceptual boundary of the work in which developers engage. This view reduces methods from being *the* story and framework for thinking about systems development to being just one element in the process. Truex et al. advocate that loosening our grip on methods might open for other ways of thinking and theorizing systems development as mundane practice, compromises, and tinkering (2000).

To link back to the three established ways presented in the previous section, traces of this methodological thinking runs through all three stories. What happens if we abandon thinking about ISD in terms of one orderly prescription or model? To explore answers to this question I will turn to Ciborra's article *Crisis and foundations: an inquiry into the nature and limits of models and methods in the information systems discipline* (1998). Ciborra presents a similar critique of ISD research and has some suggestions for what an alternative path of

inquiry might look like.¹⁹ He advocates (slightly provocatively) that we start by bracketing everything we know.

Bracketing everything we know?

Ciborra discusses the limits of methods and models as posing a serious crisis for the discipline. He proposes that what we tend to think of as successful technological innovations have mainly grown out of organizational practice, Internet use, and experimentation that he suggests lie outside the very focus of academic teaching and research (which has been on methods and methodology for systems analysis, design, and development). Ciborra suggests we bracket what we know and “go back to the world of practice” to find new foundations and develop a new style of ISD teaching and research (*ibid.*, p. 5). I will sketch out his critique and proposals advocating a focus on practice.

Similar to Truex et al. (2000), Ciborra notes how systems analysis and design methodologies have dominated teaching and research: “The core, if not the identity of our discipline, has been revolving around such methodologies, or... around the very idea of ‘method’” (Ciborra 1998, p. 6). Yet, despite the proliferation of methodologies systems, projects and plans more than often diverge from or fail to live up to their promises. Ciborra looks to organizational experimentation, tinkering activities, and the fine-tuning of IT that takes place in organizational settings of use. He explains how most strategic applications of IT in organizations largely came *before* any article or textbook wrote about it. Or, how the Internet and its success grew out of horizontal networking practices, incrementally and without any master plan (*ibid.*, p. 6f).

Ciborra draws on phenomenology, in particular Husserl (1970), to find a possible path out of this crisis by returning to forgotten dilemmas that have been obscured and marginalized by our preoccupation with method and models. This forgetting of the very problem is for Ciborra precisely what keeps the wheels turning: He notes that by systematically ‘forgetting’ the crisis, ISD can “live with success in a sort of business-as-usual fashion” (Ciborra 1998, p 7). The notion of the hidden and forgotten is parallel to

¹⁹ Some researchers distinguish between IS research and ISD research, where IS research is about the implementation and management side of IT in organizations and ISD is about design and development. Ciborra (1989) is writing mainly to the IS management-oriented niche of Information Systems Research. I suggest that concerns overlap and build on the same foundations, rendering this critique equally relevant for my discussion.

Truex et al.'s way of writing about the amethodological as deferred and marginalized; the fact that something is deferred, hidden, and forgotten is precisely what sustains the dominant narrative (2000).

For Ciborra (and previously for Husserl) the core of the crisis comes out of a separation of *practice* from the domain of science – the thorough and systematic forgetting of the role of mundane everyday life activities that make and maintain any methodology, information system, or organization: We have adopted a scientific way of doing research that privileges methods and models (the universal) over practice (the particular) and thereby obscures the messy hybrid nature of our very subject matter. Ciborra characterizes the problem as follows:

“Our discipline, being hybrid and dealing with socio-technical hybrids, is hard to classify between the natural and human sciences. The very definition of information systems as sets of technical (scientific) and human resources devoted to the management of information in organizations, spells out the composite nature of our field. The same could apply to the well-known definition of data (signs - hence physical or logical, i.e. natural-scientific) endowed with interpretation by a user (i.e. human or social-scientific)... [D]espite the hybrid and, at limit, ambiguous nature of our discipline, a common unified paradigm has been adopted across the board to treat its human and natural dimensions: the paradigm of the natural sciences and relevant methodologies of measurement, formalization and calculation.” (Ciborra 1998, p. 8)

So, a scientific paradigm has largely been adopted as *the* way of understanding and improving upon information systems. With this way follows ideals of providing order, explanation, and predictability, and objectives of uncovering essential laws of causality. Ciborra notes that a widespread critique of this paradigm is at work and a growing body of more qualitative and practice oriented studies exist (e.g. strands of the sense-making story described above). Yet Ciborra finds that this work continues to have a very marginal place in most educational programs and ISD research arenas. And more often than not, these studies tend to adopt and mimic a scientific way of working by relying on and striving for abstract representations, for example the geometrical boxes and causal lines that map and overview practice. Ciborra notes the irony and dead-end here of working with and within the very tools under critique:

“What I am concerned with here is something subtly pervasive: it is for example, that in order to show that structured methodologies are a failure or plainly not used, one has to adopt a structured scientific method to measure empirically the

phenomenon, otherwise one remains neither credible nor legitimate; and even then, given that methodologies are at the core of our discipline, these empirically measured facts still tend to be dismissed... the preoccupation with method is present even when we question the efficacy of methodologies. Hence, *concern with method is probably one of the key features of our discipline, and possibly the true origin of its crisis.*" (ibid., p. 8 original emphasis)

What can we do to circumvent these dead-ends? Firstly, Ciborra works back to the historical origins of methodology to locate historically the notion of methodology and scientific ideals of abstraction and formalization. Secondly, he works towards bringing out a 'slippage' as a main problem.

The slipping and sliding of the ideal and the real

Slippage is the tendency over time to mistake the abstractions and representations for reality and thus forget the everyday practice that forms, uses, and sustains the relevance of these abstractions (ibid., p. 9). Ciborra suggests that ideal representations tend to 'materialize', and we come to see organizations and ISD in terms of boxes and causal arrows. These ideal representations become maps with which developers, managers, and researchers themselves, venture out into the world. And as they are used and refined, these maps slip into a status of being more real and that to which the real world has to conform. We slip into granting ideal entities (models and methods) essence and existence, and "such pure idealities come to be seen as the way nature really is in itself requiring 'discovery'" (ibid., p. 9). He calls this a methodological inversion or distortion. This inversion over time obscures the practice grounds, the messiness, and situated character of any activity. Again this is a series of subtle slips and shifts through which the ideal representations gain their value and a kind of self-reinforcing effect. To refocus on practice, Ciborra suggests looking and listening closely to how people deal with everyday life, the puzzles and riddles it poses. Listening closely entails suspending what we know about strategy, structure, process, data, stages, or system and not attaching any particular relevance when these words come up. Instead, he suggests openly reflecting upon that which we observe. He gives examples from his own studies of implementation and management practices where he found a striking lack of leadership in IS projects and a *drifting* of technology, "as if out of control" (ibid., p. 11, Ciborra 2000). He summarizes the discoveries that have come out of this bracketing approach:

"... plans keep being diverted, surprises arise constantly, and opportunistic adjustments must be carried out on the spur of the moment, so that planning is

espoused while circumstances compel managers to improvise. The implementation of the technology, too, is punctuated by unexpected outcomes and turns that require frequent adaptations if not re-inventions of the initial system.” (Ciborra 1998, p.13)

New openings and a warmer vocabulary

Instead, new phenomena emerge such as caretaking, hospitality, and cultivation. These are ‘warmer’ terms, more intuitive, and about people living with technology. *Caretaking*, for example, helps us to think about how systems become so familiar and taken for granted that they disappear. Ciborra suggests looking closely at the alignment process whereby information systems - or concepts related to information systems - are understood and made a familiar, intimate part of practice. *Hospitality* refers to the extra effort involved in coping, accepting, and embedding new technologies into work practices. This kind of activity cannot be represented geometrically: “...it is made of absorbed coping, care, being there amidst ambiguity, intimacy, sporting hospitality as well as tamed hostility towards what the new and unknown is unveiling” (ibid., p. 14). Lastly, *cultivation*, an agricultural metaphor, brings out how the material under development – the technology – is dynamic and growing through a life of its own (ibid., p. 14, Dalhbo and Janlert 1997). Development becomes helping this growth along and sustaining it. This vocabulary and attentiveness to practice opens for a different line of inquiry: How and when do technologies drown in the flow of every day practice? How are technologies coped with and welcomed? How can they be cultivated over time?

Questions such as these along with Truex et al. and Ciborra’s critical line of thinking have been useful in thinking about my study and experiences working as a qualitative researcher in the ISD field. They encourage turning a critical eye to the taken-for-granted and propose new kinds of questioning and thinking. They suggest that although the messiness of ISD practices might make us uncomfortable and uneasy (what to do with it if not order and control it?), we should address it head on and without panicking.

Being critical along the lines of Truex et al. (2000), Ciborra (1998) can be seen as another way of extending and informing the field and practice, a fourth story or way of doing and informing ISD. There has been quite a bit of discussion in the field as to what extent theorizing and critical perspectives really help developers with the task of making better technology, whether good IS research is and should be applied and provide tangible results – such as building systems that work here and now. So how do critical perspectives help us to move forward with the job? At a first glance they do not. Truex

et al. provide little indication about how we might go about reconstructing a new narrative after deconstructing the dominant one. And Ciborra provides little indication of precisely how to bracket everything we know to finally find this truth of practice (Vann and Bowker 2001). But on the other hand, such critical perspectives open for other ways of thinking about ISD and help us to be more circumspect towards the question of how the technology should be developed and used (Bloomfield et al. 1997, p. 3).

In this thesis I follow Truex et al. (2000) and Ciborra (1998) in this critical and circumspect attitude rather than continuing in a business-as-usual manner. I do this by asking what it means to inform and improve ISD. I have looked through established ways of doing so, some critiques, and as a final section of this chapter I will introduce three alternative paths for understanding and informing systems development and contemporary contexts of development. The works I will present here address the particular critiques lined up above and the very question of how we can inform ISD in other ways than by simplifying and controlling it.

Approaching ISD as local practices

The first article is taken from the journal of CSCW and written by a group of researchers working in Denmark and England: Büscher, Gill, Mogensen, Shapiro (Büscher et al. 2001). Their backgrounds are in ethnographic approaches to ISD and Participatory Design. The second is a conference paper from two Norwegian researchers, Aanestad and Hanseth (2000). This is written for an IS audience and extends Ciborra's work outlined above (1989). And the last work I will refer to is a book chapter by Hales reflecting on relations of design and use (1994). The first article is an applied research initiative, where the researchers themselves have set up and taken part in the ISD process and simultaneously study it as they go along. The second article is, like my study, based on a study of systems development 'in the wild'. The third approach has a more theorizing and critical objective. Thus, these three contributions exemplify different ways of *informing* the field - an interventionist research initiative, a study of naturally occurring ISD practices, and theorizing reflection. They also illustrate alternative ways of thinking ISD in terms of local practice. The thesis arguments and the analysis chapters build on this work and notions of ISD as firstly 'assembling heterogeneous elements', secondly, 'cultivating hybrid collectives', and finally, as comprising 'multiple loci of design'.

Pasting together heterogeneous assemblies

In a paper entitled *Landscapes of Practice: Bricolage as a Method for Situated Design*, Büscher et al. (2001) discuss ISD as a complex, unpredictable, and moment-to-moment activity. These authors suggest thinking about design in terms of bricolage and assembly, as an ongoing pasting and patching together of technologies and work practices. They thus rethink development in continuous terms and move the very locus of design away from a professional design setting and into a use setting. This is done to address and incorporate the unpredictable ways in which technologies are applied, modified, or rejected in work settings and to create affordable make-do solutions under time pressure and shifting demands (in contrast to grand revolutionizing development schemes).

The paper reports from a research project carried out with landscape architects in northwest England. I will focus particularly on their concept of bricolage and assembly (used interchangeably) and their use of actor-network theory and the notion of heterogeneity (Latour 1990, 1999, Law 1999). I will replay one example from the text that illustrates the notion of assembly as an alternative understanding of ISD.

The example concerns a project where a number of branches in the landscape architect firm are working with technical engineers from another firm to re-design a road running through a national park in Wales. The project aims to ‘calm’ the heavy traffic on the road to protect the countryside. One aspect of the project is collaborative work (between the landscape architects and the traffic engineers) around a photomontage of the road plan to work in new traffic signs, experiment with textured road strips, and incorporate different hedge and fence features to slow down the flow of traffic and encourage other routes. In creating this new plan, a large body of materials and concerns need to be drawn together (Büscher et al. 2001, p. 8). The plan and proposals combine traffic engineering plans, accident histories, maps on sensitive landscape areas or historical monuments, areal and ground photographs, hand sketches, and video montages. And subsequently, this work involves debates and negotiations on what is relevant or not relevant to the plan and what the different symbols used by the different professional groups represent. Using actor network theory, the authors discuss the different materials as assemblies (that hold together the heterogeneous networks from which they were composed) and view them as entering into new assemblies as they are inserted into the photomontage (ibid., p. 11). Their design project seeks to facilitate these linkages, find new ways for easily revising sections of the plan without having to redo the entire plan,

and finding ways of communicating successive revisions to the plan across the geographical and professional distance between the landscape architects and traffic engineers.

As part of the design project they introduce PhotoShop and AutoCAD software as a new way of adding and revising features, keeping some layers and elements of the photomontage flexible and others stable as these are sent back and forth between the firms (*ibid.*, p. 14ff). Several problems arise. Firstly, the high resolutions needed for satisfactory picture quality overburdens existing equipment. And a new workstation and better Internet connections become necessary to deal with the storing and transfer of large files. Secondly, as these new technologies are taken up, the way people work starts to shift in subtle ways. The traffic engineers are more familiar with computer programs and the technical drawings supported by the software supports than the architects, who now find it more difficult to convey ideas that they earlier quickly sketched with paper and pen. To deal with this second unexpected problem, they introduce an electronic pen and tablet sketchpad, whereby the landscape architects can communicate work in progress and ideas in their own drawing and sketching terms. With this example – and the problems that arise in connection with hard disk space and the architects' way of working with sketches – are examples of design as a co-evolving assembly of technology and work practices (*ibid.*, p. 14).

Here development is thought of as a long term process going on in the setting of use. This is a modest and incremental way of thinking technology design that does not strive for the grand solution, but works outward by creating new assemblies of software, hardware, and ways of working that continuously can be assessed and fine-tuned. Problems and outcomes are difficult to predict beforehand. The example shows the ongoing problems that arise and the subtle and unexpected ways in which new technologies link up to work practices. In actor-network terms, work practices can be thought of as heterogeneous assemblies of social and material elements: When one element is added or adjusted in such an assembly, the entire assembly and all elements will undergo translations and transformations. Technologies exceed themselves and what they were originally supposed to do. Technology mingles with other technologies, people, skills, and work practices in ways that may alter characteristics of all the elements involved. For the AutoCAD software to work as part of the collaborative practices in the road re-design project, it is necessary for other technologies such as new modems, cables,

and workstations to be added to the assembly. Furthermore, the AutoCAD software shifts the assembly in ways that translate the engineering skills into the preferred or right way of working, causing the architects' sketching skills to become superfluous. To balance things out, the authors added another element (the pen and tablet sketching). In this way of thinking about work and technologies as heterogeneous assemblies, options and benefits can only be compared and judged along the way. It thus makes sense to design immediately and assess what happens.

“Bricolage can be described as ‘designing immediately’ using ready at hand materials, combinations of already existing pieces of technology, hardware, software, and facilities (e.g. Internet providers) – as well as mostly ‘off the shelf’ ones. It therefore involves design as assembly... this is not just an assembly of technical components, but also of appropriate work practices, skills and training, communications, affordability, legal and contractual arrangements etc. In other words, the design is of a totality of technical support in context.” (ibid., p. 23)

Assessing what happens, balancing out the assembly in line with problems that arise, is described by Büscher et al. as an “open-ended journey of innovation and experimentation, a kind of situated trajectory or migration with unknown commercial, professional and even personal consequences” (ibid., p. 17). They cite the sociologist Beck’s notion of risk to emphasize how any technology, adopted to address a particular problem, must be expected to create new problems for the practice in questions, or, for other practices elsewhere (Beck 1992). To think about this situation, the authors propose the metaphor of a life raft - ISD as patching, bailing, and staying afloat with no prospect of return:

“At every point in the journey an assessment must therefore be attempted whether, overall, the gains from the new practical-technical assembly outweigh the losses. Yet after a certain number of steps, land has been left so far behind that there may be little realistic prospect of return. We might therefore... term this the ‘life-raft’ model of systems development – a continuously unfolding bricolage of technologies to hand, requiring much patching and bailing, with an unknown destination.” (Büscher et al., p. 17)

The systems developer (or participating ISD researcher) works to hold the assembly together and to navigate towards an unknown destination. This is quite a modest role compared to the stories presented above by Hirschheim and Klein (1989), where the developer does not strive for control and is not the main expert in the process. The

authors emphasize this role of technical support (as opposed to grand new designs) and recommend ways in which an IT facilitator may continually assist in navigating through available standardized solutions and provide assistance in selecting, combining, and customizing these, and ensure the attunement and adjustment of the working assembly of technology and work.²⁰ This enables the systems developer to stay close to and attentive to unpredictable problems that will inevitably be generated in user settings. They thus also bring what we usually refer to as support and maintenance (something after and outside development) into focus as a vital aspect of design. This work extends a line of discussions on the use of ethnography in systems development (e.g. Anderson 1994, Hughes et al. 1994) and on the renewed roles of Participatory Design (discussed above under the radical structuralist story).

Cultivating a double dance of agency

In their article *Implementing Open Network Technologies in Complex Work Practices: A case from Telemedicine*, Aanestad and Hanseth (2000) follow Ciborra's call for focusing on other aspects of development than strategy, predictability and control (1989). They draw on the concept of cultivation (Ciborra 1989) and the concept of the hybrid collective inspired by actor-network theory (Callon and Law 1995). They apply actor-network theory to conceptualize an implementation process as a 'double dance of agency' through which a new 'hybrid entity' emerges (Aanestad and Hanseth 2000, p. 356, Jones 1998). I will present the ideas advanced in Aanestad and Hanseth's article with examples from their case study and draw parallels to the work of Büscher et al. (2001).

Aanestad and Hanseth's study concerns a multimedia communication technology facilitating work in and between two major Norwegian hospitals. We thus have a very different kind of case than of the landscape architects: a large-scale systems development initiative 'in the wild' in contrast to an interventionist project initiated by researchers. This case also involves a different kind of setting and technology. Here, I will focus on how Aanestad and Hanseth similarly look at the local and contingent aspects of ISD and thus likewise reveal a blurred picture of where development takes place, starts, and ends. In their own words, their study describes a continuous, iterative process where "activities

²⁰ Similar arguments and suggestions are presented by these researchers in a paper by Hartswood et al. that draws on other experiments with the bricolage approach and develops the role of the systems analyst as an IT facilitator in more detail (2002).

of design, implementation, and use are not clearly separable” (ibid., p. 356). Furthermore, they extend our ways of thinking about ‘who acts’ (a central element of the Hirschheim and Klein stories) in the process of development and thus challenge the notion that design solely originates from the professional developer. They introduce both users and technology as *actors* in the process. I will explain this idea through their examples of a double dance of agency.

The case concerns surgical work in a Norwegian hospital and experimentation with new imaging technology to facilitate surgery and live transmissions of the operations for educational and informational purposes. The surgery is ‘minimal invasive’ surgery, operations through small holes using multiple video and x-ray images to mediate the vision of the surgeon. There are strict requirements for the quality of images, colors, and textures since these are vital to the surgeons’ work. This particular type of surgery has proved useful for educational purposes since most of the image materials is already in place and ready for transmittal.

The "double dance of agency" concept provides a good picture for thinking about how work practices and technology enter into relationships with each other and work back and forth to accommodate one another. As this dance evolves, the people and technologies align themselves with one another and grow together to constitute a hybrid entity. As work practices and technology meet (begin to dance) the way things go is not defined by internal properties of people or workplaces or by the technology. Rather properties transform in subtle ways through the dance. Aanestad and Hanseth scrutinize this ongoing dance of alignment, adjustment, and subtle transformations of technology and work practice.

The hospital surgical practices impose specific demands upon technology. As the new imaging technology is taken up and used in surgical situations, it is vital that the equipment does not affect patient outcomes and that the imaging quality is in order. Also, the equipment must be adjusted to accommodate the way people work: cameras and microphones need to be placed in very specific spots to be able to see and hear the surgeon; transmissions must be timed according to the work pattern of the surgeons; and surgeons have, for example, demanded that a red light be added – so they can see when they are ‘on’ – and that a screen be placed inside the operating theatre so they can see who is watching. If the technology does not comply with these criteria, it is not ‘let in’ (ibid., p. 359).

Likewise, technology imposes a set of rules to which the people and practices must comply: surgeons must speak into the microphone and not out into the room; images must follow a particular technical format to be transferred through the available cables and bandwidth; additional technical equipment such as adapter cables must be added by technicians for specific types of transmissions; and technicians and nurses have to turn on and continuously adjust the settings of the cameras and the microphone. During surgery, the doctors rely on as many as 16 different images that they switch back and forth between to see what they are doing. The receivers (those in the lecture hall or meeting room who are watching the transmission) can only view one image at a time, since more bandwidth and additional monitors would be too expensive. So the surgeon has to adjust her/his work and say out loud which image she/he is using, and the technicians involved have developed new skills in detecting which image the surgeon is using and in switching the image transmitted to the viewers.

In this way Aanestad and Hanseth illustrate in detail how the installation and use of the imaging technology introduces a number of demands and disturbing effects on pre-established work practices and how work is modified to balance out such effects. A lot of extra work is involved in making technology and work align. Then there are other disturbances that must be dealt with, such as noise from a suction machine, technicians that suddenly enter the room to fix equipment, or calls from the receiver hall saying, for example, that a camera position needs to be adjusted. Aanestad and Hanseth emphasize that any alignment is fragile and may break down due to all sorts of minor problems that arise: an ill technician, a failing projector or projector remote control, suddenly images come out only in black and white, the patient fails to show up or give consent, or the lecture hall at the other end has been changed. “‘Behind’ the presence of a sufficiently high quality image lays a host of other actants that need to be aligned” (ibid., p. 366). Aanestad and Hanseth unpack the agency imposed by both organization and technology and the local and mundane activities through which both work and are accommodated and adjusted – through a double dance. “There is a concurrent design and redesign of technology, individuals, and work practice – all parts in the network are involved” (ibid., p. 368). These authors thereby take a wider view of IT as a complex and integrated infrastructural phenomenon that forms a pervasive part of everyday life, as something that emerges not from a center of professional design, but through use and through a life of its own. Various people and technologies both impose agencies and mutually accommodate one another. They ‘act together’ to form a new hybrid entity over which

no one has control and which exceeds the entities that make it up. They apply Ciborra's concept of cultivation to shift focus to this distributed and continual development of technologies, showing how such hybrids need to be nurtured to thrive, grow, and succeed (2000). This stands in contrast to the more traditional notions of IS development projects described above, which is based on predefined methods, rational control, and structured goals and plans, and shifts our attention to systems development as something extended across many sites and heterogeneous actors.

This work extends a line of study that emphasizes the importance of implementation, use, and ongoing situated accommodations and alterations, in particular the work of Ciborra (1998), Monteiro (2000), and Orlikowski's work on improvisation (1996). Aanestad and Hanseth underline how experimentation, user training, and ongoing support play an important part for how technologies succeed or fail - that such practices must be better understood and theorized as part of the process through which technologies come into being. This view breaks with assumptions that separate design from use as distinct and bounded phases or processes. This again shakes the notion of development as belonging solely to a professional domain as well as the idea that any one actor or group of actors is in control of the ways in which technologies evolve. All actors involved impose rules and demands, yet they each have only limited influence upon the outcome.

The unpredictability of heterogeneous assemblies (Büscher et al. 2001) and the double dances of agency (Aanestad and Hanseth 2000) are thus some of the phenomena we can 'discover' if we temporarily bracket methods thinking and engage with local ISD in alternative ways. The authors extend the concept of 'design' to include implementation the ongoing practice of putting together, configuring and adjusting information system and that take place in settings of use.

Multiple loci of design and objects of design

Here I will look at Hales' article, *Where are designers? Styles of Design Practice, Objects of Design and Views of Users in CSCW*, to call attention to a way of thinking about ISD as a distributed activity that takes place across multiple sites of design and use (Hales 1994). Hales asks where designers can be located in what he terms the "geo-economic location problem" (Hales 1994, p. 165). He discusses ISD in terms of visibility and distance between the (human) actors involved. This provides us with a final story and an alternative picture of the practices involved in ISD. This involves a de-centering of the

design process in order to theorize a conglomerate of actors as part of ISD, similar to the approaches of Büscher et al. (2001) and Aanestad and Hanseth (2000). Yet Hales, addresses more explicitly the consequences this de-centering has for the role of the professional designer. What problems are provoked in redefining the professional systems expert as a more modest IT supporter or cultivator, or, in leveling out different practices and proposing that a nurse's adjustment of a microphone is equally important to the coding work for the program for digital imaging? As a final thread of this chapter, I will look at Hales' ideas on multiple sites of design, multiple objects of design, and the ways in which some kinds of work become valued over others.

To illustrate the diverse locations and practices involved in ISD, Hales considers three designers at work: firstly, a designer working for a software company in Silicon Valley. This designer works at a distance from and has a limited view of the user and possible use situations. Hales mentions the usability laboratory, perhaps focus group interviews, and universalized theorizing on cognition and social practices as the 'closest' this designer can get to users. The user is here an ideal and generic user, produced and accessed through the experimental set-up and techniques of the professional designers. The second designer is located in a user organization configuring the generic systems developed by the previously mentioned designer. This designer works on contract and within a project deadline and on a limited budget that frames the kind of relationship she/he may have with potential users. Finally, we have the user – “lowest in the pecking order, overworked and lacking in self-esteem” who struggles with configuring the technology for the work tasks at hand (ibid., p. 166).

The description of these three actors working at different locations provides a picture of a development process distributed across multiple sites of design and use. Hales discusses these as many “loci of design activity” characterized by different styles, conditions, and norms (ibid., p. 167). He suggests looking at the process as a “cascade process of stepping down the hierarchy”, from generic to standard to local configuration, where each step involves *articulation work* (Gerson and Star 1986, Schmidt and Bannon 1992). Articulation work is a term for talking about some of the ongoing accommodation, adjustments, and moment-to-moment activities people engage in to make things work and move on with the task at hand. Gerson and Star (1986) describe articulation work as: “carrying through a course of action despite local contingencies, unanticipated glitches, incommensurable opinions and beliefs, or inadequate knowledge

of local circumstances... Articulation resolves these inconsistencies by packaging a compromise that ‘gets the job done’” (ibid., p. 266). Likewise, articulation work packages technology so it may be transferred from one site to another (Suchman 2002).²¹ So, in Hales terms, the technological artifact can cascade down through a global division of labor from suppliers/innovators, to developers/appliers, down to implementers/final users. Hales argues that the continuous activities of articulation work at each level ought to be acknowledged as ‘design’. He discusses how different styles, occupational structures, and objects characterize these practices and suggests four categories of design based on the division of labor in a technological artifact’s history (ibid., p. 169).

- Design of generic products: standard systems and platforms in a different time and place from the local configuring of the artifacts
- Design of use activities: the configuration and integration activities in local settings of use (an IT department, IT consultants, and local experts)
- Design in use: the articulation work that takes place to make a technology work smoothly as a daily integrated part of work practices
- Design of design: the managerial practices of planning, organizing, and facilitating the processes above

In this way Hales reworks what we commonly think of as design - professional work of prescriptive statements such as requirement specifications about the system to be built and implementation of these in a technical solution. He introduces ‘design of design’ which resonates with the line of research on methodology discussed earlier in this chapter. Hales is particularly interested in the practice of ‘design-in-use’ and advocates

²¹ Drawing on Hales (1994) as well as Haraway’s work on ‘situated knowledges’ (1991), Suchman similarly presents an understanding of how technologies are stabilized as working technologies through what she coins “a series of hand-offs across multiple worlds that are discontinuous and somewhat invisible to one another”. Suchman, similarly to Hales, calls for an orientation towards the work through which stabilization of an artifact is achieved and maintained. “Actors within these discontinuous worlds work to achieve enough coherence in the artifact that it becomes possible to hand it off to others. So product developers hand off a technology to sales and marketing, whose work makes it possible to effect hand-offs to third party developers and system integrators, whose work makes it possible to effect hand-offs to purchasers, whose work makes it possible to effect hand-offs to local implementers, whose work in turn makes it possible to effect hand-offs to end-users. Two aspects of this process as currently constituted are crucial. It relies upon articulation work at each boundary crossing and that work, whether mythologized or denigrated, is largely invisible.” (Suchman 2002, p. 101)

rethinking users as actors or constructors to counter the tendency to understand design only in terms of a professional expert activity.²² Design of the IT artifact in the professionalized sense, Hales argues, does never fully design use. Here, the lowest level of articulation work – that of users – often goes under-recognized and undervalued. His arguments are in line with the two previous texts I have presented, that question the boundaries between design, implementation, and use. What Hales adds – or centers in his discussion – is the taken-for-granted privileged status and position of professional designers and the problems involved in attempting to blur the boundaries between the various categories.

“Users ‘construct’ technology; they do this symbolically, in their ‘reading’ of artefacts, and literally, in the articulation work that is essential before a concrete *configuration* of artefacts (as distinct from the generic products that emerge from usability labs in Silicon Valley) can serve as an adequate day-by-day supporting structure for live practice. Formal hierarchies, constructed in the Taylorist machine model, are specifically intended to prevent this kind of ‘wildcat’ action through the strict separation of managerial (knowledgeable) and operational (unknowledgeable) roles; thus in conventional organizations, user-constructors are necessarily illegitimate constructors. Designers attempting to perform in a user-actor style find themselves in the middle of a power struggle of not insignificant proportions.”
(ibid., p.162)

There is a connection here back to the radical structuralist story I have presented above, seeing a power struggle as an inherent aspect of ISD. As presented above, conflicts of interests are written into the material properties of technology – whereas here power relations are written into the very definitions and distinctions of designer-user, professional-non-professional, and knowledgeable-unknowledgeable, and into the ways in which some design practices are valued over others.²³

Clement, for example, elaborates on Hales in developing a more “comprehensive concept of design” as an explicit political project (Clement 1993). In quoting a line of

²² Hales present this notion of user as actor/constructor as one of three interpretations of users among designers: as clients, as permitted co-designers, as illegitimate actor/constructors (Hales 1994). This differentiation of different design styles and relations to users is the main aim of the article, but in my review I foreground his discussions on multiple loci of design presented in the latter part of his article.

²³ See also Adam and Richardson (2001) for a discussion of ‘epistemic hierarchies’ in the Information Systems discipline and critical understandings of how some kinds of work become recognized and acknowledged as ‘knowledge’ and others do not.

researchers working with variants of the radical structuralist story, Clement compares ‘formal’ design to ‘informal’ design:

“It should not be overlooked that this definition of design favours those that formulated it by implicitly reserving a central role for themselves and relegating others to the margin. This is in keeping with Nygaard’s observation that ‘language, concepts, theories... reflect... the interests of those who created [them] (Nygaard 1986, p. 9). As some feminist critics have noted, this separation of roles has been exaggerated by the adoption of design techniques that stress the use of formal, abstract models deemed to reflect the underlying information processes, in preference to those relying more directly on experience in the physical and social world (Benston 1988, Greenbaum 1989). This denies those not following rationalistic traditions, notably women performing service work, a claim to ‘authoritative knowledge’ (Suchman and Jordan 1989). Not only has this served to inhibit users participating in formal design settings, it helps render invisible users’ informal design activities outside these settings.” (Clement 1993, p. 325)

So what Hales, Clements (and the authors he quotes) bring forth is that our definitions of design and development are gendered and valued differently. Hales complicates the situation even further by introducing the thought that there are not only different sites and styles of design, but also different objects of design. He notes that the difficulties in coming to terms with this situation are due to this multiplicity and to issues of power and visibility/invisibility involved. Hales notes the difficulties of finding one theory or concept of design that can cover the different sites and styles of design presented through the three design locations (Silicon valley, the IT department of a user organization, and a final use situation):

“[T]here can be no theory or method of design that covers all situations. Each of these situations is objectively different from the others (and there are other cases, too, not represented here). The nature of the object being proffered for designers to work on differs, as does the nature of the access that the designer has to it...” (Hales 1994, p. 166)

Given the problems that Hales points out, we would need different tools and different types of knowledge for studying the diverse practices involved in the making of a new information system, as well as for keeping a critical eye on the political implications of who gets positioned as knowledgeable or unknowledgeable. Again, these are other phenomena that we ‘discover’ and can render as focus of our questioning by bracketing a methods path of research and working in new ways to explore, experiment with, and

reflect on ISD as made up of diverse and distributed practices.

Chapter summary and openings

In this chapter I have provided a picture of very diverse ways of understanding, studying, and improving ISD. Delineating these different strands of research is one way of ordering what Checkland and Howell (2000) describe as a messy sticky briar patch and helps us, as a starting point, to think about different ways of doing ISD research. I have started out by presenting three well-known and established ISD research repertoires - previously and neatly ordered for me by Hirschheim and Klein (1989). These were labeled functionalism, social relativism, and radical structuralism. Under each of these headings I have related a narrative about how the ISD process unfolds, where it happens, who the key actors are, and what key features and activities it should comprise. I stress that stories are always acted out and embedded in material practices, and as such, they are continually enacted as resources for our present work as ISD researchers. I gave examples from my own work and the DIWA project of how all three repertoires were drawn upon to explain aspects or bring order to the development initiatives we studied and were engaged in. Stories thus have very real material effects.

I have also presented two very critical articles – one from Truex, Baskerville and Travis (2000) and one from Ciborra (1998) - that resonate with my own questioning of methods and models as *the* way of bringing order to, and thereby improving, the process of ISD. Universalizing methods and models are most prominent in the first functionalist story, but the ideals embedded in methodology thinking are also prominent in ISD research in the social relativist and radical structuralist vein. Both Truex et al. and Ciborra elaborate on how this way of thinking and informing ISD tends to marginalize the inconsistent, messy, and unexpected aspects of ISD. Both Truex et al. and Ciborra call for work that attends to and brings out more of the local and specific practice that has been systematically obscured in existing studies and discussions. Their critiques thus provide me with the first openings for an exploration of an alternative mode of research.

In the last section of this chapter, I have chosen three articles that indicate possible directions such an alternative path of inquiry might take. I have reviewed these three articles as different attempts to deal with the chaotic practice aspects of ISD without claiming to order and encapsulate the process in any universalizing manner. The texts are very different in character and outline a range of possibilities for understanding ISD practices in local settings - through change-oriented research experiments, studies of

systems development in the wild, or more theorizing reflecting lines of research. Furthermore, I have sought to bring out images of ISD as a moment-to-moment patching and bailing life-raft journey, ISD as cultivating a double dance over which no one has control, and ISD as something that involves articulation work at many sites, different styles, and different objects of design. These are images that refresh the established stories presented by Hirschheim and Klein and the methods/model view critiqued by Truex et al. and Ciborra.

This research addresses the influence of *multiple actors* upon the development process and brings forth locations of design or design-in-use that lie outside a formal development project and project team. In addition, this research attends to risk and *uncertainties*: thinking beyond drivers and determinants, and more about ways in which people, technologies, and practices play together in unpredictable ways. I suggest that these discussions complicate the picture of ISD and indicate a move away from the universalizing tendencies embedded in the established ways presented by Hirschheim and Klein (1989) and in methods and models thinking as discussed by Truex et al. (2000) and Ciborra (1989). Such discussions lead us to question the notion that technological artifacts are constructed in a professional site of design and are to a certain degree fixed and finished once they ‘leave’ design and enter into use. In fact, the work presented question this very image and explores that which lies in between a clear conceptual distinction between design and use. This thesis addresses and extends these research themes.

3. Field study and research design

The present chapter has two aims. First, to present a general discussion of qualitative field studies of IT development and use practices, and second, to relate the research design of my fieldwork in the companies Novo and NNIT. I introduce a commonly accepted mode of conducting fieldwork within a single site and suggest that this mode is insufficient when it comes to tackling the phenomenon I set out to study. As an alternative approach, I present and discuss a multi-sited framework for conducting qualitative research that I have found to be better suited for incorporating the complex, emergent, and at times paradoxical nature of contemporary information systems development. This chapter thus outlines the research design and empirical approach that underlies this thesis: an open-ended multi-sited research design and an analytical strategy of juxtaposing sites and situations. This section also serves as an introduction to the research setting and sets the scene for the following analysis chapters.

Entering the field – what field and where?

In Information Systems Research, entering and being in the field is a legitimate and valuable way of producing new understandings of and insights into technology production and use practices. Empirical field studies are widely recognized as relevant for gaining insights into systems development practice and into a specific domain of work or particular settings where information technologies are in use or soon to be implemented. Also, we have increasingly come to view fieldwork as pivotal for developing concepts and analytical understandings of information technology and work practice. Suchman's (1987) work on the situated character of human-machine communication, Stolterman's (1991) practice studies of systems developers, Heath and Luff's (1992) study of a transport system control room, and Orlikowski's (1993) examination of Lotus Notes in use are just a few such examples of field studies that have served to re-orient the research agendas and concerns of Information Systems Research in valuable ways. This type of work has shifted our attention to the intricacies of technology-related practices and paved the way for new understandings of how technologies come to work successfully, or how they come to fail.

In the seminal studies mentioned above, along with most other research that is based on field studies, the site and object of study is generally considered to precede the empirical investigation. We tend to think of a field study as a situation in which the researcher in person enters a bounded site, for example a particular organizational department or a single control room, to investigate the nature and characteristics of the setting for a specific period of time. Such notions of field study and fieldwork rely on the concept of a field site as an already delineated geographical location.

When investigating the design and use of emergent and distributed technologies in networked organizations, however, locating and delineating exactly where the field begins and where it stops is not a simple matter. Likewise, information systems that are emergent, designed, and used across distributed locations pose challenges when it comes to pinpointing exactly what and where the object of research is. We are thus faced with fields in which a bounded site for entry and emersion does not clearly delineate nor pre-exist our research practices (see also Newman 1998). On the contrary, such technologies seem to happen as simultaneous occurrences in a broad range of design and use sites that may be more or less connected. As Law notes, this may lead to a situation in which the action always seems to be where we are not (1994, p. 45). Studying a systems development initiative is thus complicated by the lack of overview, by issues of scope and scale, and by the dispersed and emergent character of technology.²⁴

Such challenges of complexity have been approached as issues that require the development of new and better research tools. In connection with my research program, Bødker, Bøving, Pors, and Simonsen experimented, for example, with the use of log file analysis for the study of IWAs and distributed work practices (see e.g. Bøving 2003). Challenges of distribution are viewed from this perspective as technical difficulties that may be tackled by means of log file analysis techniques. Other options involve using more video cameras or perhaps screen tracking and screen capture technologies that allow the researcher to record mouse movements on many screens at once. With reference to the previous chapter, I suggest that in this case, one kind of complexity is merely substituted for another. With one problem ‘solved’, a new one arises, such as how

²⁴ As Balsamo reminds us, new technologies also rearticulate old identities (1995, p. 131). In her analysis of new virtual reality technologies, she discusses how what is new or better is not easily judged and how these often reproduce traditional narratives, for example, about the gender and race (ibid., p. 132).

to sort and visualize the mounds of unmanageable data produced by, for example, log filing. These alternative methods are thus a particular translation or technologically mediated way of seeing and analyzing the subject matter of distributed technologies.

In drawing on STS insights, I have instead tried to work with these challenges as productive conditions that force us to ask new questions and to rework our limitations. In my own work I have sought to capitalize upon such fieldwork challenges, viewing them as opportunities for discovering new ways of understanding our subject matter. This approach takes seriously the problem that there is not one high place from which we can look down upon and overview that which we study (see Haraway 1991). I have therefore drawn on mundane methods of interviewing, participant observation, and document analysis and applied an analytical strategy of juxtaposing multiple sites of both design and use practices. Rather than providing a total overview or mapping out general patterns, this juxtaposition of sites and situations dives into selected places and moments and explores in detail the specific arrangements and situations in which ISD unfolds. Such a strategy brings out differences, connections, and disconnections between the practices, and thereby produces data material for thinking about ISD in novel ways.

This way of doing research is inspired by the work of anthropologist Marcus (1995), feminist theorist Haraway (1991, 1994), and by the work of ethnomethodologically inspired science studies researchers (e.g. Latour 1987). A basic notion for all of these authors is that we as researchers participate in constructing the objects and field sites we study. This turns debates on intervention and the researcher's influence upside down. Instead of trying to avoid being biased by our own limited points of view - the issue can be posed in terms of how we can best set up and produce good research objects and research experiments in relation to the research questions we wish to explore. I will explain this idea with Marcus' notion of a multi-sited research design.

In a discussion of post-modern ethnography, Marcus (1995) compares a common mode of field research to a multi-sited research design. Research within the common mode focuses intensively upon one single site of observation and participation and subsequently relates the material to a wider global or macro-theoretical context. In contrast, a multi-sited fieldwork strategy takes as its focus of investigation the connections and circulations between multiple sites. Thus, Marcus does not approach the global (or macro) as an outside or contextual aspect of study, but traces and questions the connections of the local and the global as a starting point:

“Multi-locale ethnography moves out from single sites and local situations of conventional ethnographic research designs to examine the circulation of cultural meanings, objects, and identities in diffuse time-space. This mode defines for itself an object of study that can not be accounted for ethnographically by remaining focused on a single site of investigation.” (ibid., p. 96)

Moreover, Marcus suggests thinking about fieldwork and qualitative research methods not as a set of prescriptions laid out in advance, but rather in terms of the designing of a multi-sited space that is iterated and adjusted throughout the research process according to findings, challenges, and shifts in focus (ibid., p. 90). The set-up of the study, the methods applied, as well as the opportunities and obstacle that arise continually shape a space for asking new questions.

Marcus suggests that multi-sited fieldwork can follow different methodological paths (depending on the kind of question one hopes to pursue) and can be constructed through different strategies depending on the research questions and focus. For example, by following people as they migrate or move through different locations, following a metaphor or discursive figure, following a story or narrative, and lastly following an artifact (ibid., p. 90ff). This fieldwork strategy of following people and things *diversifies* the space of the object of study. In contrast to the approach of investigating a single pre-defined and bounded site, this kind of research is “designed around chains, paths, threads, conjunctions, or juxtapositions of locations in which the ethnographer establishes some form of literal, physical presence with an explicit posited logic of association or connection among sites that in fact defines the argument of ethnography” (ibid., p. 90).

This mode of research is parallel to Latour’s dictum ‘follow the actors’ (Latour 1987), which Marcus also draws upon. Both use this approach as a way of dissecting the global (or macro), collapsing it into the local, in order to study the practices, connections, and associations that constitute and sustain the global. What is global or macro is not in any way given in the nature of things, but an *effect* of moment-to-moment local practices (Callon and Latour 1981). This approach thus radically levels out what we usually distinguish as local and global or micro and macro. Furthermore, this approach radically levels out scientific research practices and the everyday work we study. As mentioned above, research is not carried out from higher ground (where we can ‘see’ the global and macro structures), but is fully immersed in the messy practices we study. Research is in itself a messy practice, based on craftwork and know-how “no more miraculous than that

of a painter, seaman, the tightrope walker, or the banker” (Latour 1988, p. 218).

Lastly, along with this mode of research come reflections on how methods we apply work to shift, transform, and redefine the field site and object of study in particular ways. Each research activity from the initial research proposals and literature surveys to the final analysis and publication can be seen as moves or steps that carve out new connections and a space for further research as well as particular openings for producing results, theorizing, or intervening.²⁵ The following section conveys my own research process and the methodologies applied for carving out such a space of possibilities. It has been my aim to follow ProjectWeb through different sites, and I suggest this multi-sited mode of research informs my research aims by:

- - sensitizing research to the exploration of a distributed technology designed and used across multiple sites in an open-ended and descriptive manner,
- - investigating design, use, and research practices in parallel and in the same terms (as opposed to assuming that the design comes first, is privileged over, or can explain use).

Carving out a space for the study

The study is organized around a web-based application, ProjectWeb – how it appears, acts, and emerges at different sites. I have explored connections and disconnections between sites of design and use as well as established new links along the way. ProjectWeb is the object around which the study is organized, the ‘thing’ followed and juxtaposed through different sites and situations in the companies Novo A/S, NovoZymes A/S, and NNIT.

Literature review and DIWA

As formulated in an early research proposal, I intended to explore empirically how a web-based collaborative information system was integrated in distributed work practices and the subtle ways in which such integration might entail re-designs of both work and technology. The research was (and still is) thought of as an entry into debates on contemporary information systems development (see introduction on DIWA). Based on

²⁵ In the article “Locating virtual field and a dispersed object of study” I have developed this argument and scrutinized in more detail the spaces of possibilities constructed in the course of the field study (Henriksen 2002).

a study of one such web-based information system, I hoped to produce empirical material useful to theorizing the ways in which ISD unfolds as a situated and distributed process without end, dispersed across a proliferation of users, professional designers, maintenance and support, and various other new intermediary actors. Thus, an interest in ISD, design-in-use, and a collaborative research program (DIWA) formed the initial context of research. The DIWA project and IS literature have been introduced in chapter one and two. The production of pharmaceuticals was selected as a compelling context for this research due to the distributed character of the work and a presumed dependency upon web technologies. Colleagues in my collaborative research program provided access and initial contacts to Novo and NNIT as well as an exploratory working paper on ProjectWeb.

Exploratory interviews

The next phase of research consisted of 15 in-depth interviews (Taylor and Bogdan 1984, Kvale 1997) with systems developers in NNIT and project members from three different pharmaceutical development projects working at different Novo sites in the Copenhagen area. These first interviews were conducted together with Jørgen Bansler, Erling Havn, Jens Kaaber Pors, and Hanne Westh Nicolajsen, and they were shaped by our different approaches and interests as well as by the DIWA research agenda. A contact in the project management department provided us with names and emails of possible interviewees who were working within three different development projects. The initial interviews typically lasted from one to two hours. Some of these interviews included demonstrations of ProjectWeb and informal conversations over lunch or while walking around the company. The interviews were recorded and fully transcribed. And in addition, I wrote up notes and impressions from the conversations. Interviews were semi-structured by a shared interview guide. This first part of the study and analysis can be characterized as an open-ended exploration of ProjectWeb in use and the daily work practices related to ProjectWeb. We asked about everyday usage and problems and how ProjectWeb compared to or was integrated with other technologies such as email, web-publishing software, the company intranet, word processors, presentation software, local area networks, the company intranet telephone, and web-conferencing. Also, we were particularly attentive to the different metaphors people used to characterize ProjectWeb.

The interviews produced insights into a striking diversity of use practices and visions of what ProjectWeb is and might be capable of doing. Descriptions and usages spun out in

many directions, and ProjectWeb was described as a means for storing, searching, and retrieving information, bringing together and delineating projects as a community, team, or family, enabling quick overviews for employees working on many projects or for those moving from one project to another. Also, it was seen as a means of managing and coordinating tasks within the project as a whole as well as within subgroups. Some described it as a secure space for distributing confidential documents or collaborating on specific issues within smaller groups. Some, in contrast, described ProjectWeb more as an archive for future use, for example for new projects, or as extra documentation backup in case of lawsuits. In addition, these discussions concerning ProjectWeb would constantly slip into various debates on tedious bureaucratic paperwork vs. the ‘real work’ of research in the lab, or, into various contests on for example how to share information within and between projects, how development projects should be managed, and whether or not these should be increasingly standardized. The material was analyzed collectively and written up in field reports and in two articles presenting different categories of use and metaphors about “what ProjectWeb is” in different development projects (Henriksen, Nicolajsen and Pors 2001). These metaphors included depictions of ProjectWeb as:

- - a central project *archive*, ensuring a shared project memory and easing knowledge transfer and re-use
- - a *bulletin board* for general orientation on project events and news
- - a communication tool or *newsletter* for publishing news from a project center to peripheral project members
- - a *project management tool* for coordinating distributed projects
- - a *shared space* for getting to know one another and building project spirit and a virtual community
- - a *search tool* for backtracking previous events and decisions, finding addresses and locations of other project members
- - a *shared workspace* for collaborating and securely collaborating in subgroups within projects

These descriptions and the pros and cons of ProjectWeb were, in the interviews,

compared and weighed against email, file transfer protocol (ftp), local area networks (lans), and the company intranet. These different visions of what ProjectWeb will and can do for project work were studied as active constituents of ProjectWeb that mediate the way it is used and redeveloped, as well as 'what it is'.²⁶ In this way, ProjectWeb was studied as an *outcome* of an extended network of design and use practices, a product of its relations to other technologies and of discourses on what ProjectWeb might do. De Laet and Mol's (2000) study of a fluid technology provided important inspiration, and I will return to their ideas in the following chapter.

In these first studies, project assistants (the right hand and assistant of project managers working in the management department) recurred as a group of actors who were active in both maintaining ProjectWeb for project use and in the development of earlier versions. These assistants have - with the introduction of ProjectWeb - become the responsible IT administrators. Due to my interest in design-in-use, the work of these project assistants became focal for the study. These project assistants have varying backgrounds and experience with IT.

Documents and inscriptions as methodological entry

In trying to move 'closer' to the material aspects of the artifact and use situations and take seriously what ProjectWeb does (how it acts), I found document analysis of a system description and a user manual useful. Not only as a source of data, but also as an entry for my own analysis of interview and observation data. I collected and studied documents, screen printouts, the systems description, and the interface of ProjectWeb in the three different versions. I also compared ProjectWeb inscriptions to other similar web-based applications such as BSCW and Quickplace.²⁷

In particular, I looked at the features for configuration and the administration section, only visible to project assistants, in order to determine what kind of technically mediated roles they were delegated by way of ProjectWeb. The administration pages (as well as other pages and functionalities) can be analyzed as offering a script for action that users must recognize and follow in order for ProjectWeb to work. The terminology of scripts

²⁶ For an early analysis trying to work through this notion see Henriksen et al. (2001). A similar analysis - of how discourses of the new, better and more effective constitutes ProjectWeb - is also developed in more detail in chapter seven of this thesis.

²⁷ See <http://bscw.gmd.de/> and <http://lotus.com/products/qplace.nsf/>.

and inscriptions is borrowed from Akrich (1992). In the article *The De-description of Technical Objects*, Akrich analyzes design as a process of inscription whereby anticipations about user patterns and competencies are defined and translated into technology.

”Designers thus define actors with specific tastes, competencies, motives, aspirations, political prejudices, and the rest, and they assume that morality, technology, science, and economy will evolve in particular ways. A large part of the work of innovators is that of ‘inscribing’ this vision of (or prediction about) the world in the technical content of the new object.” (ibid., p. 208)

Such materially embodied roles and expectations often become naturalized and invisible once they have been incorporated into a finished technology – especially when the user fits, or learns to fit, the patterns of use of the imagined and prescribed user. The term *de-description* refers to the analysis, to the making visible of such embodied scripts. Akrich points towards a number of methodological tricks one can apply to bring out these scripts. One of these is to study design plans and instruction manuals to uncover the way expectations and patterns of imagined use are built into technologies. In such documents, the ideal user and her /his characteristics are often described. What the technology can do and how it should be used is often explicitly stated. A second trick is that of following technologies as they move from one context to another. Once a finished designed technology is moved from its context of design to situations of actual use, these situations rarely unfold as imagined. Akrich describes how users can pursue all sorts of interests and unexpected paths of action, other objects and people intervene, and scripts are hereby renegotiated. Looking for a gap between the ideal-user and the actual in-the-flesh-user and tracing processes of negotiation is thus another method for pinpointing technological scripts and articulating the work they do.

Two documents were particularly useful: an official system description created in 2001 by NNIT for the development of a new version, and a manual created the previous year by a project assistant: the system description in a technical terminology and the manual as a step by step, do this do that instruction. In parallel, I compared the analysis of these documents to the interview material and later to observation notes.

These documents and their inscriptions have provided indicators of vocabularies and project organization, routine events, and troubles frequently encountered. Aspects of the system that are naturalized and mute while interviewing and observing were made more visible (Star 1991). Some use events that were too rapid, too minute to observe, or one

that rarely could be dissected in more detail. Modules that have disappeared, such as reporting, opened up new lines of inquiry on how and why this section was developed but never put to use. And lastly, inscribed scenarios could be juxtaposed with situations to open up the reciprocal accommodations of both practice and technology for detailed analysis.

In later analyses and in this thesis I have, however, moved away from this notion of scripts and this very coherent notion of design (as intentionally envisioned and inscribed by designers) as well this tendency to view use as a back and forth designer-user contest. Rather than starting with embedded properties (inscribed by designers) and then studying how these are resisted, modified, and adopted, I have sought to more openly explore ProjectWeb in use in open-ended terms by analyzing how ProjectWeb emerges in use situations. The next chapter returns to these theoretical considerations and implications.

Historical focus study (while waiting for the new development project to start)

As first planned, I intended to study both use practices pertaining to ProjectWeb and to follow the development of a version four. This development project was to start in early 2001, but was first delayed due to other projects with a higher priority in NNIT, later entirely cancelled, and finally, a year later taken up anew and redeveloped. The new version is to be launched May 2003. As a result of these delays, my research took a number of shifts and drifts. One of these was a series of interviews (conducted with Jens Kaaber Pors) in which we deliberately sought out employees from other departments and from the firm NovoZymes (earlier a part of Novo Nordisk and separated out as an independent pharmaceutical company) who were involved in the development of the first versions of ProjectWeb. These interviews were more open-ended and focused on historical narratives about ProjectWeb, asking interviewees to elaborate on key moments, events, and tensions. We asked interviewees to find beforehand any documentation, emails, slides, or documents they had archived on the earlier versions, and we organized the interviews around this material. In these interviews we found that many actors – human and non-human – had been involved. Many people attributed the ownership and origination of ProjectWeb to themselves. Some aspects have become central and others deleted. This process might be thought about as drift, where no master plan or strategy has guided the process (Ciborra 2000). Our work on the history of ProjectWeb was written up for a conference paper as a construction story of ‘how ProjectWeb came to be’ (Henriksen and Pors 2001, see also Bansler and Havn 2003). Writing up this story led

to reflections on the problems of fitting a complex story into a linear narrative to be presented in a paper. Here is one version:

Two librarians initially developed an application that they named ProjectWeb. They were inspired by the World Wide Web and the possibilities such technologies might provide for project archives in the company. Difficulties in writing the application database and integrating ProjectWeb with existing document library databases led them to hire the internal IT department to co-develop parts of ProjectWeb. A number of IT developers from the IT department later took over the entire development and produced two new versions, initially financed by the Novo Nordisk project management department for use in development projects and subsequently a second version was ordered by a top level management group to assist the distributed work of restructuring Novo Nordisk in 1999, separating out NNIT as an independent firm. With this version, ProjectWeb also became interesting to the IT developers as a product that could potentially be marketed as a generic knowledge sharing application to other settings and corporations. At the same time, it was also viewed as a publishing tool that could assist in a parallel strategy of restructuring and organizing the firm's intranet. Web sites for project groups would thus all be more similar, making it easier for project members to orient themselves in a new project or to work on several projects at once. And as project managers and their assistants in the development department began using ProjectWeb, they also became active in articulating new requirements for the system. Project assistants have, for example, arranged focus group meetings to negotiate ways in which ProjectWeb should be implemented in project groups and to suggest what types of new system features and functionalities they would like to see developed. Several have participated in workshops with IT developers and have continuously contacted the main IT developer with minor suggestions for changes or problems.

To sum up the three year development process in this way involves condensing a complex and drifting process in which various librarians, IT developers, project assistants, managers, and members have been actively involved, rendering it difficult to pinpoint a locus of design and an overall strategy or rationale behind the system (Henriksen and Pors 2001). Many different visions and ideas about ProjectWeb and its possible uses have been negotiated and combined throughout this process. These activities and ideas about what ProjectWeb is or should be have been inscribed in the interface and functionality, and these have meshed to make the various ProjectWebs what they are today. Besides the human actors emphasized above, discursive and material actors have also played a part. Visions concerning the organizational benefits of web technologies played a part, existing company infrastructure placed specific demands, and technical difficulties have enabled and restricted the development processes.

Observing design-in-use

In the next and final phase of my empirical research, I conducted further in depth interviews in NNIT and with active ProjectWeb users of the same three development projects. I applied snowballing techniques (asking interviewees for further contacts) as well as statistics generated by the various ProjectWebs to track down project members who were frequent users of ProjectWeb. To move away from design-in-use as being located in technology or individual skills, I approached design-in-use as an effect of particular situations. Also, in the empirical observations and in working through the empirical material, I looked particularly for design-in-use situations, events, and moments in order to map out the kind of situations, circumstances, and conditions of possibility that could be related to the activity of design-in-use. Both use and design-in-use was thus seen as an activity to be explored openly rather than as a definitive analytical entity (where what is or is not design-in-use is defined beforehand).

I carried out a series of participant observations of everyday work situations in one department to focus on intermediary development activities of the project assistants. I conducted a series of short-term observations or shadowing of three different project assistants in the project management department one to two days a week during the months of June, October, November, and December 2001. Observations consisted of 'hanging around' in the offices of three different project assistants where we throughout the day discussed most of their activities and the different desktop applications they used. Also, I talked with other employees in the halls and over lunch and listened in on meetings. Sometimes I made tea and photocopies, and on several occasions I offered suggestions on how to solve glitches and problems with ProjectWeb and other applications used by the secretaries. Project assistants tended to 'save up' tasks to do in ProjectWeb for the day I was present, and observations were planned around days when they did not have any confidential meetings that I would be unable to attend. During these observations I took detailed notes and wrote these up the same day or the day after. Here the previous interviews and script analysis proved useful in filling in details of these observations while writing up my notes. This last phase of research carved out a space for scrutinizing design-in-use as a central research theme.

On analysis and writing

Analysis and writing has, as indicated, been carried out throughout the research process, continually producing new themes and possible storylines, which then were pursued in

the following phase. Also, the data material has continuously been coded openly throughout the empirical research (see e.g. Emerson, Fretz, and Shaw 1995, Boyatzis 1998). This coding consisted of writing themes, notes, and memos of interest in the margin of interviews (on paper and in Word) as well as keeping notes in separate documents. In coding this material I have drawn on both theoretical concepts and concepts from the field, continually oscillating between the empirical material, literature, and discussions with fellow researchers. Based on the open coding, a number of broad themes and story lines were developed.

Subsequently, a number of selected situations were analyzed in more detail in relation to these themes. The method of analysis has thus been an oscillation movement between condensing the data material through writing summaries, listing out themes, and finding story lines on the one hand, while at the same time expanding the material through an interpretive analysis of selected excerpts in relation to one or more particular themes of interest. The analysis drafts and notes have been summarized in the field reports and in a number of conference papers. These working papers and articles have, along the way, been shared with systems developers at NNIT and with some of the project assistants, and I have, with my colleagues, presented findings on three occasions: a one day user workshop organized by NNIT, a presentation day at the Danish Technical University where three employees from NNIT participated and commented, and a feedback meeting and discussion session for project assistants for which two colleagues and I had set the stage by sending out an article on our preliminary findings in advance. The feedback and discussions from these meetings have provided important data material for analysis that is also presented in the thesis.

In separating out these phases I hope to have illustrated the research process as an interplay of academic literature, discussions with co-researchers and in the DIWA research program, conference activities as well as opportunities offered and obstacles presented by the socio-material setting in which the study took place. The fact that the official development project for version 4 of ProjectWeb was first delayed, then cancelled, and then initiated a year later anyway (spring 2002 at which time I was at Lancaster writing up research), for example, rendered professional development and design more marginal to the study. I assert that such research dilemmas also provide valuable data – obstacles tell us interesting things about the phenomenon – and I have sought to use these productively in my analyses.

Juxtaposing ProjectWeb sites and situations

For the present thesis I will not present a summarizing map of all research findings. Instead, I take another path of argumentation: the analysis of particular situations. This mode of presentation relates closely to the aim of the thesis and to my arguments concerning radical localism. The level of analysis applied in my analytical work has been *the situation*. In the terms of science studies researchers Clarke and Fujimura (1992), this is a strategy for placing ‘interrelations among elements’ in the foreground. In an introduction to a collection of STS studies of scientific practices, Clarke and Fujimura write:

“We intentionally use the term research or production “situation”... because what we are challenging in part here is a common connotation of the term “context”. Context is often used to designate that certain things or attributes were around the work site, framing it in some ways like concentric circles at more or less remove from the heart of research production. In sharp contrast, a major point we seek to make is that things, attributes, elements are *in the situation* itself. While they can be abstracted from that situation, something (often quite a lot) is lost in translation.” (ibid., p. 17)²⁸

I have thought of a situation in terms of any moment or event where ProjectWeb appears, acts, and emerges. This includes conversations or an interview situation where I likewise have analyzed talk as an event (see e.g. Mol 2003, p. 14). I see situations as occurrences or events that may or may not be related to one another. They are, of course, related in the sense that they are put together here in this thesis, yet juxtaposing situations serves to show how these can be incoherent and discontinuous. Furthermore, unpacking selected situations moves away from a search for general patterns, and instead explores particular arrangements in which ISD unfolds and ProjectWeb comes into being. This analytical approach has allowed me to juxtapose different practices such as design and use, different domains of activities, and units of analysis that we normally

²⁸²⁸ In a footnote, Clarke and Fujimura (1992) note that this approach is shared by symbolic interactionists, ethnomethodologists, and other varieties of ethnographers/field researchers “though each would offer a slightly different account or explanation” (ibid., p. 130). I suggest that Marcus (1995), Haraway (1991), and Latour (1987) referenced in this chapter can be included in this group, since they are similarly committed to the study of local practice. Although their accounts certainly would differ, I see their approaches as compatible. For an insightful elaboration on the differences between Haraway’s and Latour’s approach to the global and the macro, see Michael (2000, chapter 2). Michael’s way of combining their work and “developing analysis from within situations” has also provided an important source of inspiration for the present thesis.

would place on different planes of investigation and levels of abstraction. The analyses thus provide snapshots of the process and no explanatory concentric circles or explanatory macro context. This strategy of analysis avoids talking about context (or the global or macro) as an outside determinant for how things go. What drives action – the way a situation unfolds – cannot be explained by reference to anything outside the situation. I do however supplement these situational analyses with material from other interviews or for example the script analysis, yet this is done without attaching any particular explanatory power to that which I fill in. In this way, the situations are also (just as the object of study and research site) a construct of the analytical work and previous study.

The situations presented in this thesis have been selected according to the following: findings and the data available, a situation displaying themes interesting to the academic discussions and IS literature that frames this study, and situations that may rework some of the established stories and concerns presented in chapter two. I have selected situations that somehow complicate the picture and might provide alternative stories for reflection. Of the episodes picked for analysis, some are more ‘typical’ than others. The episodes in chapter seven on researcher involvement are, for example, less common in such development initiatives, whereas the workshop scenario and scenes from everyday work resonate with other studies and experiences. However, the aim here is not to generalize empirically. On the contrary I aim to sensitize the reader (other researchers I suppose) to events and situations that are under-recognized in the literature. The multi-sited research design and method of developing analysis within situations is thus not seen as offering a full overview or empirical generalization, but more as a tool for describing and theorizing the processes of systems development in a new way and thereby also reflecting upon our very possibilities for doing so.

Closing

In this chapter I have introduced the empirical study the thesis is based upon: a field study of ProjectWeb in Novo and NNIT. I have started the chapter with a general discussion on qualitative studies of contemporary design and use practices and argued for the relevance of an open-ended and multi-sited research design. Next, I have sketched out phases of my own field study to illustrate how the insights produced, research discussions, preliminary analyses, opportunities, and obstacles along the way continuously have shaped the possibilities for and focus of my further research. I have

presented the notion of juxtaposing sites and situations and developing analyses within situations. In the next chapter I will specify the theoretical underpinnings of the thesis arguments.

4. Theorizing technology and practice

Technology *in* practice. Technology *as* practice. Little words can make big differences. In this chapter I elaborate on the notion of technology in/as practice as a key theoretical theme that has grown out of my study and analysis of ProjectWeb. I see this discussion as an organizing device for the thesis as well as an alternative view of systems development, namely radical localism. I will introduce how technology has ‘disappeared’ from view in ISD research and flesh out the notion of radical localism through a discussion of two practice-oriented approaches: Orlikowski’s practice lens (Orlikowski 2000) and de Laet and Mol’s practice approach (de Laet and Mol 2000, Mol 2003).

Locating technology: the curious case of the vanishing artifact

Entering into a debate on the links between sociology and information systems development, Button suggests that the research preoccupation with the social practiced side of technology has caused technology to ‘vanish from view’ (Button 1992). He refers to this as the curious case of the vanishing technology.²⁹ Monteiro and Hanseth similarly criticize a tendency in IS research to black box the specificities of technology by applying monolithic terms such as an information system, information technology, or computer system (Hanseth and Monteiro 1995).³⁰ They call for research to be more specific about technology, and the level of granularity at which it is studied.

²⁹ Button reviews various sociological theories of technology as well as social constructivist and constructivist approaches to the study of technology. He appreciates these in that they take seriously that technology is always a socially organized phenomenon – a much needed anti-dote to technology determinist and technicist conceptions – yet, Button finds these developments problematic in the way that technology vanishes from view: “for the technology as a wordly phenomenon seems, like the bottom of the rainbow, to move on even as we reach it.” (Button 1992, p. 14). Button suggests “that ethnomethodological interests in the organization of working practices and in the methods through which technology is built into working life by those who use it; interests in: interactional details; in organization: and in practices of design... are all interests that, albeit in different guises to those manifest in ethnomethodology, are shared by those in the various sciences of computer systems development”. He sees these common interests as the starting grounds for linking sociology and ISD. I see the approach I develop in this chapter as parallel to and consistent with much ethnomethodological work on work practices and technology. The empirical commitment, close attention to local situated practices, and way of conceiving social order as an ongoing accomplishment in the field of STS has grown out of ethnomethodological work (see e.g. Latour 1994, p. 50).

³⁰ Hanseth and Monteiro draw on Latour’s notion of black boxing (Latour 1987).

Orlikowski and Iacono (2001) follow up on this curious disappearance of the IT-artifact in a research commentary entitled *Desperately Seeking the "IT" in IT Research – A Call to Theorizing the IT Artifact*. In a literature survey of articles from the journal *Information Systems Research (ISR)* Orlikowski and Iacono find that the “IT artifact tends to disappear from view, be taken for granted, or is presumed to be unproblematic once it is built and installed” (ibid., p. 121). In their literature survey they delineate different ways in which technology is understood. These are by means of a tool view, a proxy view, an ensemble view, a computational view, and a nominal view of technology, each with a number of subcategories.³¹ They thus found *many* conceptualizations of technology and discuss how most of these take the technology for granted as a universal object. They consider the disappearance of technology as a serious problem for the field:

“[T]he tendency to take IT artifacts for granted in IS studies has limited our ability as researchers to understand many of their critical implications – both intended and unintended – for individuals, groups, organizations, and society. We believe that to understand these implications we must theorize about the meanings, capabilities, and uses of IT artifacts, their multiple, emergent, and dynamic properties, as well as the recursive transformations occurring in the various social worlds in which they are embedded. We believe that the lack of theories about IT artifacts, the ways in which they emerge and evolve over time, and how they become interdependent with socio-economic contexts and practices, are key unresolved issues for our field...” (ibid., p. 133)

Orlikowski and Iacono suggest five premises for a research agenda that could adequately re-theorize IT artifacts. These five premises are ways of working against the tendency to view and talk about IT artifacts as universals, as single, stable entities that remain the same every time and everywhere. Orlikowski and Iacono note that such simplifications

³¹ In a tool view, technology is an engineered artifact expected to do what it is designed to do. Here technology is black boxed and assumed to be an individual and stable entity that can be transferred from site to site and used as is. In a tool view, Orlikowski notes, technology is the independent variable – left stable and unexamined – while the studies focus on dependent variables – that which is affected, transformed, and altered by the tool (ibid., p. 123). A proxy view “focuses on one or a few key elements in common that are understood to represent or stand for the essential aspect, property, or value of information technology” such as ease of use, intentions of use, measures of diffusion or cost-benefit. An ensemble view, in contrast, looks at technology as one element in a wider ensemble and at the dynamic interplay of social and technical entities (Kling and Scaachi 1982, Latour 1987). One variant of the ensemble view is exemplified in the notion of technology and work practices as an assemblage or hybrid as discussed in chapter two (see also Büscher et al. 2001 and Aanestad and Hanseth 2000). Lastly, articles where technology is omitted and absent from the article are categorized as a nominal view. (Orlikowski and Iacono 2001)

make it easy to talk and write about technology, but render it difficult to see how they fall apart, must be held together, and are altered at different times and places.

Orlikowski and Iacono's five research premises:

1. IT artifacts are not natural, neutral, universal, or given. They are never “just objects” but always already implicated in actions and effects.
2. IT artifacts are always somewhere – embedded in particular times, places, discourses, and communities. “Their *materiality* is bound up with historical and cultural aspects of their ongoing development and use, and these conditions, both material and cultural, cannot be ignored, abstracted, or assumed away” (ibid., p. 131, my emphasis).
3. IT artifacts are made up of multiple fragile and fragmentary components “whose interconnections are often partial, provisional and which require bridging, integration, and articulation in order for them to work together” (ibid., p. 131).
4. IT artifacts are not fixed or independent, but emerge from ongoing social and economic practices. They both undergo transitions over time and may co-evolve in multiple ways.
5. IT artifacts are dynamic, and their stability is always conditional. It thus becomes important to understand why and how artifacts are stabilized in certain ways at certain times.

These five premises question the tendency to take IT-artifacts for granted as stable and fixed entities and resonate the concerns of the alternative approaches to ISD which I presented in chapter two. These premises all abandon any notion of IT-artifacts as universals and, similarly to my aims, call for attending to the practices in which they are implicated, assembled, transformed, and held stable. Turning to local practice and situations is one way of realizing these premises. Yet as Button notes, in attending to social and human issues, practice-oriented studies of technology have tended to push the technological artifact out of view. How can we conduct research based on these premises without technology vanishing from view? In the light of this discussion and in order to flesh out the notion of radical localism, I will spend some pages presenting two approaches to the study of technology and practice.

I will present the work of Orlikowski (2000) and de Laet and Mol (2000) as two theoretical approaches that explicitly attempt to move beyond our commonplace conceptions of a particular technology as a single, fixed, and stable object. Both attempt to work beyond the notion of construction that is embedded in this way of talking and thinking about technology. I will start with a structurational view of technology-as-practice as an influential line of research in IS, presenting Orlikowski's critique of construction thinking and relating how she theoretically reworks the notion of the fixed stable artifact. The article lines up the main problem with existing structurationalist conceptions of technology and presents an alternative. I find that Orlikowski does not push her own premises far enough and therefore draw on Mol's work to introduce a set of additional analytical tricks (more than a grand theory) by which we may circumvent the problem of the vanishing technology by making its appearances the focus of inquiry.

Technology *in* practice: a structurational approach

In her article *Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations* (2000), Orlikowski proposes what she calls a practice lens that can allow us to focus on the use of technology as a process of enactment. Enactment is defined with reference to a dictionary definition: to constitute, actuate, perform, or to represent in or translate into action (ibid., p. 425n2). The term indicates an activity, a process, and an event through which something is done or acted out. Orlikowski uses the term to extend a structurational understanding of technology design and use (inspired by Giddens' structuration theory, 1984). In structurational models, technologies are approached as embodying social structures, which have previously been built into technology - most often by designers. This is a process of construction through which designers' intentions, or, social, political, and moral structures such as hierarchies, procedures, and knowledge become written into material artifacts. This way of thinking is similar to Akrich's notion of scripts discussed in the previous chapter. Once embedded with properties, technologies work back in shaping the social, structuring organizations, work practices, and use activities in particular ways.

This way of thinking the relation of technology and social practice is quite common in both IS literature (e.g. Orlikowski 1992, DeSanctis and Poole 1994) - and in social studies of technology (e.g. Bijker et. al 1987, Mackenzie and Wajcman 1999). The image is recursive. The social shapes technology, and technology shapes the social. This is a perpetual interplay, and over time the social and technical are increasingly enmeshed and

entangled in one another through this process of mutual shaping – or recursive structuring. This is a useful way of thinking about how information technology and social practice co-evolve through a dynamic interplay. Yet, this view presumes that a technology's physical properties are in place and stay in place after being constructed. This view falls into the universalizing trap of treating the properties as fixed, stable, and the same everywhere and at all times.

Orlikowski sets out, as I do, to point out problems with this perspective and with the very notion of design as construction. Her first problem concerns the concept of stabilization and technology as 'embodying structures'. I will present her points of critique and her way of working around these problems to better account for ongoing evolving changes in technology and usages.

Stable properties?

Firstly, the notion of technology as a fixed and stable entity does not align with empirical evidence and contemporary circumstances where technologies are modified, continually evolve in use, and do all sorts of things neither anticipated nor planned by designers. Orlikowski posits the following critique of existing structurational models:

“[T]heir presumption that technologies embody specific stable structures is nevertheless problematic because it depicts technologies as static and settled artifacts with built-in arrays of fixed and determinate structures that are (always and readily) available to users. Such assumptions of technological stability, completeness, and predictability break down in the face of empirical research that shows people modifying technologies and their conceptions of technology long after design and development (Rice and Rogers 1980, von Hippel 1988, Ciborra and Lanzara 1991).” (Orlikowski 2000, p. 406)

Orlikowski refers to a range of studies of how use evolves in ways unanticipated by designers. Examples include misunderstandings of designer intentions, inadequacy of user skills and competencies, or, that users deliberately resist, alter, or work around the technological design perhaps by adding, modifying, or substituting procedures or elements. Like Orlikowski, I find it valuable to be attentive to this excess – the actions, outcomes, and detours that cannot be explained by the technology or design as source. This shifts focus away from the interior stable properties of technologies to that which is enacted and emerges. This focus corresponds to that of Büscher et al. (2001), Aanestad and Hanseth (2000), and Hales (1994) presented above. Orlikowski, however, is more

specific about the problem and suggests that the dilemmas of the field derive in part from *starting with the artifact rather than starting with practice*. Orlikowski problematizes this construction notion - that structures are embodied *in* the technological artifact.

Orlikowski argues that technologies can only be seen to structure action when *routinely mobilized in use*, when linked to and made part of specific practices and settings. If a new technology does not get off the shelf, what does it structure? Perhaps something somewhere we could study empirically, but it cannot be said to determine use. What emerges – or is structured – depends upon particular practice. She offers an everyday example of how people most often use less than 25 percent of the available functionalities in standard software tools such as word processors, spreadsheets, or presentation graphics. Most of us focus on the few elements and items that are necessary to complete the task at hand and simply ignore other parts of the software.

Orlikowski elaborates upon her practice lens with a critique of more traditional sociological ways of thinking about structures, rules, and resources as existing either external to and independently of human action (out there), or, as internal schemas built into people as programmed rules of thumb, skills and judgments, or cognitive abilities (in our heads). With reference to Taylor, this view is criticized as objectivist reification - rules exist out there prior to and independently of our action - and as subjectivist reduction - that rules and procedures reside internally in individual subjects (Taylor 1993 in Orlikowski 2000, p. 406). The problem with both of these views is that they assume that rules and procedures exist outside and separate from practice, be this in individuals, in communicative structures, or in material objects. With her emphasis on practice, Orlikowski seeks to counter these views and to understand technology's capability to structure the social as something always unfolding in and through practice.

Ongoing enactments

The concept of enactment is brought in by Orlikowski as a resource for thinking about the world as dynamically in the making. She stresses that it allows us to study how that which we might think about as structure is always constituted *in* practice and only gains its existence through performative events or moments. This view takes as its starting point the practice, and always looks for structures, rules, and procedures as outcomes or effects of practices. Social structures are embodied in instantiations, not in the materials of the technology.

Orlikowski argues that by studying enactment we are better equipped to acknowledge and account for the processes through which technologies are used - both in line with the designer's expectations, but also in new and different ways that may be different from or perhaps contradict or exceed the intended use foreseen by the designers (Orlikowski 2000). This view allows us to explore, as Orlikowski moves on to do in the article, the differences in use – different versions of the artifact that evolve through use. Technology in practice is seen as an ongoing accomplishment, “a situated and recursive process of constitution” (ibid., p. 407). This allows us to think about technologies-in-use as being continually enacted, and long spirals of repetitive enactments come *to look* like sameness and stability. A stability that is always provisional. According to Orlikowski, what we can and should study is thus such practices and processes.

“Rather than starting with technology and examining actors appropriation of its embedded structures, this view starts with human action and examines how it enacts emergent structures through recurrent interaction with the technology at hand.” (ibid., p. 407)

In her discussion of technology and practice, Orlikowski distinguishes between a technology-as-artifact and a technology-as-practice. Technology-as-artifact is described as the “bundle of material and symbol properties” and technology-in-practice is “what people actually do with the technological artifact in their recurrent, situated practices” (ibid., p. 408). And while I follow Orlikowski's commitment to studying technology through a practice lens and her view of seeing any structure (the structuring effects of technology, the global, the macro) as an outcome of ongoing practice, this is where I depart from her view. I suggest that she does not press her own critique far enough. What starts out as a critique of the construction view (artifacts as designed by designers and thereafter the same and stable every time and every where) ends up as another version of this view by maintaining the IT-as-artifact as an object existing ‘outside’ of practice and discourse. The IT-as-artifact stays in tact. Before returning to this point of disagreement I will first present a second approach to the study of technology practice.

Technology as practice: a relational view

To introduce a way of studying technology *as* practice I will turn to STS researchers de Laet and Mol and their way of thinking through the concept of enactment (de Laet and Mol 2000, Mol 2003). Unlike Orlikowski, de Laet and Mol are less interested in developing a robust theory, but they use the term enactment much more loosely to bring

a number of empirical questions and problems into focus. Their work represents a very different way of doing research and producing new knowledge. And I will therefore present their work as providing ‘analytical tricks’ for investigating material objects in practice.

De Laet and Mol’s work forms part of a wider STS group of researchers who are theoretically concerned with shifting social science away from dealing only with social structures, communicative layers, symbols, and meaning, and with moving sociological theorizing into the physical realm of material objects, nature, bodies. These aims entail new ways of thinking about relations of the social and the material as ‘mutually constituted’ and not belonging to different ontological domains (see e.g. Latour 1999a, Law 1999). The work of de Laet and Mol can thus be grouped together with other STS work that is particularly preoccupied with materiality (for example, how materialities appears and vanishes) and socio-material hybrid phenomena. Both these preoccupations resonate with concerns of ISD research and have provided a theoretical resource for the field as seen, for example, in the work of Büscher et al. (2001), Aunestad and Hanseth (2000), and Hales (1994) presented in chapter two.

This orientation furthermore foregrounds the very practices, events, and situations in which objects are handled, made, and re-made. Similar to Orlikowski’s suggestion to start with practice and not the object, de Laet and Mol’s study implies never viewing objects as given beforehand, but as always brought into being through practice. They illustrate how technological objects can be investigated through the practices in which they are made, used, adjusted, become localized, framed, visible, or invisible. Again similar to Orlikowski, de Laet and Mol aim to move away from the notion of construction that posits that objects, once constructed, are stable and fixed entities: Maintaining identity and stability of any object requires continuing efforts. Things fall apart, need to be used, maintained, and valued. In short, they *are* through all sorts of practices. This turns the focus of study around and renders technology not what one begins with, but what gets constituted (Mol 2003, see also Law 1999).

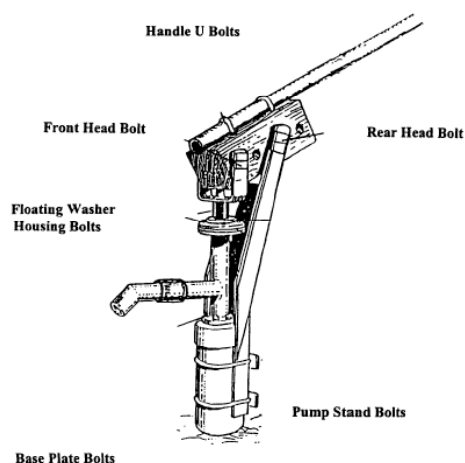
I will give an example to illustrate what this entails. The example is from a study by de Laet and Mol (2000) of a water pump in Africa. They analyze the pump, a technological

object, as adaptable, flexible, and ‘fluid technology’.³² I will outline their arguments and then contrast these with the proposals of Orlikowski.

Appearances of a fluid technology

De Laet and Mol explore different ways of describing what the bush pump is and explore the different practices in which it is located. On the one hand, it has a history. An inventor and an engineering company have developed it in different versions. Secondly, it has a certain look and feel. They describe what it looks like as well as a number of invisible parts that are under the ground, the mechanisms that pump water out of a well (see figure below). Next, it can be compared and described as different from other pumps, for example by way of its effective hydraulic system, its durability, and specific functionalities. There is thus a range of possible descriptions, each of which enacts particular properties of the pump (ibid., p. 237).

Pump Head as Pictured in Instruction Manual



Community Drilling a Borehole



Figure 4: Bush pump and community drilling borehole
(source: de Laet and Mol 2000, p. 229 and 233)

The bush pump also appears differently from one village to the next. It is set up in slightly different ways. Different parts and pieces have been removed, renewed, added, or

³² Here, I draw on an earlier article by de Laet and Mol (2000) rather than on Mol's newest book since this is about bodies and medicinal practices and would be a further excursion from the subject matter of the thesis. The analytical strategy is elaborated upon in more recent work in which Mol also names her analytical approach 'praxiography' (Mol 2003). "[A]n ethnographer/praxiographer who sets out to investigate diseases never isolates these from the practices in which they are, what one might call enacted. She stubbornly takes notice of the techniques that make things visible, audible, tangible, knowable." (ibid., p. 23)

tinkered with from one village to the next. De Laet and Mol describe how, in the villages, the pump has to enter into a collaborative relationship with other technologies, such as a drilling device for boring well holes for the pump. And the local villagers need to be engaged and to collaborate for the pump to start working and keep working. So the pump is also closely tied together with the local communities and family relationships, and another appearance thus includes these people that make it work, their collaborative efforts and organization, their use of instructions, and their collective tinkering about.

Lastly, de Laet and Mol look at the practices of the Zimbabwean state and how the pump is part of a national strategy for building an infrastructure for clean water. Distant actors can also be seen as forming a part of the pumps, for example governmental agencies, NGO's, and the engineering companies that are continually supplying new parts. The pump is also a national health promoter and a way of encouraging units of collective action in the villages, thereby building a stronger nation. De Laet and Mol suggest thinking about the pump's existence as *co-extensive* with this whole line of other things, people, and activities. In this way, they unravel a set of different descriptions and practices that *frame* the Pump in different ways.

“[I]ts boundaries are not solid and sharp. The pump is a mechanical object, it is a hydraulic system, but it is also a device installed by a community, a health promoter, and a nation-building apparatus. It has each of these identities – and each comes with its own boundaries. To write about the Bush Pump in this fashion means that we do not mobilize the arid trope of describing a small technological artifact as if it were surrounded by large social environments – to which it inevitably remains alien. In each of its identities the Bush Pump contains a *variant* of its environment.” (ibid., p. 254)

The article unpacks these different identities and explores the different enactments of the technology. It is, however, not completely random and can't be just anything at all. “...the Bush Pump's various boundaries define a limited set of configurations. They each, one might say, *enact* a different Bush Pump” (ibid., p 237).

In applying this strategy of analysis, de Laet and Mol also question what it means that the pump “works”. They look at the different and continual practices of villagers repairing parts, adding new parts developed by the engineering company, or experimenting with their own solutions for solving problems that come up with the pump. New bits and pieces are continually added over time for the pump to work. It is taken apart and put back together in new ways.

The analysis of Laet and Mol is useful because it opens for a way of thinking about grades and shades of working. Workability is, on the one hand, defined by the measurements of cleanliness and official, standardized health indicators. Whether the pump works is dependent upon whether it produces clean water. What defines clean water is dependent upon international criteria for measuring the count of E.coli bacteria in one liter of water, for which one needs specific measurement instruments. Some pumps meet these criteria. Some do not. Some pumps are not tested at all. And when tested, the measurements can also be tinkered with and handled in ways that sometimes make the count fit and the pump work a bit better. Success or failure is thus variable and dependent upon a range of other elements such as water, bacteria, instruments, and calculation procedures. Working is a matter of tinkering and assistance and is also related to other elements such as the size of the well, the organization or conflicts of the village people, national health committees, and engineering companies.

“This also more sharply frames the question about whether or not the Bush Pump succeeds in its activities, since this is different for each of its identities... The Pump may work as a water provider and yet not bring health. It may work for extended families but fail as a connecting element in larger communities. It may provide health in the dry season but not in the rainy season. It may work for a while and then break down.” (ibid., p. 254)

Different enactments assemble together and produce consequences, such as the pump being successful or providing better health in Zimbabwe. De Laet and Mol suggest that the pump holds together precisely because of the many differing local enactments, distributed action, and surprises (ibid., p. 253). They therefore suggest thinking and talking about the pump as a fluid technology, a flowing object that does not have a fixed pattern or boundary, but may alter shape as it flows or meets with other elements. Also, the very configurations of which the pump is a part are not stable either. Villagers and families may fail to cooperate around drilling holes and maintaining the pump, and spare parts may be unavailable at different times and places. The configurations and relations the pump is part of gradually shift and change. The central point here is that these subtle changes in the relations that sustain the pump, and a series of different enactments and gradual adaptations, allow for the pump to hold together as an overall successful, working, and continuous technology. The analysis moves across different levels of abstraction and combines these in the analysis. For example, national strategies, water bacteria, screws and bolts, and village communities are analyzed in similar terms as

elements that form part of the configuration that shapes the pump as a working technology. They illustrate that boundaries between technology and context may be drawn in different ways. And the authors thereby suggest that the very distinction of what is defined as technology or context – properties of the pump or the community – is also an enactment, a boundary continually drawn in practice.

If we link back to the studies I presented in chapter two, de Laet and Mol's line of thinking resonates with Büscher et al. (2001) and Aanestad and Hanseth (2000). These studies similarly build upon an actor-network tradition and view a working technology as made up of heterogeneous practices and thus dependent on a range of elements. As discussed in chapter two, this style of analysis moves away from treating technology or practices as surrounded by context and concentric circles, but instead uses imagery of extended networks and network configurations. De Laet and Mol extend this way of thinking by arguing that nothing in particular holds the pump in place and that the pump gradually incorporates (and transforms) its surroundings.³³ Here I would like to emphasize the analytical move de Laet and Mol make in that they let go of talking about the artifact *outside any description or practice*. Instead they make parallel many different descriptions and practices and study how the line between artifact and context blurs and shifts.

IT-as-artifact as a particular enactment

I will now compare this analytical trick to Orlikowski's practice lens. Orlikowski launches the practice lens to say something new about how technology's structuring capabilities emerge through use. And it is her way of working towards the five premises for how we should re-theorize technology (2000). I have suggested, however, that Orlikowski falls short of her target in that she retains the notion of IT-as-artifact as something that lies outside of practice, outside of any discussion and debate. Orlikowski separates the material properties embodied from instantiations through her distinction between technology-as-artifact (stays stable) and technology-in-use (as instantiations). She describes the "symbolic and material properties" that are embedded, prior to use – that users then misunderstand, ignore, react to, or respond to. The vocabulary she applies is one of humans choosing, adapting, and inventing ways of engaging with technology to

³³ For a further elaboration on fluidity metaphors and the critique of actor-network theory implied, see Law and Mol (1994).

accomplish various ends (in a humanistic resistance sense). With Orlikowski, use and instantiations unfold above or outside the artifact. A slightly more radical practice commitment exemplified by a study of de Laet and Mol is to always ask *where* IT-as-artifact can be found.) In a footnote from Orlikowski's enactment article (which quotes Grint and Woolgar 1995, p. 298) Orlikowski seems to be in line with the radical practice way of thinking about the object:

“As Grint and Woolgar 1995, p. 298 remind us ‘[Technology] exists only in and through our descriptions and practices, and hence it is never available in raw, untainted state’. Thus, even the description and observation of ‘technologies’ and their ‘properties’ including their designation as artifacts, is a kind of *use* of that technology.” (Orlikowski 2000, p. 425)

However, she continues to maintain the distinction between technologies as artifacts and the use of such artifacts as an analytical distinction “useful in both empirical research and everyday usage” (ibid., p. 425). In contrast, I suggest that treating the IT-as-artifact as a particular enactment can open for new lines of inquiry. This view – or even more radical commitment to practice – presses us to rethink and accept technology as a phenomenon of which there can be no self-evident or transparent account.³⁴ In recognition of this theoretical dilemma de Laet and Mol avoid talking about the pump's properties a priori, but work towards understanding properties in relation to specific descriptions and practices. Properties are thought of as something to be examined as co-extensive and dependent upon a range of elements and practices.

IS researchers Bloomfield and Vurdubakis similarly point out how we tend to ignore the question of how technology becomes recognized as such:

“Technological objects do not speak for themselves, we posit such objects in our accounts of the technical and then speak on their behalf. For example, in seeking to describe the material or physical properties of technology one does not leave the social behind and cross, as it were, a boundary into the realm of the technical: for such description is inherently social. It implies that certain objects and practices can

³⁴ See also Grint and Woolgar (1998, p. 21ff) for a review of different sociological theories of technology and a similar discussion and critique of the essentialist assumptions embedded in structuration theories of technology. Grint and Woolgar advocate analyzing technology as text, and in doing so build on semiotics similar to Mol's praxiography. Their differences are beyond the scope of my discussion.

be demarcated and distinguished from others on the basis of an agreed set of properties.” (Bloomfield and Vurdubakis 1994, p.9)

Bloomfield and Vurdubakis point out that locating technological artifacts as single and coherent entities also requires work. When moving into practice, IT implodes into an array of distributed elements and practices. With this line of thinking, we can see the ‘IT-as-artifact’ as a particular enactment - that is enacted recursively in so many places and times that it appears self-evident and becomes taken-for-granted. Bloomfield and Vurdubakis suggest constantly being aware of *how* technology is recognized as such and to think about how “... any account that takes the “properties” of a particular technology as its starting point, is from the beginning caught up in those practices that generate and sustain the objectively given quality of those properties” (ibid., p. 10).

Following Mol and Bloomfield, I suggest that it is not so much a matter of eliminating such accounts as a question of locating these accounts. A radical practice commitment thus abandons the very notion of the symbolic and material properties that Orlikowski describes and continuously works back to investigate the practice in which something is said to be social or material. Technology-as-artifact is *also* achieved in practice, and as Bloomfield suggests, we may benefit from being more attentive to the particularity of these enactments. If we are not, technological artifacts slip into being “everywhere and the same again”.

Juxtaposing different appearances and descriptions as de Laet and Mol do in their study of the bush pump, is one way of problematizing the fixity and boundaries of technological artifacts. And Orlikowski and Iacono in fact also make this very move in their call for re-theorizing the IT artifact (2001), presented at the start of this chapter. In their survey of ISD and conceptualizations of technology they find a whole list of different versions of technology: as tool, proxy, ensemble, and nominal, and under each of them the authors list additional subcategories. Upon scrutiny, the IT-artifact differentiates. For Orlikowski the lack of a clear theory or account is a theoretical problem. But what if these differences are turned into an opening rather than a dead end? I have found de Laet and Mol’s approach a useful analytical trick for circumventing the problem of the vanishing technology by working empirically and studying the practices in which a technology appears and is framed as such. This provides empirical answers to a theoretical problem.

Law, working with a similar framework, calls this analytical move a principled naiveté, a “what if” experiment (Law 2003, p. 192) that sensitizes us to ask new questions and shift our usual perspective. What if the characteristics and boundaries of artifacts are approached as effects or results of a wider network or arrangement of elements? What might this perspective bring to thinking about ISD in organizations? What possible new problems and questions might such a shift in perspective entail for thinking about information systems and their development? This is the path of inquiry taken in the following analyses.

I will call this approach radical localism and work towards analyzing ProjectWeb as practice, thus viewing the way in which ProjectWeb comes into being as an emergent effect of a set of more or less related practices. Radical localism starts with these practices, situations, and particular moments of enactment rather than starting with the technology. The last section of this chapter summarizes the approach.

Bringing technology into view by studying its appearances

Radical localism is, as I have indicated, a very loose set of principles. The framework has been developed as an analytical resource for sensitizing research to practices and events of which technology is a part. I thus emphasize the framework as a sensitizing device and have in this chapter attempted to outline what this device can bring into view. I will summarize what it does, or has done, for my empirical study and the organization of this thesis. Applying this analytical device in the following analysis, I have refrained from starting with a fixed definition of ProjectWeb, but instead start with practices, situations, and events in which ProjectWeb appears, and I ask openly about what occurs and what emerges. This implies:

- - Never isolating ProjectWeb from the specific settings, situations, and relations in which it is made, made to work, and re-made,
- -Tracing in detail the different network arrangements and configurations through which ProjectWeb is framed, assembled, localized, manipulated, brought into being locally,
- - Scrutinizing how enactments of ProjectWeb, its properties and boundaries, alter and fluctuate with different practices,

- - Not looking for explanations or determinants for what ProjectWeb is, but describing the process – how it came to be that way through distributed, ongoing, and collective achievements.

This approach is illustrated in the following three analysis chapters. I have organized these around three additional concepts: framing, assembly, and interference, to give this approach additional texture. These concepts are thought of as salient to the cases, but not exclusive. These concepts will be presented and illustrated as part of the case stories, and in doing so I will draw additional theoretical resources into the text along the way. The theoretical literature will be accentuated by using a different font just as field notes and interview fragments are indented in the text. These concepts developed are not seen as definitive concepts that demarcate a type of enactment that belongs to design, to use, or to research - but are sensitizing in the sense that they assist us in bringing out, seeing and discussing how technology emerges through particular practices and arrangements.

5. Framing practices

A design workshop event

It is a Wednesday morning, and 17 invited persons have found their way to the conference room inside the newly refurbished buildings and the new corporate site of the NNIT firm. Along with the physical move of site and new layers of paint and finish in these buildings, comes NNIT's newly acquired independence from the pharmaceutical company Novo Nordisk (now Novo and NovoZymes). As an independent firm NNIT now competes with other IT companies for providing new IT systems and consultancy services within Novo and NovoZymes. Also, the new firm now targets a wider market of other companies which may or may not be engaged in pharmaceutical production. As participants sit down, most take out an email print sent out a week before this gathering. The email invitation sent by Michael, a systems developer from NNIT, includes a notice about the new buildings and room number, an agenda for the day, as well as information about a new project starting up for the development of a version 4 of ProjectWeb. ProjectWeb in its new version is to be redeveloped as a more generic system to be sold not only to development projects and departments within Novo and NovoZymes, but to other firms and industrial branches. The email also explains the renaming of ProjectWeb to PWeb and how this reflects the move away from developing ProjectWeb as a tool mainly for pharmaceutical project work. A report is attached to this email about the new version and a system description of features the new PWeb might include. As all the invited participants sit down around the table, most take out their copy of this report, many of which are annotated with highlighters and comments. My research group has also sent out an email with a report entitled *Uses of ProjectWeb* to be presented as the second point on the day's agenda.

Michael opens the meeting by welcoming the participants and introducing the plan for establishing an overview of needs and requirements before developing a new and improved version 4 of ProjectWeb. He then asks everyone to briefly introduce themselves, indicating company affiliation and experiences with and interests in ProjectWeb. Then the participants present themselves, as NNIT employees, as academic researchers (myself and four co-researchers), and as employees from various departments in the pharmaceutical company (the growth hormone research section, two different production sites, the research library section, and the management department for development projects). Most have been involved in the development of earlier versions, and Lars, a senior librarian from the research department, introduces himself, for example, as being involved "way back when ProjectWeb was in its first baby stages". Another participant, Marge, has brought a long list of requirements she has put together based on experiences and requests

from project assistants in the Project Management Department, and she waves this in the air as she proudly presents herself as the main ProjectWeb administrator and support person in that department.

Following the first item on the agenda, Carl, a graphic designer at NNIT, steps forward, wearing a slick business suit and with his long hair tied back in a ponytail. Carl begins his presentation by walking up to the blackboard at the end of the room and writing the question "What is ProjectWeb?" He runs through ProjectWeb's development history and explains how it was first developed as a document management tool for project use and how it expanded through use into areas of content management as well as project management as new modules and features were added. He adds that today we even find it providing glimpses of e-Collaboration possibilities as smaller groups within development projects have taken up the technology for working together on specific short term tasks. After writing the words Document Management, Content Management, Project Management, and e-Collaboration on the blackboard, Carl rhetorically asks how these aspects of ProjectWeb link up to or compete with other systems. Regarding document management, he mentions Documentum (a central company database for all regulatory documents concerning, for example, clinical trials), private and public file folders on local area network servers (LANS), and Lotus Notes, which has been employed for collaboration in some projects and departments. He illustrates each of these systems on the blackboard with database symbols. ProjectWeb for content management competes – or could possibly be tied to – a range of databases, the WebStarterKit (an internally developed web-publishing application), a web version of Lotus Notes, Broad Vision, Interwoven, e-Venture, Luna, and others. Next, e-Collaboration competes with Outlook Exchange (a Microsoft calendar system). After elaborating on the similarities and differences between the technologies depicted on the board, Carl moves on to describe how ProjectWeb could become "a very cool system if we establish processes to use it systematically. ProjectWeb combines features from all of these systems on the blackboard." (The picture on the blackboard now resembles the figure from the report in front of all the participants.) Carl suggests that by "putting it all into one huge bubble, then we can actually talk about Knowledge Management instead of competing systems". As he pulls together these systems in a big chalk circle, Carl lists out various knowledge management advantages of developing a new version of ProjectWeb as one central integrating system through which all other applications and document repositories can be accessed. (NNIT workshop observation)

What is going on here? For people familiar with the worlds of systems development, this is a somewhat recognizable scenario of developers, a sample of 'representative' users, and an agenda and organized setting for a mutual discussion of the benefits, problems, and potentials of a new information system. A bit more unusual perhaps, is the presence of

groups of ISD researchers that have been invited to inform the process and mediate some of the diverse use practices taking place in different parts of the organization. By bringing together people from different parts of the organization, these introductions as well as the presentations and debates throughout the day cover very different descriptions and ideas about what ProjectWeb is and should be. Lars, the librarian, stresses that the first version was developed to conduct literature searches relevant to specific research projects, to create overviews of these search queries, and to provide direct links to other literature databases. According to Lars, this should remain high priority. Marge, with reference to her list of requirements, stresses that ProjectWeb's document database is the most important feature of ProjectWeb and currently unsatisfactory. Others call for more customization features and, for example, possibilities for changing background graphics. In Carl's opening presentation he outlines current complications of having so many diverse systems in use and notes how ProjectWeb has evolved through three previous development phases to span various system types such as document management, content management, project management, and e-collaboration. His presentation revolves around the diversity of ProjectWeb use and compares this versatility to various other information systems with which ProjectWeb currently competes. He thus renders the competition between ProjectWeb and various other systems in use and the advantages of increased systems integration as the central issues.

One possible view of technology and discussions about it would be to look at the presentations, the participants' commentaries, and perhaps the figure on the blackboard and the report, as perspectives upon or interpretations of the technological object existing and in use somewhere outside the workshop. The discussions, the report, and the figure on the blackboard thus represent the concrete thing somewhere else. In analyzing this workshop situation we might then look either for correspondence between "the thing" and the various accounts or seek social explanations for why different accounts take the form they do. How adequately do the report, Lars' historical account, Marge's list, and Carl's map of systems in use represent ProjectWeb and related practices? What do they include or exclude? And why? In searching for explanations, we might look to how the various accounts can be linked to the background, position, or social world of Carl and other participants and how these infuse or warp the way in which various participants represent the technology. Instead of searching for correspondences and explanations, however, I will invert this way of thinking about

representation by approaching representation as construction of the material world rather than as a reflection of it.

Representation: Throughout this chapter, I draw on STS studies on representational practice (e.g. Latour 1990, 1999a, Lynch 1990, Goodwin 1994) and on literature that deals more specifically with the role of representations and representational practices in systems development (e.g. Suchman and Trigg 1993, Kyng 1994, Newman 1998, Bødker 1998). In a detailed study of representational practice among artificial intelligence researchers, Suchman and Trigg, for example, explore the whiteboard activities that make scenarios, abstractions, and formalisms relevant to the particular purposes at hand (Suchman and Trigg 1996). They analyze the practical activities of sketching, gesturing, and collective discussions around the whiteboard as a process through which the researchers develop a specific understanding of the phenomenon and make relevant certain problems and concerns. Bødker similarly addresses the question of what work representations ‘do’ in design (Bødker 1990). In discussing alternatives to the conventional idea that representations are mappings of present or future work practices and computer applications, Bødker illustrates how representations, for example, enable developers to divide and delegate work, act as contracts with management, or are productive for cooperation and dialogue with users. In various ways, representations can be seen as mediating the systems development process, forming a basis for particular actions (*ibid.*). This kind of analysis of what representation do, how they participate in constructing the world stands in contrast to a notion of representation as mirroring the world.

In thinking about representations as construction, we can analyze this workshop situation as a moment or event in which an information system is bounded and rendered observable as an entity with specific characteristics. Similar to the methodological dilemmas I have discussed in chapter three, neither the developers of NNIT nor other workshop participants have one location from which they can overview the entire distributed information system and the complex of related interdependencies and practices involved. Their picture of the system is, like mine, pieced together by notions about what a web-based information system “is”, previous work and experiences, as well as through deploying techniques, figures, and representations such as Marge’s list of requirements or the figure and symbols Carl depicts on the blackboard.

In the workshop introductions that are summarized in the vignette above, each participant relates their different ways of using ProjectWeb in particular departments or projects, some with their earlier involvement in the development of previous versions and some with reference to the report, for example main features or uses that they would like to see redeveloped in the next version. The discussions are thus materially embodied

in both previous practices and in this workshop situation. Lars, for example, mobilizes a historical trajectory and his own personal involvement, Marge a list of requirements that stands in for the use experiences of a whole department. Carl's presentation is also acted out not only through talk, but also by means of very material gestures and by the layered sketch on the blackboard to depict how different system types compare to other information systems in use. Likewise, the invitation email, the agenda, and reports that the participants have laid out in front of them also participate in staging the event.

In this way, the workshop is a set-up or event that works to trace, mediate, and render a complex and distributed technology observable as a bounded object that can be acted upon. This is done in specific ways and may be seen as a process that draws a boundary around "what ProjectWeb is", what is important, desirable, necessary, or problematic. This process entails *framing* technology as distinct from a range of related practices and interdependencies.

Framing: In an analysis of economic markets, Callon explores framing as a process by which a line is drawn between, on the one hand, bounded passive commodities, and on the other, active calculating human actors that produce, consume, and distribute goods (Callon 1998, 1999). "... if calculations are to be performed and completed, the agents and goods involved in these calculations must be disentangled and framed. In short, a clear and precise boundary must be drawn between the relations which the agents will take into account and which will serve in their calculations, on the one hand, and the multitude of relations which will be ignored by the calculation as such, on the other." (Callon 1999, pp. 186f). Performing an economic calculation and making a decision about action thus involves making particular relations and connections external and disassociated. He gives the example of a car as an identifiable and distinct object that can change ownership in a transaction between buyer and seller. This is a disentangling of the car as a bounded singular object separate from other goods and from the networks of practices through which it has been produced or is maintained. While such a framing allows for the economic transaction, Callon highlights the impossibility of cutting all ties. With the car travels, for example, particular traces of know-how, histories, and practices of the producer that might be imitated by a competing firm as well as needs for spare parts or repair. Framing is therefore an ongoing achievement and never total. Specific relations may defy framing, rendering processes of *overflowing* part of any framing.

In the following, I turn to analyze Carl's blackboard sketch of competing systems. The report, the drawing, and the presentation define the current version of ProjectWeb by features of document management, content management, project management, and e-collaboration, a typology or classification scheme common to developers and people

working within the area of technology production. ProjectWeb is thereby defined through its similarities to four more general types of systems and its placement in such a classification scheme. The question of “what ProjectWeb is?” is posed in terms of singularity and answered through a comparison to other singularized technologies, generalized types and specific products developed elsewhere and either competing with ProjectWeb or potentially interfacing with it.

Opening up episodes from this workshop – as a moment in a systems development process – I provide a snapshot of the complex interdependencies and how these are addressed. Following a further analysis of Carl’s opening, I turn to a presentation on ‘ProjectWeb uses’ conducted by my research group as an example of different framing. In contrast to Carl’s account, I look at our presentation as a technique for seeing and representing ProjectWeb that relies on a different set of practices, figures, and techniques. Whereas the first framing can be traced into traditions of software development practices, the second presentation of the workshop re-enacts very different disciplinary practices, humanistic ideals, and a research tradition of user-centered design. In a third and final section I turn to the differences and similarities between the two accounts and to the ways in which these are taken up in a subsequent discussion among workshop participants and reworked with reference to a number of other concerns and experiences.

Framing ProjectWeb as discrete technical entities

In Carl’s presentation and in the report figures, a set of boxes and arrows is mapped out in two dimensions. The figure below is imported from a system description report and resembles Carl’s blackboard sketch described in the opening vignette. In this sketch ProjectWeb is framed as a set of discrete technical entities. The technological components are singularized and disentangled from a complex network of technological infrastructure and continual processes of development, maintenance, and use practices. These are outside and separate from the technical object.

At the blackboard, Carl draws a row of cylinder-shaped figures and explains that these are the organization’s main document repositories, database systems produced and sold by various vendors. In the middle layer, a number of mediating applications allow underlying systems to interact with the company network and produce “diverse output” on networked employee workstations, which is illustrated as a top layer of user interface symbols. ProjectWeb (on the right in figure 1) is linked to a separate application server (IIS App Server). Carl connects this symbol to another

cylinder and explains that the server connects to another database (SQL) and is accessed through an Internet browser depicted as the layers of windows and “web pages” (top box left in figure 1). Carl explains how one main PWeb 4 platform will form the foundation on top of which various modules that enable interaction with specific systems and provide specific services can be added. As Carl draws the line around all the systems now on the blackboard, he depicts how ProjectWeb thereby will become the main portal and framework for enabling the communication between all the devices and applications. Users, illustrated by two user stick figures under the bubble (he adds to the figure), will be able to access all the various document repositories. Carl explains enthusiastically how this will allow for cross-organizational knowledge to be integrated, accessed through one main interface, and thus accelerate information exchange and retrieval across multiple document repositories at once (the cylinders at the bottom). This new system will not only glue existing databases together, but reshape the whole organization in one big knowledge sharing bubble.

Carl then elaborates on the built-in advantages of flexibility. An IT administrator can turn modules on or off and control or enable/disable functionalities and parts that are running and visible on the different running webs. Here the customer might only pay for the enabled components rendering ProjectWeb a flexible product that can bend and merge with different needs and demands. Carl concludes the presentation by referring to the two stick people – the customers and users – and how they comprise many different demands, qualifications, and ideas about how they wish to use ProjectWeb. An increasingly flexible and modular system architecture would make ProjectWeb “into a generic collection of features, so that you can have the tool that matches your needs exactly.” (NNIT workshop observation)

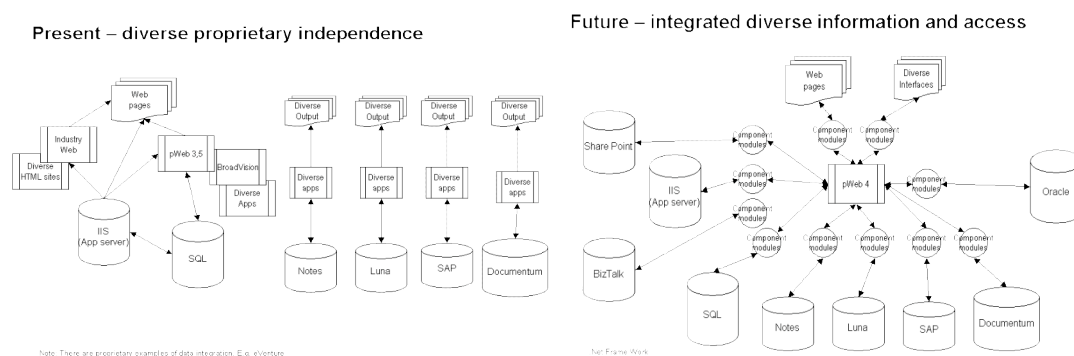


Figure 5: 'ProjectWeb today' and 'what is to be done' (source: NNIT ProjectWeb system description 4.0)

This depiction of ProjectWeb is intricately linked to (and constituted through) practices of redevelopment and market competition. ProjectWeb is a discrete technical entity that

can be plotted onto a larger inevitable technical trajectory of past and future system types. The current version, benefits, problems, features, and functionalities are spoken of and continually redefined in relation to a future version and potentialities and vice versa. The future vision - of what ProjectWeb might come to be - cuts across all systems and envisions ProjectWeb as an "integrating tool that allows putting it all together" in one bubble for knowledge sharing among dispersed project members, as a superior technology that might subsume all the others.

This depiction of ProjectWeb is not Carl's alone, nor is it particularly strange or surprising. The notion of a singular generic system, classification schemes of (singular) system types, and talk of technological phases and trajectories can be traced through an extended network of engineering education and practices. One cylinder symbol and the word "database", for example, invoke an entire research tradition and know-how - as do the various system names written out on top of these symbols. Ideals of building one central system that will integrate and subsume all other sub-systems likewise reverberates throughout academic and media discourse on the potentials of IT and, more recently, web-technologies. This singularizing figure and presentation rely upon these reverberations in re-enacting a specific way of representing information technology as well as the benefits it may bring. These notions can thus be traced into academia, media, a tradition of engineering practices, as well as NNIT's present situation of new market competition. Technology is framed as a set of discrete entities with technical attributes that render ProjectWeb flexible and transferable. At the same time, it is such reduction and simplification that makes this kind of technical representation useful to development work, as is discussed in the following.

Reshuffling relations to customers and vendors

The blackboard presentation provides (a specific) overview of the situation at hand and works towards rendering the many practices, components, and interconnections more manageable. This representation thus does the very job of mediating or translating between the complex of practices and this particular event, at which ProjectWeb is to be evaluated and plans for future actions are to be laid out. The representation is a mechanism for seeing ProjectWeb, seeing what is going on, making claims about how the current state should be re-arranged, and it holds on to something not yet known, a vision of how ProjectWeb might become the central system that ties together all other databases and diverse applications. Figures like these make the work of developing and

managing information technologies possible, they provide overviews and allow developers and designers to locate problems, to divide and distribute work, and to show what has to be done, as indicated by Bødker (1998).

Embedded in the two figures is, for example, a reshuffling of relations to customers and users. Customers are expected to know what their company and department needs, to articulate these demands and combine the appropriate modules, or, pay for additional new consultancy services that can assist in this process of selection and customization. They will, in the new version, no longer buy ProjectWeb as an application, but access it as a service on an NNIT server as a web-service, where they pay for the number of licenses they need and pay for updates or new modules as new demands arise. In this way, the figures form part of the company's attempts to propose and discuss new orientations and ways of organizing development work towards generic platforms, web-services, and shifting user-developer relationships. These issues are specific to NNIT's situation of recently becoming an independent firm and having to navigate and position themselves in a shifting landscape of technological development, alliances, and competition. Concerns and target groups have shifted, involving altered relations to customers as well as to other vendors. To clarify this point, I will backtrack discussions (from other interviews and informal discussions before and after this workshop event) concerning the choice of development platform and previous problems of transferring ProjectWeb in its current version to other user organizations.

In earlier meetings in NNIT, several debates, meetings, and negotiations have revolved around the choice of platform, programming environment, and architecture. This digression illustrates some of the debates and concerns that one icon in the figure – the Share point icon - stands in for (cylinder to the left in figure 5). In the months preceding this workshop, various vendors have been invited to demonstrate their generic “ready-to-install platforms” upon which the ProjectWeb modules may be built. Among these are Share Point, Composite, Exchange 2000, and HP's BroadVision. These products provide different constraints and possibilities for adding and extending modules. They have different infrastructural requirements, tie into certain standards, and have been weighed up against current network configurations in the pharmaceutical company and other potential customer firms. In addition, the dependency of the platform implies that the success of ProjectWeb is also dependent upon other vendors' market success and redevelopment. Furthermore, different vendors have different licensing and maintenance

agreements. This then entails that ProjectWeb must be sold with a similar licensing and payment, which in turn feeds into whether ProjectWeb can be defined as a product or perhaps is more of a web-service that is rented out rather than sold. The choice of platform thus involves balancing the advantages and disadvantages of the various interdependencies involved. These interdependencies include integration, standardization, uncertainties of market shifts, as well as how to organize future work under tight time-pressures so that modules, for example, may be re-used for other purposes and products, may be changed and added without rewriting the entire application code.

In an earlier interview Neal, the main programmer of ProjectWeb, has explained how the system is caught up in and emerges through the company's struggles to find a place for itself and ProjectWeb in shifting market conditions. At the same time, his work is moving into services of customization, perhaps creating minor additions necessary for the specific setting of use rather than developing new solutions from scratch. His orientation is toward more general trends and toward software development taking place elsewhere and is one way of thinking out new positions for this corporation in this shifting landscape. Neal explains the difficulties NNIT has experienced in selling and implementing ProjectWeb in other organizations due to the Microsoft standards upon which it is built. The transfer of ProjectWeb to other firms has been problematic due to the intricate connections between ProjectWeb and the local platforms and technologies in use in the pharmaceutical company.

“Basically, all you need to run ProjectWeb is a web-server and a database. Well, then the web-server has to be Microsoft because the technology is Com-objects, and they only run on Microsoft. Yeah, and then it is made to run on the Microsoft SQL Server, but whether it can do it, I wouldn't bet on it. That's basically all it takes. We have tried to sell it to other companies. CleanCo (a large facility service support corporation) has one running. But the problem is that it wasn't made for that. So there are a lot of little peculiarities that are specific to this company - that are built into the system. For example, when you add new users, then it looks up names and addresses in our internal telephone directory based on the initials you insert. You can't just throw that into another system. These are the type of things you have to shut off when you install it. And then it's really never been made as a package you just can install. You have to create a dummy base and then delete all the things they don't need in the other company.” (Interview, Neal, Systems Developer)

Neal explains how time consuming it is to send out a person to create and test this dummy base and to continually adjust and maintain it, and how they prefer to host the application on their own servers and rent out the application to customers rather than sell it. The quote brings out some of the particularities of ProjectWeb, how it is intricately linked to a history of internal development and integration with other technologies implemented in Novo Nordisk. The difficulties illustrate interdependencies of local infrastructures and the articulation work required to ‘cut technology loose’ from its network of development and transfer it across sites (Hales 1994, Suchman 2002). Extra work and modifications (work Neal hopes to eliminate) are involved in making the transfer smooth and at all possible. More recently, another software consultancy firm has been hired to sell and carry out this work of setting up, modifying, and adjusting ProjectWeb for use in other settings. Grounded in these experiences, a new modular architecture will provide customers with the option of picking out and combining modules as well as ease the work of re-development within the IT company. Neal explains how new modules can be built and added, bugs can be fixed, and updates and adjustments can be made more easily without having to re-write the entire code.

I suggest that these discussions on the choice of programming platforms, new modular architectures, and the advantages of licensing ProjectWeb as a web-service can be read as attempts to juggle the paradox of redeveloping the particular ProjectWeb (developed for pharmaceutical projects and in relation to an existing Microsoft infrastructure in Novo) as a more generic system that would be marketable in an array of different contexts, a technology that might spread with less friction due to a built in flexible modular architecture. I suggest that these discussions are folded into the figures presented in the workshop. Depicting ProjectWeb as discrete technical entities on the one hand frames and disentangles development from the many relations and practices involved: from company infrastructure, from the work of setting up and transferring ProjectWeb. And at the same time, it locates ProjectWeb in a particular network of new technological development practices and competition. Existing technologies in the pharmaceutical company and in CleanCo, for example, (to which ProjectWeb must connect), as well as new technologies produced elsewhere, are thus part of the figure and shape the development process. As discussed in chapter two, these can be seen as active constituents in the development process.

Lastly, personal preferences and the careers of the individual developers are also at stake. The main developer, Neal, is, for example, not very enthusiastic about continuing work in the programming language of ProjectWeb's current version, Visual Basic. He is much more eager to learn and try out Microsoft's .net framework. He has suggested using the development of the new ProjectWeb as a pilot project and showcase for other .net development projects in NNIT. He is planning a trip to California to take a course on developing in the 'dot-net environment', and for him, the choice of platform is the main issue to be resolved, both out of concerns for the generic as well as his own personal motivation and desire for new professional challenges.

Handling complexities via technical representations

These discussions concerning customer and vendor relations, redeveloping ProjectWeb as a generic system, and the personal preferences of the people involved are collapsed into Carl's presentation and the sketches above of ProjectWeb today and in the future. The very representation separates the many interdependencies of ProjectWeb's redevelopment into a set of manageable issues. Looking at some of the particular issues and practices that the presentation reshuffles enables us to think about how Carl's presentation is situated, firstly, in a wider tradition of development practices that frames technology as discrete entities, and secondly, in contemporary concerns of redeveloping ProjectWeb as both a specific systems for Novo Nordisk customers and a generic modular system that may be sold in as many diverse sites as possible.

This analysis of Carl's presentation illustrates how redistributions of development and maintenance work are implied and how customer relations, alliances, and competition with other software development companies are negotiated as part of the representation practice. These depictions are thus a way of bounding a complex of things and relations existing elsewhere and approached here as practice and part of the very specific work of locating ProjectWeb in relation to NNIT's independence and an uncertain future. As Carl animates ProjectWeb now and the new version 4 scenario, he thus articulates specific relations and brackets out others in order to make ProjectWeb available as an entity or set of discrete entities. Problems, issues, and various interdependencies can be dealt with separately and allocated to each of the entities on the board. In this way, the framing is productive for the particular work of gaining an overview and laying out a plan for redevelopment.

What is not included in this framing? Obviously, the two stick figures provide little

insight into the diversity of existing user practices or how the radical changes suggested might actually unfold in the organization. ProjectWeb stands alone as singularized entities. Communication between these entities (the squares, circles, and cylinders) is mediated by other components such as other boxes, arrows, and modules. Once developed, the system will on its own allow applications to interact and to structure and organize information. If the system is flexible and integrated, it is assumed that it will align with existing user needs and diffuse throughout settings of use (with a little technical help from consultants). Here the representations work to reshuffle relations and re-delegate work, but they provide little direction for re-embedding the new version into actual use situations. These two stick figures at the bottom of Carl's sketch are, in contrast, the focus of the next part of the workshop to which I turn in the following section of this chapter. The next presentation at the workshop provides a very different picture of ProjectWeb and reduces the complexities of its redevelopment in a different way.

Classifying users and usage – a second framing

The subsequent point on the workshop agenda is a presentation of our preliminary research findings. Hans, my co-researcher, presents a typology of users and usages delineated during our studies. A report "Uses of ProjectWeb" has been sent out before the meeting along with the system description and invitation. The report and Hans's presentation frames users and usage as the foundation upon which a system should be understood and redeveloped.

Hans steps up to the blackboard, shuffles papers, and turns on the overhead projector. He explains how an interdisciplinary research team of five researchers (myself included) has conducted an exploratory study surveying different ways in which ProjectWeb is used and described among a range of employees within the Development Department of Novo. He explains techniques of sampling employees from different departments and positions within three development projects and of interviewing to produce a report and this workshop presentation. The focus of the study is depicted as a mapping of ProjectWeb's role and integration in geographically distributed organizational work practices, as well as a comparison of the use of ProjectWeb to that of other communication technologies used in distributed project work.

Hans passes out power point handouts and places the first slide on the overhead projector as he presents user types and categories of ProjectWeb usage. He explains that reading through the interviews has produced a varied picture of ProjectWeb

usage. There are remarkable differences in the way ProjectWeb is used and in which features and characteristics are perceived as important. Both ideas and visions about what ProjectWeb can be used for and the actual use varies in the three projects investigated, and furthermore, it varies among project members within one project. The different perspectives on ProjectWeb found in the interviews roughly follow the structure and organization of development projects. It is thus to some degree a person's work tasks and communications profile that shape ideas about what ProjectWeb can be used for and how it is used. The main user perspectives are therefore presented as: project management, core group members, and project members. These are well-known formal positions around which pharmaceutical development projects are hierarchically organized. Hans adds that interviewees may, however, belong to more than one user type. The second part of the presentation describes a more general typology of use derived from the interview material. Four types are defined as publication, orientation, archive, and document sharing.

Publication: ProjectWeb is used for the publication of project relevant information such as status reports, project plans and achievements, events, news articles, documents, stories, and pictures. This use type is related to ideas about using ProjectWeb to create a shared project identity as well as marketing projects and new products internally within Novo.

Orientation: ProjectWeb provides a place where geographically distributed project members can orient themselves within a project – find general information on project background, news, past and upcoming events, and information on project members and their locations.

Archive: ProjectWeb is used both as a central process archive (where documents, decisions, and progress can be backtracked) and as a dynamic working archive used in project coordination and planning.

Document sharing: ProjectWeb is used as a medium for rapidly sharing documents and for commenting on or co-authoring these within smaller project working groups.

Hans explains how these usages are linked to the different functionalities and features of ProjectWeb and how they compare to other communication media such as electronic newsletters, email, local area networks, and a centralized clinical trials archive. In closing, Hans presents the metaphor of an onion as a way of thinking about how new layers over time have been built onto ProjectWeb and how it has evolved in successive stages and through these usages. Different layers depend upon each other, and the inner layers have stayed intact even though new uses have proliferated. Document sharing is a newer use type that has emerged out of the

archival function by users adding new “drafts for commentary” menu categories and organizing private workspaces with restricted access. The process has been regulated very little, and Hans suggests a cleaning up strategy in which these usages would be more formalized, for example, by deciding on what kind of documents should be uploaded to ProjectWeb versus sent around by email, and where better facilities for categorizing and searching documents could be developed.

This presentation provides a different overall picture of ProjectWeb that, in contrast to Carl’s presentation about the system, is focused on use and the application area in question. The presentation, the power point slides, and our report frame and make ProjectWeb available in specific ways. Instead of applying a syntax of icons and arrows, the next part of the workshop provides another kind of overview through text, bullet points, and a classification scheme of use types (see figure 4 below that conveys the list and presentation format).

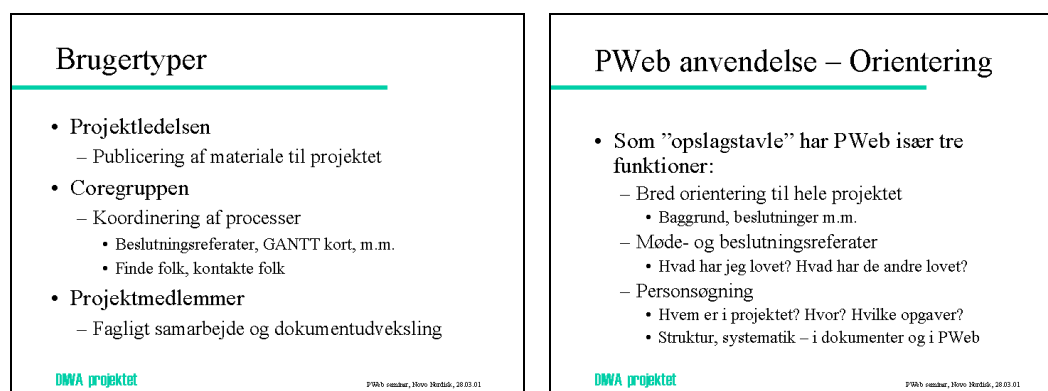


Figure 6: Presentation slides: user types (left) and the use category orientation (right).

This second section of the workshop event is about past and current use and thus frames ProjectWeb as an object of use. This framing serves other purposes and can be traced into extended networks of research work that seek to center the user in development processes (i.e. the radical structuralist story presented in chapter two). This way of seeing ProjectWeb, defining and delimiting use types, is about recovering problems, needs, and requirements relevant to those involved in actually using ProjectWeb as part of their everyday practices. The development process and design suggestions should be guided by these settings of use. Instead of separating out technological entities and components, a complex of organizational practices are translated into categories labeled publication, orientation, archiving, and sharing of working documents. This renders these practices visible and makes it possible to subsequently translate them into suggestions for

redevelopment and new system requirements.

Hans renders the area of use visible so that this may be better modeled in a future version of ProjectWeb. Here, the proliferation of ways in which ProjectWeb is used is the central challenge for further development: the main problem is that there are too many problem areas. He recommends narrowing down the application area and more explicitly developing ProjectWeb in line with one of these usages since it is problematic for one system to cover all of them. New needs and new demands have emerged with the growing layers of the onion. The report quote above notes that the taxonomy provided is overlapping or overflowing as “users often have more than one user perspective”. And this metaphor might thus be seen as a way of including some of the excess or complexities that overflow the very framing of fixed user roles and use types that our presentation proposes.

Narrowing down the ‘application area’ is put forward as the most important challenge for development to address. Besides considering these use experiences in the development of a new version, its implementation should also be followed up by strategic regulation and cleaning up the proliferation of usages. Most of the challenges mentioned by Hans (and our report) pertain to the use and the need for establishing one shared understanding of the problem area as the foundation for building a new version that can model one problem area. Providing a list of four categories is proposed as a basis for selecting, prioritizing, and discussing what ProjectWeb is and what it should be.

Focus is thus on how technologies evolve in use in relation to specific work practices and other technologies in use. This second presentation emphasizes the needs and demands of the application area and the ways in which these may shift and proliferate over time. Hans’ classification scheme is organized around the notion of roles, needs, and demands and around the extent to which these interests might be better modeled in the system design. Enacted here are thus not only the technology as an object of use, but also usage as object, or use as a numerable collection of things. By making user practices, user groups, needs, and use types pivotal, these are also bounded and framed as entities to be accounted for separately from a complex of other work practices. Again, this framing is productive in that it provides the possibility of evaluation and managing possible paths for further redevelopment. This is a different way of reducing the complexity of ProjectWeb and imposes a different frame and order through which the phenomenon ProjectWeb may be overviewed, evaluated, and acted upon.

Framing and overflowing

Both the presentation of ProjectWeb as discrete technical entities and as usage are similar in the way that they steer towards drawing out the essential, typical, and general characteristics of a phenomenon (Lynch 1990). Thus also glossing over the specific and unique. In Carl's account, ProjectWeb is dislocated from its particularity and entanglements. In Hans' presentation all of the specificities of our interview material can be placed within these general categories. As suggested in the discussion on methods thinking in ISD research, simplification and overviews are necessary and productive for 'getting the work of development done'. In contrast, a big pile of personal anecdotes on the problems developers have had previously in other firms implementing ProjectWeb or a bunch of tapes with interview recordings would not be of much use.

The presentations condense, simplify, and allow us to see the very issues, things that are up for discussion, that need to be handled and acted upon. What is framed as relevant or irrelevant, desirable or problematic, is contingent upon particular circumstances such as NNIT's current restructuring and position in a wider market and upon development traditions such as user-oriented development. I argue that when conceptualizing systems development, we might be more attentive to this specificity and develop better analytical tools for thinking about how accounts always reduce, privilege, and marginalize some practices, concerns, and actors as opposed to others. They enact what ProjectWeb should be and work back to enact what ProjectWeb is now – thus constructing the present as much as providing visions for future changes. The representations thus do more than represent in the mirroring sense, they enact ProjectWeb in particular ways and work to position people, locate problems, and suggest relevant actions.

Locating the problem, placing the blame

In a third workshop section presented here, a participant discussion opens on the topic of what and where current problems regarding ProjectWeb "workings" really are. In the discussion, both Carl's technology-oriented framing and Hans' user-oriented account butt up against a whole set of other practices and concerns. The presentations thus exceed themselves and are read out by participants in relation to specific experiences. The debate circles around whether problems are technological or human and what exactly needs to be done in order to "fix" the current inadequacies. Lars, the librarian, emphasizes that the technology must be designed to "fit the user", made easier and more intuitive.

Lars: "ProjectWeb is a common repository that may be used cross-organizationally - as opposed to wasting time and money by simultaneously duplicating information in different departments. That is the goal. But to achieve such goals, the technology can't be too difficult for users, it has to be as easy as "Snap" (and he snaps his fingers). It has to be as easy as placing a document in the shared file, and then it's there. If the tool is easy, it will spread by itself, but developing it - that is the art of the impossible". (NNIT workshop observations)

Another workshop participant insists that user deficiencies and cultural-organizational constraints, such as inhibitions concerning the sharing of documents, must be addressed alongside a redevelopment of ProjectWeb. Lizzie draws in the academic (and later managerial) notion of 'communities of practice' (Lave and Wenger 1991, Vann and Bowker 2001):

Lizzie: "Yes, ProjectWeb is a tool for supporting 'communities of practice' and as such it should direct the traffic of information that flows through the organization. Following the work of others can give employees a feeling of safety and encourage efficiency, but what is needed are strategies for handling the human side of all this, the cultural problems, and resistance towards knowledge sharing across departments and professions." (NNIT workshop observations)

Lars and Lizzie discuss what ProjectWeb is and can be, and try to identify what is the actual problem. Lars maintains that problems and explanations are technological, whereas Lizzie articulates organizational factors as restricting the need and demand for knowledge sharing. At the same time, Carl keeps returning to an overall priority of ProjectWeb's future with regard to the four aspects of document management, content management, project management, and glimpses of e-Collaboration, yet no one picks up on these categories. Instead the discussion continues to revolve around what ProjectWeb is/should be and where problems can be located. Carl's figure is somewhat abandoned as no one seems to connect to the separation of ProjectWeb as a set of distinct technical entities. Another participant from the production department objects to the categorization of our report and explains that in their department, ProjectWeb is set up entirely differently and does not follow the use types and development project structure elaborated in our report. And minutes later, the 'onion' invokes a heated debate on whether or not ProjectWeb has or ought to have a core. Other metaphors are mobilized as a way of entangling and disentangling particular issues and pointing to local experiences as the vital aspects to be focused on. The Lego block metaphor is suggested by Carla in order to bring out more flexibility for customers who can select, combine,

and build local solutions and thereby avoid being tied down by inflexible designs.

Carla: “Instead of an onion I think more in Legos. They always fit. I can have 20 lego pieces in a box and they can always build a house no matter whether I need a door on this side or that side. If everyone is building with the same duplos – not quite as complicated as legos – then I can borrow a block from you or from you, because you have a really awesome chimney. If you start thinking about blocks, then you get into a modular way of thinking where there is a possibility for adapting to the respective needs that one might have in a given area.” (NNIT workshop observations)

This last discussion illustrates how framing practices are continual and never completed. Problems are relocated as part of the technology, as residing in use or organizational structures, or as the lack of a proper IT strategy and regulation. Locating the problem and the blame as technical, organizational, or in user inadequacies is yet another way in which the complexities of redeveloping a distributed web-based information systems is dealt with.

It is striking how this conversation resonates with ISD literature and discussions of why and how information systems fail. Problems of ProjectWeb are located as technical issues (recall the functionalist story), social issues (recall the social relativist story), and as political matters of how work will be delegated and become more or less skilled (recall the radical structuralist story). The discussions are an attempt to pin down and locate ‘the problem’ once and for all - which has also been the hopes of much ISD literature.

Through the workshop presentations, problems are relocated and redefined, and possible courses of action are laid out. This is done in this instance through several forms of framing: through a particular technically-informed two-dimensional sketch of ProjectWeb as a set of discrete technical entities, through a list of user types and usages, and through a number of metaphorical figures and attempts to pin down ‘the problem’. These material and discursive mediations condense and reduce the phenomenon in different ways into something that can be seen, overviewed, and acted upon. More than mirror a material world (ProjectWeb as a fixed and bounded thing out there), the representations frame and bound ProjectWeb as an object of potential redevelopment in different ways.

Closing

In this chapter I have analyzed workshop presentations and discussions of how

representations and discursive figures work to delineate, simplify, and extract ProjectWeb in different ways as these are played out in the workshop. What does this analysis tell us about ISD? Problems of the ISD research field presented in chapter two are strikingly similar to the problems people deal with in practice. In this chapter I look at how those engaged in ISD work in different ways towards simplifying, explaining, and ordering the process, how they seek to locate problems and explanations. This is a new perspective from which to view ISD – not providing suggestions as to what developers should do, but openly studying how complexities are handled in actual situations. I have compared how two workshop presentations bound and frame ProjectWeb in specific ways, making relevant and irrelevant particular problems and benefits, as well as laying out possible paths for subsequent action. I have illustrated the way in which technology is framed, firstly, as discrete technical entities, and secondly, as object of use. I consider these representations as two ways of reducing the complexities involved in systems development and discuss how these representations are embedded in particular practices, concerns, and situated interdependencies. The analysis discussed how these accounts of ProjectWeb are contingent upon particular practices. The ways in which ProjectWeb is framed provide specific overviews and serve as a basis for evaluations and future development. Despite differences, both accounts similarly depict technology and related practices as entities that can be mapped and overviewed. The accounts frame both technology and practices as objects, make these stable in order to represent and remodel these, define problems and benefits, and make decisions on redevelopment.

6. Assembly practices

Whereas the previous chapter dealt with what can be characterized as a location of professional development, the following chapter shifts location from the NNIT company to the project management department of Novo, Project Portfolio Management (PPM), a big brown building located at the company headquarters in Bagsværd. Here I will explore what we commonly refer to as *use*.

In PPM all pharmaceutical development project managers and their assistants are co-located on the same hall.³⁵ After a series of organizational restructurings, PPM is now formally *the* central place from which development projects are planned, managed, and monitored. This building is thus the official site for coordinating projects, facilitating communication, and ensuring progress in relation to project plans, budgeting, and competition from products developed in other pharmaceutical companies. PPM might thus be thought of as a center of coordination (Suchman 1997) for the long term and geographically distributed development projects.

As part of PPM's strategy of supporting communication and coordination within development projects, each project owns a ProjectWeb. Very few official rules and guidelines exist to formalize or establish the use of ProjectWeb in development projects, and ProjectWeb forms part of projects in a variety of ways (as discussed in chapter three). A management guideline, posted in an obscure corner of the company Intranet, states that ProjectWeb should be the development project's main tool for sharing documents, that all project members should have reading access, and that at least core group members should have uploading rights. In most projects the project assistant, the right hand of the project manager, is responsible for setting up and maintaining ProjectWeb. Also, the department has co-financed the development of the first version, and several of the project assistants have been actively involved in stating project needs and demands, testing out prototypes, and in continually pinpointing problems (some of these surfaced at the workshop analyzed in the previous chapter). PPM is thus an important site in which ProjectWeb has been taken up and put to use. But what goes on

³⁵ In this chapter I refer to the *pharmaceutical* development projects in Novo as development projects. These are not to be confused with *systems* development projects in NNIT.

in use? In the following I explore episodes in which ProjectWeb appears in everyday work and how we might think about such episodes as part of ProjectWeb's development.

'Use' in ISD research: Before moving on, it is necessary to locate the term *user* as a systems developer conception and preoccupation (see e.g. Agre 1995, Cooper and Bowers, 1995). Grudin offers a critique of this common understanding of the user as a singularizing concept that fails to encompass the diversity of technology related activities and concerns (1993). Often *use* refers to social or organizational processes that delay or facilitate the spreading of technology in a phase presumed to be after and outside development. Talking about use furthermore assumes that it is people's central activity and thus reduces their activities to components or extensions of machines. Grudin notes that precisely these singularizing features make *use* so applicable as a term in development, while at the same time excluding the possibility for local change and the integrated nature of use in daily work activities (ibid.). This chapter draws on this critique as well as on a number of alternative conceptions of the user: users as co-constructors or informal designers (Clement 1993, Hales 1994) and users as gardeners or cultivators (Mackay 1990, Nardi 1993, Aanestad 2003).³⁶

I investigate episodes of use as snapshot insights into the ongoing practices that assemble ProjectWeb as, for example, a good tool for publication, or something less beneficial for the quick exchange of documents or sharing ad hoc confidential information. These characteristics are analyzed as ongoing *enactments* as discussed in chapter four. In an analysis of three situations in PPM, I propose that ProjectWeb (or IT artifacts more generally) are not finished and fixed once they enter into use. Use and the consequences of use might therefore beneficially be viewed as part of systems development, not as residing outside or taking place afterwards. I discuss the local character and distributed nature of these use activities and show how outcomes are open-ended. I suggest that a close investigation of *ProjectWeb as assembly practices* can provide a new perspective from which to view systems development. The notion of assembly is inspired by Büscher et al. (2001), de Laet and Mol (2000), presented in chapters two and four, as well as by the work of Aanestad (2003) discussed in this chapter.

³⁶ There is also a large body of work on design-in-use under the heading *tailoring*. See Mørch (1995) for work on different types of tailoring and Trigg and Bødker (1995) for a discussion of how to structure and systematize tailoring practices. The focus and starting point are the technological properties for tailoring, which is a very different approach to the issue of design-in-use than my study of ProjectWeb 'from within' design and use situations. Another related notion is that of *end-user programming* where users are viewed as developers (see e.g. Nardi 1993 and Lamb and Davidson (2000)).

Isabelle's office: assembling ProjectWeb for use

As a first example I will unpack one situation, the project assistant Isabelle's activities of publishing project news. The project is developing a pulmonary insulin device, and Isabelle has been working on the Aox project for two years. She has set up ProjectWeb colors and graphics in line with the project image and logo to "give the feeling of our own shared project space" and to ensure that people working on several projects will always be able to see that this is the Aox project's ProjectWeb. She has, for example, also added a section with successful case stories from the patient trials and added small digital video clips with these patients. She keeps the Aox project's ProjectWeb up-to-date by always posting upcoming events, the most recent results from clinical trials, and by adjusting the project plan and the Objective and Goals section (a category she has inserted in the 'system administration section').

In the following section I will describe how Isabelle adds pictures to the news page from a recent project celebration. Isabelle does not just turn on and use ProjectWeb as a tool for fulfilling a task, but rather seems to assemble it in the process. Through Isabelle's activities, diverse elements are brought together and negotiated into place in order to use ProjectWeb and to make it work for others as a shared project space. I look at this situation of publishing project news as a sequence of events, presented in three parts, starting with her receiving digital pictures about an important project event, which she then proceeds to post them on the news page of ProjectWeb.

Publishing party pictures from the CPoC celebration

Isabelle opens the email program Outlook and clicks on one of the newly arrived emails entitled 'CPoC pictures'. It is from Jesper, the project director whose office is two doors down the hall. The email opens up to 15 pictures of people drinking champagne. In the pictures green banners and bright balloons, with the words 'CPoC Celebration! CPoC – We made it!' printed on them, hang down above the people and the cake-covered buffet tables. As Isabelle looks through the pictures on the screen by clicking the mouse and enlarging and minimizing the pictures, she laughs at some of her colleagues and explains to me who the people are: "That is Jens from the Clinical Department. They made a presentation about the project with him, Mads from Marketing. The guy here in front of the projector screen is our old project boss, now part of the project's top level Steering Committee." Through Internet Explorer she opens the ProjectWeb to post the pictures of the CPoC celebration to the news page of her project's ProjectWeb. (Office observation, Isabelle, Project Assistant)

CPoC is pharmaceutical project-speak for Clinical Proof of Concept. CPoC is about passing a 'project milestone' that distinguishes one project phase from another. The product under development has now been approved for further development by a Management Reference Board, thus moving project work into a third phase of clinical trials. (This is described in the project manual as testing the product on larger and more differentiated groups of patients). The next time project members elsewhere open and log onto ProjectWeb, news of CPoC and these pictures will be visible. The party pictures marking this event will appear alongside news about a recent conference in Athens, the latest information on the development of a competing product, and a link to a world map showing where the new product will be marketed. Isabelle explains to me how important it is to publish visuals, pictures, and graphics in ProjectWeb, as a way of increasing awareness about what is going on in distant places and for getting to know one another.

In posting these pictures, ProjectWeb participates in the staging of the event as an important turning point. This is a moment in which ProjectWeb participates in connecting people in distant places and rendering events taking place elsewhere present and visible (Callon and Law 1995). So, in this situation, ProjectWeb is somehow more than a technical entity, in the sense that it is inseparable from the project activities and events that form its content. It is inseparable from notions of virtual communities or digital spaces in which people may meet, get to know one another (or laugh at one another), which seems to invoke Isabelle to post these pictures to ProjectWeb instead of, for example, sending them out by email.

To upload the pictures, Isabelle clicks her way through the administration menu to the page 'add news article'. Here a template presents a series of boxes and buttons for selecting keywords, filling in date, title, and abstract sections, and adding a picture with the 'add image' button and a browse function. Isabelle moves quickly through this sequence and knows from previous experience to upload the image file to the 'library images' page, another similar page and template. Shifting back and forth between the two pages, she clicks the button 'upload new image here', saves, and previews the article. A news page appears where the picture fills up half the screen. "Oh, it's too big" Isabelle remarks, and to adjust the size she opens another program, PhotoShop, that offers menus and functionalities for adjusting the size of the digital image. She then walks through the steps of uploading the image and then goes through upload, save, and preview on this template again. When preview appears, the picture still fills half the screen, "oh, it's because I forgot to save it (the PhotoShop image file) before I previewed". Isabelle shifts over to PhotoShop, saves

the files, and repeats the template steps above a third time. (Office observation, Isabelle, Project Assistant)

In this sequence, ProjectWeb begins to act more like an application or program as we commonly think of it. ProjectWeb performs a specific task or function (almost) on demand. The administration section of ProjectWeb presents a template and various possibilities and paths that are predetermined in order to publish a picture and text on the news page of ProjectWeb. On each page certain boxes must be filled out or clicked on in specific ways and sequences. The abstract section, for example, cannot be empty nor exceed 2048 characters. To choose more than one keyword, the Ctrl-key must be held down while clicking with the mouse. Before clicking the upload image button, the image must be uploaded in 'library image pages' which presents another set of prescriptions. Isabelle fills in the template as an experienced user.

Figure 7: 'Add news article' page (source ProjectWeb Manual, PPM)

The pages and functionalities enable and constrain this work of publishing project news: ProjectWeb structures both Isabelle's activities at the keyboard and the particular way in which the CPoC event can be broadcasted from the PPM department to project members around the world. The page, for example, only allows for one picture and posts this in parallel with other project events and information, creating a quick overview of

“what is going on” in the project when members log on to ProjectWeb.

At the same time, the template and pages of ProjectWeb offer resistance if the precise prescriptions are not followed or if, for example, the format of the picture is different from that required by ProjectWeb. Isabelle thus not only adjusts her work to follow the options offered by ProjectWeb pages, but she also engages in the creative work of re-negotiating the possibilities and functions provided. Redoing the sequence three times is a sort of tinkering work, where the incompatibility between a specific ProjectWeb functionality and the file format of the digital images is negotiated into alignment. A gap between the pictures and ProjectWeb is filled in by a detour into the PhotoShop application and the adjustments made here.

What follows next is an extension of the functionality and possibilities provided by the ProjectWeb news section. Isabelle attempts to create a hyperlink from the news page to an additional Web page that she creates in FrontPage (web-publishing application). The ‘add news article’ page only permits one picture per article, but by making a page extension, Isabelle makes it possible for project members to click on a web link and see more party pictures on a different page. Using ProjectWeb as a tool for publishing project news thus entails following templates and specific instructions, tinkering with these, as well as extending them.

Isabelle struggles as the pictures on the linked page keep coming up blank. She goes through several attempts and strategies to locate the problem and to get these pictures and the additional web page to connect with ProjectWeb. She moves back and forth between different desktop applications, incompatible file types, does a lot of redoing and rechecking of the hyperlink paths and the folder placement of files. She looks back at a page she has made earlier in an attempt to find out what it is that is not working. She looks through a manual and tries out various trouble-shooting possibilities. At one point she walks down the hall to ask Mia, another project assistant, who recognizes the problem: “yeah, that happens to me sometimes as well - just try uploading both the html-page and all the pictures again”. After this Isabelle starts again, redoes the routine, yet a new set of contingencies arises when ProjectWeb replies that the page cannot be uploaded when a user page with the same name already exists. Isabelle renames the files and uploads them one at a time again. And still the pages refuse to link up. She remarks that if only Marge were here today, she could ask her. She then leaves the CPoC pictures and ProjectWeb until the day after, when Marge is present and shows her how to find and insert the precise link numbers necessary to make the two pages connect.

Marge shows Isabelle how to insert `` where XXX is the particular ProjectWeb identification number: 5578. She shows Isabelle how to see this by right clicking the mouse when on the ProjectWeb page and selecting “view source” and reading the number in the top line `<link rel="stylesheet" href="stylesheets/projects/5578/style.css">`, then moving back to the "add news article" page, linking the web page by inserting `see more pictures`. She also instructs Isabelle that it is a good idea to create a link back to ProjectWeb from the new page from the Web page extension. (Office observation, Isabelle, Project Assistant)

Making ProjectWeb work for the task at hand involves tying together a range of other programs, people, and practices. This situation can be described as the work to make it work (Bowers 1994) or as an artful integration of heterogeneous elements (Suchman 2002), and as a key feature of any well-working technological configuration. Following these authors, I suggest that no matter how improved new versions of ProjectWeb might be from a technological point of view, this overflowing and local assembly of various elements will continue to exist. The assembly that emerges includes: the event and the pictures taken (events in the project and the digital pictures provide content for the news page), notions of ProjectWeb's potentials as a meeting point for distributed projects, inscribed templates and functionalities, Isabelle's experiences with the new page template and the sequence of uploading pictures in ProjectWeb (routines of dealing with resistances, redoing it again and again when something does not work, negotiating incompatibilities of file formats, extending the page), other desk top applications such as Email, PhotoShop, FrontPage, and resources such as the manual and other people down the hall. Lastly, Isabelle's sense of urgency to get the news of this important event out to all project members and her curiosity and persistence in redoing and trying out different options to solve the problem likewise form part of the assembly through which ProjectWeb becomes a working tool, or shared space, for the Aox development project.

With this example of ProjectWeb in use, I point to a way in which we might think about technology in a different light, not as an isolated entity, but as something that is inseparable from previous, present, and future use.

Configurations and assemblies: I am inspired in particular by Aanestad's analyses of design-in-use (Aanestad 2003). Aanestad applies the concept of configuration to refer to a snapshot or instantaneous picture of the mix of human and technological elements that are involved in situations in which a technology is part of work practices. The technology is designed with

certain features, capacities, and purposes (inscriptions), and Aanestad notes that these features are often the reason a new technology is drawn into or included in existing work practices. The features and capacities of technologies are expected to do something. Drawing on actor-network theory, Aanestad suggests that inscriptions are, however, not activated (or articulated) until they form part of and are aligned with a particular network of practices (ibid. pp. 9-10). This is a way of approaching an application's feature as relational, and emergent in use, rather than as a fixed object pre-existing use. Aanestad notes how, once activated in use, technologies exceed themselves and often prove to have unwanted or unexpected effects. And they may be adjusted and modified accordingly. The use of technology can thus never be pre-specified. And consequently, Aanestad suggests that the process of testing, tinkering, and modifying technologies towards "well working configurations of users and technologies" may become the core of design processes as information systems become increasingly made up by standardized and generic components (ibid., p. 17). This is a non-normative approach to design and design-in-use which facilitates a critical approach: a configuration is one of several possible, that 'could have been otherwise', for example, in the way a configuration distributed burdens and benefits (ibid., p. 17). "Viewing design as *design of configurations* captures the contingent, continuous and non-determinate nature of the process, and also the multiplicity and heterogeneity of the participants. In addition it may bring attention to the fact that as the process is iterative and continuous, it will be costly and resource demanding (funds, competence, personnel etc.)" (ibid., p. 17).

In this chapter, I use the term assembly to emphasize how practices may form different configurations of ProjectWeb. The notion of assembly is, like Aanestad's configuration, borrowed from the STS tradition and refers to an orientation towards pulling together the disparate - crossing over what we would normally refer to as either social (Isabelle, her actions, sense of urgency, notions of virtual communities) or technical (the material artifact and its inscriptions) and focusing on how these are mutually constituting. This term, and other STS terms such as actor-network, hybrids, and heterogeneity precisely play on pulling together what one commonly would separate. Unpacking assemblies thus requires a shift in perspective from entities and objects (as mapped out in the workshop analyzed in the previous chapter) to relations and associations between entities. How do Isabelle and the pages of ProjectWeb interrelate? What other elements are drawn in to tie the two together? What capacities and properties emerge out of this assembly? To press our current conceptions of ISD, I suggest that we look more closely at the processes of assembly through which both use and technologies' properties emerge.

In the example with Isabelle, the technology offers possibilities and resistances (what we normally would think of as fixed characteristics) as an *effect* of the particular resources available in the situation. If Isabelle, for example, remembered precisely how to write

down the sequence of link numbers (which she might next time, since she took notes), or if Marge had been present the first day, ProjectWeb would at that moment have been less problematic. The configuration might have occurred quicker than I could have observed sitting next to her in the office, and it might have had less of a breakdown character.³⁷ Likewise the materiality of the ProjectWeb template shapes Isabelle's use, because she knows how to follow the steps and prescriptions required and how to align these with the task at hand. Here, we might imagine that next time extending the news page with a link and an extra html page might also at a later point in time become incorporated as part of Isabelle's routine activities. Of course, ProjectWeb offers specific pages and functionalities (I have included a screen image of the template for publishing a news article), but the way in which these features are activated or articulated, whether they work in a seamless manner or are problematic and resistant, is *dependent* upon other specific elements such as those listed above. "Use" is in this case situated practices of assembling, negotiating, and aligning heterogeneous resources to make ProjectWeb work for the task at hand. In the situation, links and connections to many elements are what shapes ProjectWeb as a useful and working technology for publishing a project news event. Isabelle assembles a network of elements in order to create a space for use. And I suggest that through this activity ProjectWeb gains its characteristics and properties, for example as an appropriate tool for publishing important news events to distributed project members, as having silly quirks one has to redo and play around with.

Anne's office: ProjectWeb as co-extensive with pharmaceutical project practices

ProjectWeb is co-extensive with pharmaceutical project practices. To develop this idea I will unpack another example from the office of another project assistant further down the hall on the third floor in the brown building. I look at various elements that go into writing a meeting summary to be published to ProjectWeb and a number of interferences that play into a decision on whether or not to publish a meeting summary on ProjectWeb or to send it out to the relevant parties by email. The example specifies the point above: a wider assembly holds ProjectWeb together, and ProjectWeb emerges as a working technology for pharmaceutical development projects through this assembly.

³⁷ Blomberg (1987) makes a similar point on how breakdowns and technical problems are defined relative to the resources at hand. She highlights social interactions as an important mechanism by which technologies become embedded in work places.

Writing and uploading meeting minutes

The next excerpts are taken from observations of Anne, a project assistant, working her way through a to-do-list of various tasks in preparation for the launch of the DuoDevice product at the upcoming conference of the American Diabetes Association (ADA). The DuoDevice project has been underway for two years, and the product launch will take place at the American Diabetes Association conference in the Philadelphia in two weeks time. The DuoDevice project is shorter than most other development projects managed in the PPM department. This is because it merges two technologies, an insulin dispenser developed by Novo and a glucose-monitoring product developed by a partner firm in California.

Both previous products are already registered and have the necessary approvals from regulatory agencies in the US, Denmark, and a number of other countries where they previously have been marketed and sold. About 75 people are officially involved in developing, producing, and marketing this new two-in-one device. A third of these project members are employed in Novo (located both in Denmark and in subsidiaries abroad), a third at the partner firm LifeCo, and the rest are dispersed among the partner firm LifeCo's subcontractors located in Scotland and Portugal. These companies have produced the molds and plastic materials for the device, whereas Novo and LifeCo in cooperation are coordinating the technical design specifications, testing, and quality assurance work, as well as the packaging and marketing materials. ProjectWeb has been important to these collaborations, both for conveying news and events across the project as a whole and for collaboration in smaller working groups within the project. This includes a series of member groups with restricted workspaces that have been defined and set-up by the project assistant in the administration section of ProjectWeb (in collaboration with the manager and based on requests from the working groups).

The project assistant Anne is planning for the trip to Philadelphia, the product launch, where the Novo group will meet with core-group members from the partner firms to celebrate the launch and lay out future plans for marketing and production. She works on a meeting summary where the core-group had discussed the trip, plans, and project delays two days earlier.

Anne opens her newly acquired laptop and finds the document from the core group meeting held the day before yesterday. This was the last meeting before the trip where arrangements for the trip and launch were made. She explains the tension at the meeting due to the upcoming launch, time-pressures, and general impatience

since quality assurance papers, marketing material, and the crucial approvals of the device from the Federal Drug Administration (FDA) are not yet in place. The meeting included a lot of complaints about the way the partner firm LifeCo was working. Anne needs to tone these down in the summary. After locating the file and saving it on the local area network, she changes the connection from her stationary office computer to the laptop, logs onto the local area network, and saves the file on her own hard drive. Then she opens the file on her other office computer and works on it for a while. She shifts around sentences and sections and writes in additional details to clarify the text. She opens an email application, attaches the file, and sends it out to all the Novo core group members who were present at the meeting. She explains that summaries are always circulated first so the core group can check it and add comments before she uploads it to the member group entitled 'core group'. Usually if there are comments or topics that they do not want the partner firm to see, she sends these out on a separate email to the Novo core group members. She shows me the menu category meeting minutes where all previous meetings can be found as a list named as REF#date, making the particular summary easy to locate on the screen. All these summaries are written in the same meeting minute template created by another project assistant. (Office observation, Anne, Project Assistant)

This situation illustrates some of the mundane activities and technologies that are involved in the addition of a new meeting summary to ProjectWeb. The meeting discussions are condensed into notes typed into the template by Anne at the meeting. Discussion, events, and decisions are reduced to sections and points, which are then to be published and made visible for the equivalent of the core group in the partner form, LifeCo, or for any core-group members that missed the meeting so they can see what happened and who will do what next. The summary includes a number of future points for action and well as a schedule for the upcoming conference in Philadelphia. We thus catch a glimpse of some of the work that goes into making a summary, the path it moves through from being talk in a meeting, notes in a template on a laptop, a file transferred to a desktop via the local network, a draft sent around for comment and modification, sections deleted, re-written, and adjusted by core group members, and a final version to be fixed and inscribed in ProjectWeb. The summary is thus transformed into one trace or clickable item in ProjectWeb, collapsed into a long list of other meeting summaries whereby project members elsewhere may stay informed or perhaps later backtrack what was decided at this last meeting before the launch – thus activating the inscription. This long line of activities (with different people and technologies involved) gets packaged up into this summary, and once uploaded it is there 'in' ProjectWeb.

In cross-organizational collaborations such as this project there are continual discussions

and negotiations about what kind of project information should or should not be shared with partner firms - which are both allies and at the same time possible future competitors. These discussions tend to surface in tense situations such as the one above, where Novo project members are dissatisfied with LifeCo's handling of the upcoming launch. Summaries are almost always sent out and checked to ensure that the tentative results and decisions do not slip out in a final summary before they have been confirmed. And the closed member groups in ProjectWeb have been specifically established for the sharing of confidential information or of unfinished materials and results. In my discussions with Anne and other employees at Novo, this space is emphasized as important to cross-organizational product development where project members are unable to meet regularly and need to maintain an awareness of what is going on in other places. In several interviews, both project assistants and others express the benefits of sharing documents safely and securely in ProjectWeb and how this also alleviates the previous hassles of encryption and decryption when sending documents out of Novo.

As in the previous example of Isabelle's work, many elements and continuous activities are brought together to create ProjectWeb as a project archive and a safe place for sharing top-level core-group decisions and concerns. The core-group section to which Anne moves to upload the summary is such a 'safe place' where top-level management in the three partner firms can share documents and meeting summaries without all of the employees who are affiliated with the project sitting in subsidiaries in Belgium or Japan seeing what goes on. Both email and ProjectWeb work in sync to provide this discretionary space and delicately balance what goes into or out of the formal archive (Brown and Lightfoot 2002).

This ongoing assembly work makes ProjectWeb into a working technology for development projects and renders it *the* place for project members to locate necessary information, people, previous results, and records of decisions made along the way. Project practices of confidentiality are folded into ProjectWeb's setup of user groups and restricted areas in which sensitive documents safely can accumulate. ProjectWeb is a dynamic artifact embedded in work practices and as such continuously accumulating inscriptions, rearranging these to afford particular overviews, and emerging as a focal point of reference for orientation and the coordination of tasks (Berg 1999). Berg stresses that mutual activities and interrelations of technology and practices occasion particular capabilities and properties of technological artifacts: "capacities emerge at the

level of the collective” (ibid., p. 38), as an effect of wider assemblies. Effects are open-ended and dependent not only upon ongoing use (as assembly work) and wider project practices, but also other on elements that occasionally surface and interfere. In the following sequence of events, Paul calls Anne while she is incorporating a few comments and corrections she has received by email into the meeting summary.

Late afternoon the day after: Anne receives an email with a few comments and adjustments from two core group members. She opens the file and works in these comments. As she is completing it, the project manager Paul calls in from home. They discuss a number of things she needs to do in preparation for the trip; “Yes, I have booked the room for Sunday... No, I’ll order the gifts for the partner firm people next”. Anne says she is working on the summary. ”Does he want to check it? Does he want to her to publish it to ProjectWeb or send it around by email for commenting first? I sent it round to Marc yesterday and got it back from Steffen with some deletions so it should be ok...oh ok, well then I’ll do that.” After hanging up she explains to me that Paul is at home and has a very slow modem connection and therefore wants the summary by mail, because it is much easier than going into ProjectWeb. She adds that there are a lot of sensitive comments concerning problems with LifeCo, and he also thought it would be better if they did not see it. She finishes the summary, mails the core group, and explains again why she is sending it by email instead of publishing to ProjectWeb: things are sensitive toward the end of the launch, a lot of people are dissatisfied with LifeCo’s collaboration, and they blame LifeCo’s ways of working for the delays. The marketing group is, for example, particularly stressed and upset about having to make two sets of the product launch material for the ADA conference: one to be used if the approval goes through and another in the event that it does not. She adds that Novo and LifeCo have very different ways of working. LifeCo has a different organizational setup, which has made it difficult to coordinate work, and furthermore, they recently had a lawsuit and are now extra strict on their regulations. (Office observation, Anne, Project Assistant)

The phone call, issues of confidentiality, and Paul’s Internet connection are elements that enter into the use situation and interfere. I will replay the local contingencies of this situation. Firstly, Paul calls from home about other issues. Anne asks him about publishing, now that she has him, and because some of the adjustments made concern sensitive discussions about the partner firm. Secondly, Paul calls from home, where he has a modem connection rendering it time-consuming and troublesome for him to log onto ProjectWeb, find the folder, and download the document, in comparison to receiving it directly by email. His location (compared to working in the office) makes ProjectWeb slow, annoying, and more troublesome. Infrastructural networks surface as

part of the ProjectWeb assembly and also play a part in defining whether or not ProjectWeb is useful, relevant, or too slow for the task at hand.

Several elements enter into a relation in this situation: the timing of the meeting (the last one before launch), recent disagreements between the Novo people and the people at the partner firm, Paul's location working from home, his modem connection, and wider infrastructures. The example illustrates some of the contingent factors that go into the 'decision' on whether to publish or not to publish, whether web or email is the relevant medium. And the picture is much more complex than that of an individual user resisting or complying with a fixed or finished system. The situation opens up the particularity of use situations that do not merely sit there as background or context for ProjectWeb, but can be seen as taking an active part in making it what it is at specific moments: what is easy or troublesome, what is confidential or shared, and what ProjectWeb is/can be used for, is an outcome of the situation.

Interlude digression and discussion

Scrutinizing these use situations provides an opening for recovering how ProjectWeb is entangled in and co-extensive with the practices and assembly of elements in which it is situated. The analysis reveals an alternative way of thinking about technology as the ongoing effect of practices. I have unpacked some of the specific resources, timing, and interferences that play into use situations. Next, I will elaborate on these practices temporally, how these situations over time accumulate or layer into ProjectWeb in particular ways, and in turn, how they constrain and enable future use and work practice related to ProjectWeb.³⁸

In the example of publishing the CPoC pictures, Isabelle's activities are based on prior experiences with ProjectWeb's template pages and the FrontPage publishing application as well as on discussions within PPM that this is a good way to broadcast project news as opposed to email. Likewise, the sense of urgency in publishing the pictures on

³⁸ Suchman (in conversation) has suggested unpacking ProjectWeb-as-assembly as a spatial move and a temporal move. This allows for different types of questioning: on the one hand, for a snapshot exploration of the elements that make up the assembly and their interrelations, and on the other hand, for illustrating how ProjectWeb as assembly is not fixed, but requires continual work and is made and re-made in practice. Berg (1997) similarly points to two similar routes of analysis: a real time perspective where focus is situated on the interlocking of people, routines, and technologies, and a historical route focusing on the co-emergence of work practices and technology over time.

ProjectWeb is shaped by earlier experiences showing that project members actually use the pages she regularly maintains. Isabelle has, for example, created an email survey to get a feel for how her users (as she calls them) like ProjectWeb and how it might be improved. She was pleased to find her case stories, video clips, and news items in high demand. And she says: “They now expect news and summaries to be out immediately and available there 24 hours a day” (Isabelle, Interview). ProjectWeb becomes *the* place where project members can follow and backtrack project events, discussions, and decisions. Use and ProjectWeb have co-evolved and layered into one another.

Similarly, the situation in which a meeting summary is not published may shape expectations and future use elsewhere. In my interviews I have met both positive and negative responses. I have recorded enthusiastic comments on the advantages of ProjectWeb for rapidly obtaining documents and for backtracking action points or some particular issue discussed at a meeting. One interviewee from the quality assurance department in the DuoDevice project frequently checks the page “recently uploaded document” to see what is going on in the different groups in the project. She describes how activities presently are bubbling up in marketing and the device section since they are particularly busy in getting the specifications settled and the marketing material done for the coming launch. In another interview, I met extreme frustration from a project member because she just recently could not locate the meeting minutes she needed right then and there. In several cases, project members (or working groups) maintained additional parallel archives on the local area networks to be sure they had the documents available when they needed them. The two situations I have described above thus create particular material traces in ProjectWeb and participate in shaping expectations. Such situations constrain and enable future use situations for Isabelle and Anne (as skills become embodied and emerge with use) and for other users (in that ProjectWeb becomes *the* place to find specific material, contact persons, or share working documents). Each situation changes the circumstances for the next. Yet, precedents are not in themselves sufficient to cause or explain the way things go, as these may be re-articulated in a variety of unpredictable ways, translated, or adjusted to make do in new shifting situations (Latour 1994, p. 50).

I suggest that by looking at ProjectWeb as enmeshed in continuous use events, circumstantial project concerns and contests, we gain a different picture of how a system like ProjectWeb comes into being over time. Daily activities of the project assistants

contribute in the form of news and pictures as described above. Or as meeting minutes documents that keep track of project discussions and decisions. The project assistants also put together and upload monthly status reports and various formal documents and charts describing the particular project and work organization. They regularly maintain an overall plan where one can find upcoming deadlines and follow recent project accomplishments. Project assistants ensure that all project members are entered as 'users', continually maintain yellow pages information and user groups by adjusting members and delegating appropriate access rights, such as read only, upload to some sections and not others etc. They adjust menu categories and subdirectories and suggest conventions for file naming and the use of restricted areas. One has posted a work-around on the news page listing how to avoid uploading glitches that come up now and then with large files.³⁹

In my studies in the PPM offices as well as at other Novo sites, practices like these are ongoing and recursive practices. They are mundane and incremental, and it is difficult to pin down one location where design-in-use 'happened'. I suggest an alternative view of these small and almost invisible practices that continually keep ProjectWeb together as a working technology. Thereby, ProjectWeb becomes good for broadcasting project news, but more problematic for confidential information and the quick exchange of documents. Thinking ProjectWeb in terms of a wider assembly that fluctuates, shifts, and drifts is a way of re-inserting use as an important part of what brings ProjectWeb into being. Looking at ProjectWeb in isolation loses sight of the ways in which it is layered into a range of previous, present, and future use activities. These extend into characteristics of the pharmaceutical industry and the organization of development projects which are then embedded into ProjectWeb use and inscribed in the delegation

³⁹ In turn, a wider network affords the work of the project assistants and their work of keeping ProjectWeb up-to-date, as they call it. Above I have discussed how these activities are carried out in mutual interaction with the activated templates and functionalities. The project assistants also exchange experiences with one another. They frequently receive requests and suggestions by phone and email from their project members and managers. And as one project assistant notes, the more documents the more categories you need to get an overview. ProjectWeb makes demands back on the work of these project assistants. In the DuoDevice project most categories and a large body of documents were 'inherited from' a previous a project (on a 'earlier generation' of the same device). Also, the project assistants rely on formal diagrams of project structures and progress in defining the groups and menu categories as well as requests from project managers and project members. In the analysis I focus mainly on the activities of the project assistants, revealing how they play an active part in bringing ProjectWeb into being. The networks that afford their work and agency could be traced in further analysis.

of user access rights and visibility between member groups. Project work and organization get folded into ProjectWeb and, in turn, play a part in constituting and holding together a pharmaceutical project as such.

Marge's office: an indispensable link in the assembly

In the final section of this chapter, I move another three doors down the hall, to the office of Marge. Marge is an employee in the department Project Portfolio Analysis (PPA), previously a part of PPM. PPA is a support function for PPM and carries out risk assessments, financial patient/value calculations, market forecasts, and monitoring of project progress through reviews twice a year. Separating this section as an independent department has been part of an ongoing strategy to formalize this support work (formerly more integrated in PPM) and to standardize development projects in Novo through similar templates, plans, and guidelines for reporting on project status, budgeting, and planning. As Marge explains: “status reporting, for example, gets done in 117 different ways, and having information on project milestones available in the same format and all project reporting in one database will make it possible to draw out information and compare across projects” (Marge, Interview). Presently, she sets up much of these project comparisons herself and hopes via IT to have the comparative analysis of project progress increasingly automated. Her official title is Support Project Assistant.

Among her many tasks in PPA, Marge offers technical support to project assistants and managers in PPM. Marge is also the head system administrator of ProjectWeb and has been actively involved in the development of earlier versions. She serves as a coach for the project assistants with regard to ProjectWeb and other hardware and software equipment. She has a background in product engineering and is responsible for maintaining the department intranet web pages. She herself emphasizes that her computer skills are largely self-taught and developed during her six years of employment at Novo. She has been active in various super-user groups in Novo, attended a number of programming courses, and generally stays up-to-date on new technology by way of the news groups and computer magazines that she orders for PPM. Marge has also recently become advisor to the Business IT group (BIT), a management group that meets across departments to lay out new overall IT strategies for making the use of IT more uniform and integrated across departments in Novo. As an active member of this group she has participated in developing a ‘standard visual identity’ for all company intranet pages and

has been involved in the testing of the new software LiveLink that the IT strategy group has been considering as a replacement of ProjectWeb as the standard project coordinating tool.

Head gardeners: Nardi's notion of a head gardener has been useful for thinking about the work of Marge (Nardi 1993, Nardi and O'Day 1999). In a study of spreadsheet packages for budgeting and financial computation, and CAD software for engineering and architect drawing, Nardi and O'Day discuss how use evolves locally over time. A pattern found in both cases is what they call gardeners, using this term to indicate that the gardeners 'grow' the efficiency of the technology. Here, in particular, Nardi also finds the phenomenon of a head gardener useful, described as being someone who is particularly engaged in tinkering with the software and through such experimentation has learned to use it a little better than the other gardeners. These head gardeners are often the persons others turn to when they encounter problems or need help troubleshooting. Head gardeners, Nardi notes, like to help other people with technical problems and like to learn on their own. She notes their ability to translate between domains: "Gardeners are people who can translate concepts and mechanisms back and forth between the domain of work and the technology ..." (ibid, p. 141). Head gardeners thus speak 'more than one language'. Through experience they have developed very particular skills for bridging specifics of a work domain with its unique problems and challenges, and they often explore the capabilities of the software tools. Often a head gardener has participated in additional training courses or is active in super user groups. They often stay informed on new technological developments and perhaps participate in testing and evaluating new tools. Among their activities include creating templates and macros for use by others, debugging software and assisting others in solving problems that arise, thereby encouraging further use. "During all of this gardeners are themselves immersed in the day-to-day activities of their local group – they are intimately involved in the quotidian pursuits, as well as trials and tribulations, of their local ecology. Their advice, programming, and support is embedded in the natural flow of work in their group, providing a close match between what their co-workers need and what they can offer" (ibid., p. 143). In their analysis, Nardi and O'Day stress that these particular skills are an evolutionary outcome of intensive use and experience in the particular work domain and suggest that closer examination of such practices can provide new perspectives from which to view IT artifacts.

Marge resembles a head gardener as described by Nardi and O'Day. As Marge herself notes, her position and work is an evolutionary outcome of several years of work in PPM, her involvement in the development of ProjectWeb, and her daily work of playing around with, tinkering and adjusting software for her own use and for that of others. In this sense her skills and position have emerged alongside her work and are constituted by

the different activities she continually engages in. Only recently has her position become official as part of her work description and inscribed in the very restructuring of PPA as support to PPM. I will give some examples of how Marge acts as a head gardener and forms an indispensable link in the ProjectWeb assembly. Firstly by returning to the first example of publishing the CPoC pictures at the start of this chapter:

Isabelle is having trouble saving and linking an additional html page made in FrontPage in ProjectWeb's library section: ... still the pages refuse to link up. Isabelle remarks that if only Marge were here today, she could ask her. She then leaves the CPoC pictures and ProjectWeb until the next day, when Marge is present and shows her how to find and insert the precise link numbers necessary to make the two pages connect... Marge also instructs Isabelle that it is a good idea to create a link back to ProjectWeb from the new Web page extension. (Office observation, Isabelle, Project Assistant)

In this situation, Marge is the link that enables CPoC pictures to become part of ProjectWeb. Marge instructs Isabelle in the sequence of actions necessary to make ProjectWeb work, and, in addition, she recommends that Isabelle also remember to make a link back to ProjectWeb. In this situation I analyzed ProjectWeb's working (for the particular task) and its breakdown as dependent upon Marge's presence. What else does she do? As main administrator, Marge surveys all ProjectWebs in use and occasionally provides individual project assistants with suggestions on how to reorganize menu categories or adjust the layout on a page. She also sends out general emails now and then, with suggestions such as how to put in a background picture on the front news page to ProjectWeb, or how to create fancy web page details in FrontPage for pages linked to ProjectWeb. Marge was also the first to present ProjectWeb to the project assistants in a two-day training course. And she has extended her own assistance (for the days she is not there or too busy for 'frequently asked questions') by writing a ProjectWeb manual for the project assistants. This 26-page document runs through every page and functionality in ProjectWeb with a set of step-by-step instructions and troubleshooting suggestions. This manual has her name on it and advises users to her with any problem. It has since circulated out of PPM into other parts of Novo, and employees from other departments call her up and ask all sorts of questions about ProjectWeb. Marge's work and her manual are thus important elements in making ProjectWeb work in PPM and elsewhere.

Marge also created her own extensions to ProjectWeb such as asp pages and a calendar functionality incorporated in ProjectWeb. The calendar page was made upon demand

from the project assistants to satisfy the need for the coordination of the numerous meetings and events that take place within the large development projects. Marge built the calendar system by tying excel spreadsheets together with an automatic generation of html pages in ProjectWeb.

For some changes in ProjectWeb, such as turning modules on and off, or adjusting the top-level menu categories, project assistants need to go through Marge as the main system administrator. She sets up ProjectWebs for new projects and also withholds some parts of ProjectWeb by turning them off at set-up (for example an 'entire reporting module' is non-existent for most project assistants). As she remarked one day to the project assistant, Joan, who asked her if she could add other article types to her ProjectWeb. "Well, actually you can do that yourself, I just haven't told you because I thought it would get too complicated with all the options and you would come running constantly." (Office observation, Marge) So Marge holds the assembly together by also limiting some possible configurations.

Summing up situations and linking PPM to NNIT

Marge is also the main contact to NNIT and has been involved in the development of previous versions and she has been in frequent contact with Neal, the programmer, for minor changes to beta versions of ProjectWeb. Marge gathers up problems and new demands as these arise through use in PPM:

Marge is working on a graph for a presentation of research comparing cake figures of costs, revenues, goals, and risks of the 6 "most valued projects" in PPM. She switches over to email, where she has received an email entitled "ProjectWeb" from the project assistant Jens down the hall. She explains to me that he is upset about the recurring uploading glitches in ProjectWeb experienced by their partner firm in Australia. Marge has received a set of instructions on how to circumvent the problem from NNIT and has sent this out to project assistants, who have sent it on to project members. The 'work-around' only works occasionally, and the problem keeps shifting around between NNIT, a networks support section in Novo, and the IT department in the partner firm. Marge saves the email in a folder "ProjectWeb improvements". In this folder she collects requests that come in by email about ProjectWeb together with her own notes on reoccurring problems that she herself or the project assistants experience or complain about. Emails and notes may also be on requests for additional features or changes to the existing interface or functionalities. (Office observation, Marge, Support Project Assistant)

Marge thus collects experiences and now and then sums these up into lists and

requirements, like the one she brought to the workshop discussed in the previous chapter. In doing this, Marge labels certain properties as problematic in a document list. She translates PPM use situations (such as those I have unpacked above) into a language of requirements that professional developers can incorporate into their work. This activity defines and fixes ‘demands’ and enables these to travel to another site in NNIT and feed into what we usually think of as formal design.

The list Marge is presently working on includes diverse suggestions, numbered to correspond with the systems description document produced by NNIT. The list in a memo template entitled “wishes and improvements” for example includes:

- - possibility for automatic email notification to users on the new news items (so that project assistants do not have to send out parallel emails),
- - new features for categorizing images uploaded in the library section (which was the section that posed resistances in the CPoC publishing situation),
- - a button for turning on or off the “Please send any comments to xxx@novonordisk.com” that presently comes up on any news item (as Isabelle has remarked, “It doesn’t look good that my name is all over the page.”),
- - integration with user groups in Outlook so changes to user groups are automatically reflected in ProjectWebs (easing the double work of maintaining working groups in both Outlook and ProjectWeb). (Field notes and memo copy provided by Marge, Support Project Assistant)

In this way the local practices in PPM feed into NNIT through a long chain of translations and condensations where features and wishes are registered as problematic and necessary. Marge’s ongoing tinkering and assistance, her archive of requests, and the wishes and improvements list are elements that link use practices to formal development. Again the notion of layering is relevant, since these practices (through selection, condensation, negotiation, and translations into a language developers understand) fold into the redevelopment of ProjectWeb in NNIT. As indicated in the previous chapter, these requirements, of course, form one element in a conglomerate of other concerns that play into development, including whether a version four will be developed at all. Earlier versions have, however, been rebuilt with more and more features for customization, more advanced document database functionalities that have been

requested by project assistants (as they have become more and more familiar with possibilities and desire more). A statistics section has for instance grown out of the project assistants' demands to 'see' how their ProjectWebs are used by project members.

Marge and her work thus comprise an important link in the ProjectWeb assembly – both in holding together ProjectWeb for everyday use situations in PPM and in relating these situations to distant networks of formal development practices. Whereas Nardi and O'Day seek to value and discuss the possibility for formalizing the head gardener, I am – for now – still adhering to the descriptive stance and opening Marge's practice for inspection as one additional element in the assembly through which ProjectWeb comes into being.

Design and use

To conclude, I suggest that the PPM office situations presented in this chapter are not moments outside of ISD that come after or are separate from design. Instead, these use situations are moments where ProjectWeb's properties and capacities emerge through negotiations and alignments of heterogeneous elements and resources. This assembly work involves subtle re-designs in real time and continually reshapes the very circumstances for future use (as well as formal design). For example, in the sense that users' experience and expectations are different in the next moment and that ProjectWeb inscriptions accumulate and are altered.

This chapter thus serves to counter stories that center their focus on the work of professional developers. This case proposes an alternative story where aspects of design take place *in use* and where use co-evolves as embodied expertise. I suggest that we need better concepts for this kind of practice and for technology as the outcome of ongoing practices. A common distinction between use mode and design mode (see e.g. Orlikowski 1992) does not suffice. The three examples I have analyzed do not fit into either category, but mingle and mix. Also, I have started out the chapter with the notion of users as constructors or cultivators, which are concepts developed precisely to make visible some of this active work and the ongoing transformations that take place in use. Yet, again I find that these terms also tend towards seeing use as human resistance to characteristics embedded by designers as discussed in chapter four. In this chapter I have analyzed design-in-use not as an intentional mode of action (where users act as designers), but instead looked at how possibilities for use or design-like activities are

offered by particular circumstances and ways in which practices and technologies are brought into relation.

Mulcahy (1998) offers an alternative conception of design and use that more adequately corresponds to this case story on the practices of ProjectWeb in PPM. Mulcahy argues that *technology and practice always come together*:

“Each is transformed by the other. Conceived in this way, technology design and use are not so much stages which an object passes through, as processes which pass through one another, and in which objects are endlessly recreated.” (ibid., p. 7)

Characteristics and attributes, what is or is not a problem, are continuously enacted as the assembly shifts, expands, or falls apart. Situations ‘pile up’ (in ProjectWeb inscriptions, for example, or in the folders on Marge’s hard drive), but this piling up only works back as additional elements in the assembly that add to it, transform it – more than moving it towards any stable equilibrium.

Thinking about ProjectWeb as a practiced assembly circumvents some of these assumptions and can turn our focus to the practices in which skills, demands, resistances, and problems and benefits emerge and may differ from one place and time to the next. Neither elements nor their relations are fixed and can form different configurations. As new configurations, emerge the elements that constitute (such as routine practices of the project assistants or ProjectWeb inscriptions) are also reenacted and transformed in subtle ways. To analyze ProjectWeb as practice I thus emphasize the relevance of widening the picture to include entities and activities we would normally consider outside and separate from technology. The notion of assemblages in which technology and practices may form many possible configurations provides a new perspective from which to study and comprehend the ongoing process through which information systems come to be successes or failures, or both.

7. Interfering practices

In the introduction I presented one of the assumptions upon which I have based my research, namely that web technologies, their effects and consequences, can best be studied by attending closely to the *specificities* of concrete everyday practices. This included grounding the study in empirical research and formulating open-ended research questions that would let the particular case and, for example, the vocabulary and issues relevant to the case being studied guide the research. I sought to work with the concepts, metaphors, and figures used by people in the field and to orient my research towards the concerns of those involved. The previous chapters present results from this work by exploring how ProjectWeb is enacted firstly a design workshop and subsequently in various use situations.

This objective, however, proved to be difficult to achieve and in some cases counter-productive to my research interests. The very object, ProjectWeb, was to a greater degree the preoccupation of my own research than relevant to many of the people studied. In many interviews ProjectWeb was hardly known by users, and as mentioned, it also shifted into a somewhat peripheral concern to designers in NNIT compared to other more high priority systems development projects in which NNIT became involved during the time of my study. The ProjectWeb version 4 development project, that I intended to study, was initially delayed, then cancelled, and then taken up again a year later. These experiences lead to a number of methodological reflections on what we, as researcher of new technologies and their potential consequences, bring with us into the fields and practices we study.

The dilemmas were also of broader concern in the DIWA program. In the early stages of research, in the course of surveying possible firms and applications we might study, it posed a serious obstacle that we were unable to find any IWAs under development and much less any that were somewhat successfully in use. A midterm report from the DIWA program recaps this problem and lack of “interactivity”- the theme around which the research program was set up:

“The first round of exploratory case studies has suggested that, at the present time, web based technology is rarely used for interaction among collaborators within organizations, in the sense of “interaction” as defined in the original DIWA project

outline.... Although web technology, in many ways, is very applicable for this kind of interaction, it has proven difficult to identify actual IWAs operating in organizations.

- - The uses of web-technology for socially interactive purposes seem rare....
- - The findings indicate that the interaction between organizational actors – mostly or at least initially – takes place in the form of *collaboration and coordination through other media than the web*....
- - Even when web-based technology is used, it tends to be *supplemented by other media*.” (Bødker et al. 2002, p. 11f)

Studying the specificities of something not quite there made the objectives of a descriptive and non-judgmental research strategy difficult to carry through. These obstacles have motivated the inclusion of an analysis of how ProjectWeb is enacted in research situations and the different types of intervention involved in the empirical research activities.

In the first section of this chapter, I analyze how early exploratory interviews intervene in subtle ways. My co-researchers and I planned these interviews as non-interventionist, yet I analyze how these interviews actually interfered with that which we studied. I illustrate how the very practice of empirical exploration involved subtle interventions, also when not explicitly aiming at informing specific design or engaging in a change-oriented initiative. The second half of this chapter conveys a later research strategy - a deliberate interventionist effort - where my co-researchers and I sought to link up with and support one particular group of users, the project assistants in PPM, to acknowledge and support their design-in-use activities. I discuss how this deliberate intervention took unintended turns and was re-shaped in unexpected ways.

Enacting benefits and potentialities of web technologies

The first example illustrates how my research, a non-interventionist research project aiming to explore specificities of web use and design, got caught up in subtle interventions. I will present a few passages from an early interview with Olivia, a Medical Writer working in the Clinical Recording Department of Novo. This was an exploratory interview openly mapping and comparing use practices pertaining to ProjectWeb in three different pharmaceutical projects.

A colleague and I interviewed this Medical Writer, expecting a real end-user who might need the archive of earlier documents, abstracts, and articles that were stored in ProjectWeb and who might also contribute to its content and structure by uploading new articles and summaries to the system. Starting out with the thematic bullet points on our interview guide, we discuss Olivia's daily work and her role in the project. She is responsible for reporting on clinical trials to regulatory agencies, putting together information on various testing procedures and results in a form presentable for the governmental regulatory agencies around the world. We discuss details of her work, her main co-workers, their locations, and their means of communication. A lot of her work involves regular communication with employees in a partner firm in California. Moving from her description of these activities, I start to inquire about ProjectWeb, which was in part developed for this sort of cross-continental collaboration - for supporting project communication and collaboration across geographical distances and different time zones.

Olivia explains that she hardly uses the system. She "goes in now and then" and occasionally sends project documents from the regulatory team to the project secretary who uploads these to ProjectWeb. She explains: "I don't think our ProjectWeb has been given much attention. I know a lot of people don't even think about using it or really know that it exists... It is still a new way of communication, and people are more used to email. Or if they want other information out there, they go on the Web. No, using it as a tool within the project hasn't really broken through yet, not in that way." She replies.

Here ProjectWeb is related to email, the web, and the way it is used elsewhere in other projects, and it is related to my suggestions as to what this technology might comprise and accomplish. This example was, at the time, disappointing, since my object of study was almost non-existent in relation to Olivia and her work. This kind of example was indicative to me of ProjectWeb's partial failure: that while being an object of enthusiasm and re-designs in one context, ProjectWeb was a foreign object, or simply irrelevant in another. In contrast with the many relations and associations traced in the previous chapter, this situation is marked by the lack of connections and links. The technology is here a vague entity, an object without much form – that is, apart from my interview guide, questions, and suggestions.

Later in the interview, in a discussion of Olivia's main working group and of how they send documents around for comment and editing via email, I find myself explaining the possibilities of using ProjectWeb for working together on specific issues within smaller sub-groups, as opposed to ProjectWeb as a space for sharing

documents within the whole project. I elaborate on how restricted areas and menu categories entitled “drafts for commentary” could support collaboration in small groups without jeopardizing the confidentiality of unfinished materials. Olivia responds: “No, we haven’t used it for that. For lots of reasons... Well we do, however, have this one group, the clinical development team of about 20 people from the departments, clinical, regulatory, and safety. We meet once a month, and it would definitely be really great if we had our own little place, because those are the people I need to get hold of when I send out my report for comment. There I would be able to put it up, and the people who were interested and had the access rights would be able to go in and have a look. Can you decide on the format yourself?” she then asks me. (Interview, Olivia, Medical Writer)

This situation clashes with the very notion of an exploratory study and with the non-interventionist endeavors I saw myself engaged in. Why was I disappointed? On the one hand, this might very well be seen as a finding concerning “user needs” or “demands,” related to a new technology, yet I suggest that these are created in the situation, that the very situation establishes a space for new links and possible connections to be made. Here, the researcher is the one preoccupied with the category of end-user and the one laying out possible uses, explaining what the system is and what it might bring to Olivia’s work. These suggestions derive from literature on web-technologies, from discussions with my co-researchers, as well as earlier interviews with, for example, developers. To return to the notion of enactment, ProjectWeb, with its properties, *emerges* in the research situation and in relation to a particular research agenda. Here, the research agenda of DIWA and “findings” are intertwined. My questions and suggestions revolved around particular attributes attached to web-technology and how these features might support the cooperative work carried out by Olivia. And Olivia starts questioning me about these possibilities. The co-construction of user needs and what we as researchers bring into the field as we produce accounts of work practices is widely acknowledged, yet somewhat under-theorized in IS research.⁴⁰ How can we think of this as intervention?

⁴⁰ In ISD research, emergent demands and interests have been discussed as a ‘wicked problem’ that never can be definitely formulated and can only be understood progressively as solutions arise (see e.g. Fitzpatrick 2002). Little work, however, examines *how* demands and interests are co-constructed in particular ways through research interventions or through ongoing use. Exceptions are Markussen (1996) and Finken (forthcoming) who reflect upon the research practices in the niche of Cooperative Design or Scandinavian approaches to systems development. Both authors call for further critical scrutiny of what it means for researchers to be directly implicated in the events and experiments studied, and they suggest that such concerns

Intervention as circumstance: In a context of participatory design initiatives, Markussen notes a similar dilemma (1994). She looks back on the process through which initial open-ended field studies were translated into a set of exemplary scenarios and particularly critical situations. Markussen describes the research process as “on the one hand rather obvious and easy, and on the other hand bewildering especially in terms of what ground the decisions were made upon... it became clear to us that the situations we had stressed were the ones that could be supported by the technology we had in mind and which may support the local groups in coordinating their work... In cooperative design projects it is increasingly realized that when designers initially ‘scan’ the work and the workplace, interviewing, observing, and talking to people, their perspectives are for very good reasons shaped by their knowledge of the technology and how they want to develop it. Kyng comments on an example of a work description from the Great Belt Project: “The description is rather broad – basically it just summarises the different media used by supervisors. However, when one takes a closer look it is rather obvious that those who made the description had hypermedia as one of their concerns.” (1994:9)” (Markussen 1994, p. 63)

Markussen, drawing on Haraway (1991), reminds us that there are no innocent positions. In her analyses she illustrates how researchers often have their own agendas in studies of work and user practices.⁴¹ User practices do not present themselves as pre-given to the IT-ethnographer or systems analyst. Characteristics, problems, and themes of work emerge during the process of empirical research through a series of selections, reductions, and translations. In the same way as the AT-project or the Great Belt Project described by Markussen and Kyng did not innocently record work practices, but rather specifically selected and produced scenarios revolving around hypermedia concerns, the very interview situation I have presented above was shaped by DIWA discussions and research objectives. My own and my co-researchers were, at the time, driven by analytical interests in web technology and their relation to distributed work practices.

The interview with Olivia – and others similar to it - was thought of as an exploratory and relatively innocent mapping of existing and potential application areas. Yet, based on the example above, I suggest that in this particular situation I participate in enacting the very object I have set out to study. Intervening in the field is thus not something researchers choose to do or not to do, but rather a fundamental circumstance that is

have been secondary to the primary task of designing technology and producing recommendations for how others should design technology.

⁴¹ See also Stolterman (1991) who makes a similar point based on the empirical study of professional design work and the ‘hidden rationality’ behind designers’ examinations of work areas to be supported by IT.

present when conducting empirical research on and about new information technologies. The very practice of empirical exploration involves subtle interventions, even “before” analysis and even when the researcher is not explicitly aiming at informing specific design or action research initiatives. In the example above, the very interview situation, the interview guide, the digital recorder on the table, and my introduction as coming from the DIWA project, as well as the conversation we have, all mediate ProjectWeb as a (good) tool for communication and collaboration across geographical distances – one that might be *better* than current technologies in use such as email, web, telephones, and faxes. Intervention thus seems to be integral to the very subject matter and manifests itself even in the smallest interview.

As indicated by Kyng above, one notion is that of scanning, selecting, and filtering out that which is relevant and irrelevant to particular research agendas. This view leaves the object, people, and practices untouched since the research extracts particular bits and pieces of the practice explored and then recedes into a phase of analytical research and the write-up of exemplary and critical situations. This analytical work and writing might then lead to interventions or changes in the future, in our case for example by relating our work to new ProjectWeb designs or Novo’s IT strategies. However, an enactment view presses the notion of intervention further and offers a more precise understanding of intervention – that the object is not seen through a filter, but that the ProjectWeb can be seen as an *effect* of the interview arrangement. This is a different way of looking at where the intervention begins. I suggest that in interview situations as those above, I ‘interfere’ not only in shaping technology and implementation processes through concrete research products such as reports and recommendations, but also in re-enacting particular versions while in the field.

For one thing, I take part in preparing the ground for the proliferation of new technologies. I guide Olivia through appropriate use and invoke reflections on what she needs. And thereby I also bring in ideas about the new and the better – as well as ideas about ProjectWeb as possibly being *the* new and better. Blomberg similarly suggested has the notion of “reinventing the researcher as entrepreneur”, as an actor who moves into new territories to assess how well a new technology might be marketed and profitable (discussed in Suchman 2000). This entrepreneur both assesses as well as prepares new sites for technologies. We might think about this as warming up the sites we study for the proliferation of new technologies. By moving between different sites of design, use,

and research, I inevitably take part in laying down the tracks and preparing the ground for rolling out new technologies such as ProjectWeb. In a sense, I participate in giving the technology the potentialities (and agency) that I am studying.

How can we come to terms with the subtle interventions that are embedded in our very research conditions? One path is to try to be more reflective and to think more deliberately about how and where one wants to intervene, what kind of enactments we as researchers wish to be part of. Yet, this is easier said than done. Next I look at how the kinds of interventions I have discussed above are not only something I as researcher bring in and impose on those studied.

ProjectWeb – the new and better as a mutual enactment

In looking back at some of the interviews I conducted, it seems that interviewees also participate in enacting ProjectWeb as an object of potentiality – speaking about the technology in terms of how things might be done better in the future. Olivia does it in the situation quoted in that she reacts to my suggestions and starts asking me questions.

In other interviews, discussions of ProjectWeb likewise constantly slipped into talking about what it might bring. Wonderful future scenarios and possibilities continued to emerge, not only from me, but also from the interviewees. Interviewees would often explain what one could do or what one might use ProjectWeb for and tell elaborate stories about how other people used ProjectWeb elsewhere. So the technology was potentially of great benefit, or, of benefit to other people elsewhere, other projects, departments, or future employees. So it is not as simple as saying that the enactment belongs to research or that the intervention is something I bring in and impose on that which I am studying. Who is intervening in what becomes a messy question. I will provide some examples to illustrate this.

Several interviewees described a new functionality labelled "document commenting" as extremely useful and practical for making visible the type of information contained in an uploaded document. One interviewee, Jørgen, working in Marketing, described with enthusiasm how this functionality could be used for navigating among the many different types of documents, but when we subsequently asked him to give an example of how he recently had used this functionality in his work and search for documents, he replied that actually he did not use it. Nor did he encourage others to use it since the descriptions create a distance in the list of documents and would ruin the overview of documents on the screen. He explained that instead he and his colleagues tended to use similar file

names so one could easily see the type of document and numbers indicating versions: “We do not use it [document commenting], because, well... I don’t actually think it has been agreed upon, but it will possibly be used in the future. It is probably this tendency to keep everything as simple as possible, in order not to have to much too much to look at?” (Interview, Jørgen, Marketing)

Another interviewee, Kim, elaborates on a page where the web links of affiliated partner firms are listed in one place. He stresses that it is really useful to be able to check details about the firm, find a contact person in the particular firm, and generally navigate in the mess of affiliates associated with the projects. Frequently, Kim needs to contact people from one of the firms in Portugal where parts of the insulin device his project is developing are being produced. Yet after explaining these advantages of being able quickly to locate project members in partner firms and subsidiaries, he adds that he actually accesses this information in another way to: “I have to admit, that I do not use this access to them. I have my own shortcuts to this information via the web browser. But it is extremely important to new employees in the project and for our partners be able to enter the project quickly, that it is an official web site where things are gathered.” (Interview, Kim, Quality Control)

Here again, features of ProjectWeb are *potentially* of great benefit, or they are so to other people elsewhere, or to future employees.⁴² In these examples, interviewees thus also participate in enacting ProjectWeb as an object of potentiality. The conversation with Olivia and the excerpts presented above thus enact ProjectWeb’s potential benefits and to some extent ProjectWeb as an imperative. This is, on the one hand, a research intervention, and on the other hand, a mutual enactment – an effect of the situation where interviewees also participate in creating a space for this intervention. Again, this complicates the notion of the non-judgmental descriptive strategy of research and of unintended interventions even further.

A different research strategy, common in the field of ISD, consists of deliberate and intentional interference. If I compare these studies in Novo to other studies in the DIWA program, the lack of ‘good’ cases of IWA design and use (as stated in the midterm report at the start of this chapter) was less of a problem and bewilderment for those in the DIWA project aiming to explore potential application areas, develop design

⁴² In earlier work, Jens Kaaber Pors, Hanne Westh Nicolajsen, and I have analyzed similar examples of how non-use and visions of the future may be seen as a constituent elements or actors in ProjectWeb configurations (Henriksen, Nicolajsen, and Pors 2001).

ideas, or new basic technologies and architectures for IWA development (e.g. Bøving, Pors, and Simonsen 2000). Facing the lack of a good case, my researchers in the DIWA project planned action-oriented research where they themselves would implement an IWA and then study the changes they initiated. Whereas my work drew more on a theoretical STS research repertoire, these other studies were oriented around explicit alliances and contracts with developers and IT-management, learning from the changes invoked, and making recommendations for the better based on these experiences. In contrast to a non-judgmental descriptive approach, this action-oriented research approach assumes that a systems development process is best studied by deliberately trying to change it for the better.⁴³ ISD research can thus be done in different ways (as discussed in chapter two) where some are more explicit and deliberate about intervention than the theorizing style in which I was engaged.

In the next section of this chapter I will present a later initiative along these interventionist lines in which my co-researchers and I linked up to one particular group of intermediary users, the project assistants in PPM. This was a group of users who shared our enthusiasm and excitement about web-technology (as opposed to many other interviewers who viewed ProjectWeb as more peripheral and vague). This work also caught our attention because it resonated with DIWA related research and IS debates on design-in-use. In analyzing this effort, I will look at how a deliberate intervention for the better takes an unexpected turn – and sparks a debate on exactly what “the better” might comprise.

Multiplying the better

What did we do? During our exploratory studies of ProjectWeb we found that the work of project assistants, their enthusiasm and creativity, was largely under-recognized and marginalized in relation to the importance this had for making ProjectWeb work in pharmaceutical development projects. As a preliminary analysis, two co-researchers and I wrote a paper on the work of the project assistants for the *European Conference on Information Systems* (ECIS) held in Gdansk, June 2002 (Henriksen, Nicolajsen, and Pors 2002). In this paper we analyze the position of the project assistants as an overlooked

⁴³ In chapter two, action research is presented as a common way of informing ISD, in particular in the sense-making traditions and Scandinavian approaches to ISD. See Baskerville and Wood-Harper (1996) and Braa and Vigden (1999) for a discussion of action-research in the field of ISD.

‘cultivator’ of ProjectWeb.⁴⁴ We describe how the project assistants set-up and configure ProjectWeb in the system administration section, how they continually contribute to the content of the application, and how they encourage use among project members. We discuss different aspects of this creative work and the possibilities for acknowledging and strengthening the project assistants as an important community of users that configure ProjectWeb for use, and, as such, are a starting point for attracting additional users. This work drew on ISD notions of “cultivating the hybrid” (Aanestad and Hanseth 2000), and notions of producing evaluations pertaining not to ProjectWeb’s design as an isolated entity, but to the way in which the technology was integrated in work practices. This view implies that the “success” or “workability” of information technology can only be evaluated in relation to use. Our work thus positions the project assistants in the management department as an important constituent of the ProjectWeb-in-use hybrid, and in the paper we suggest strengthening their mediating activities and experience – as well as making this a basis for further design work.

As part of this initiative, we invited four project assistants (our main informants) to a feedback meeting. They had received the article by email beforehand, with an incitation to a discussion followed by lunch. We wanted to thank them for their cooperation and interest in our research and also wished to present our suggestions before passing these on to management in Novo and to the participants at the ECIS conference.

Deliberately valuing the work of project assistants

We arrive and seat ourselves around an oval table in a standard meeting room on the ground floor of the brown PPM building. Hanne (my co-researcher from the Danish Technical University) opens the meeting by presenting the main points from our paper. She outlines the contents of the paper and invites the project assistants to comment on the analysis and suggestions we put forth. Hanne describes different ways in which the project assistants set-up ProjectWeb for use by other project members and the relative freedom they have in doing so. Very few formal guidelines exist, for example. The way in which ProjectWeb is set-up, maintained, and used by project members differs remarkably and shapes the ProjectWeb (as hybrid) in different ways. In the article we discuss Novo’s liberal strategy of providing departments with an array of (Microsoft compatible) applications and letting them choose and experiment with these. Several interviewees link this strategy to the “organizational culture” in Novo as one characterized by “freedom and

⁴⁴ The article also draws upon Orlikowski et al.’s concept of ‘use-mediator’ (1995).

experimentation”. The IT strategy is also referred to as a “shopping basket”. (The case is of course different for accounting systems and, for example, systems for documenting clinical trials where other stricter and standardized rules apply.) In the article we suggest that this open strategy, the enthusiasm of a small group of project assistants, and the flexibility of the technology has created this space for different configurations and roles to evolve. We describe this in positive terms as an evolutionary process of development based in use experience through which two configurations of ProjectWeb have emerged. Hanne explains how the paper singles out two different configurations, named by us, as a “communication tool” and as “workspaces”. Described in two different scenarios, we suggest that each configuration incorporates different aspects of project work; positions project assistants in different ways, and distributes access rights and visibilities among users divergently.

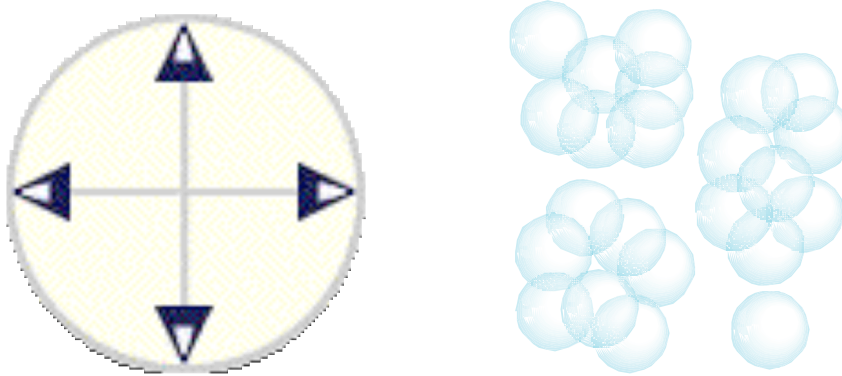


Figure 8: Two ProjectWeb scenarios, the center to periphery communication tool and the ad hoc workspaces

Scenario 1: ProjectWeb as a communication tools depicts ProjectWeb hybrid as a center to periphery image with the project management department at the center of development projects to which information flows and is redistributed. The project assistant is the web-master, who structures and maintains this flow of information. As a central gatekeeper, the project assistant collects project information and channels it back out. Most information, articles, and news are sent to the project assistant who then uploads these and thereby constantly supplies project members with updated information, making all information about the project accessible at all times and across geographical distances. All project members have reading access to almost all sections (with a restricted area for core groups members as an exception). This ProjectWeb configuration has taken the form of an ongoing newsletter or bulletin board for broadcasting general project information. As a communication tool, ProjectWeb replaces other communication tools and alleviates personal requests to the project assistants for information.

Scenario 2: ProjectWeb as workspaces is, as opposed to scenario one, figured as islands of use bubbling up with out any center. These arise and evolve through ad hoc working groups and immediate demands for collaborating on specific problem or task. Here the project assistants administrate groups and menu categories at the request of project members, but the working groups build content and shape the hybrid configuration. Project assistants thus provide the service of establishing member groups, and the delegation of reading and uploading rights and restricted areas gives sub-groups the possibility of exchanging documents and information which are either specific to that group – and that perhaps are not yet ready to be published for the entire project groups because of tentative conclusions or an unfinished draft status. Partner firms working with other quality systems can, for example, also share different folders to support another division of work tasks and documentation needs. As a workspace, ProjectWeb alleviates hassles of encrypting emails and documents and provides a safe space for dynamic ad hoc working groups and teams.

The set up of the meeting, the text and our initial presentation, thus presents the work of the project assistants and seeks to value and legitimize their activities which otherwise are carried out in spare time and somewhat invisibly.⁴⁵ With this initiative we aimed to stress the practices and experiences of active users, and thereby to value this work and the different experimental ways in which the project assistants carry out these design-in-use activities. Recognizing and strengthening their work is seen as a way of making ProjectWeb a *better* tool for project work. However, as the discussion unfolds in the meeting, it turns out that the project assistants present are not particularly interested in being defined as central cultivators or in having this work formalized in any way. Our initiative is instead is taken up by the project assistants and reworked in unexpected ways. This deliberate evaluation initiative becomes something else - an occasion for the project assistants to discuss and reflect upon what exactly is or would be better. Our study and initiative, the paper, presentation, and meeting, offer one version of ProjectWeb as part of use practices – that then sparks other debates, reflections, and additional suggestions concerning, firstly, what is “right or wrong use”, and secondly, “what they really need”.

⁴⁵ Suchman (1995) and Star and Strauss (1999) discuss the notion of ‘making invisible work visible’ and present some of the tensions and trade-offs involved in attempts to value invisible work through formal task descriptions: how these also may reify work, become opportunities for surveillance, increase work burdens, and perhaps weaken the creative processes that are the target of support.

Right and wrong use

Following our presentation, Marge picks up on the notion of different configurations and begins to talk about an employee from a production site in Kalundborg who recently contacted her. Kalundborg is a town name and a Novo enzyme production site. (This employee had Marge's email from the manual she had written that has circulated from PPM to other departments in Novo) Marge explains how, in Kalundborg, ProjectWeb is used in an entirely different way.

“In Kalundborg ProjectWeb is a portal for the entire production department. They have distributed access rights for creating articles for the entire department, and many employees themselves contribute articles on different topics. And they hardly use the documents section. We have never used it like that. They have opened it up, and everyone is adding articles without using FrontPage like we do. I think it is really impressive. And it is fun to see that some people use it as was originally intended [by the designer or NNIT]. I hadn't thought of it in that way until I saw what the guy from Kalundborg had done. Neal [main programmer of ProjectWeb] has always been shaking his head at the way we have made additional pages in FrontPage.” From here the discussion turns to whether this way of using ProjectWeb, more in line with the designer's original intentions is better and more correct and that this is ‘a more open and dynamic usage’, as Marge describes it, where “everyone has equal opportunities, regardless of technical skills or knowledge of html”. (Feedback meeting, notes and transcription)

By bringing in this scenario, Marge questions the ways in which the project assistants have distributed access rights and whether one is more correct than the other, whether their mediating activities (framed by us in positive terms) have been too possessive and actually kept other kinds of uses and configurations from evolving. The project assistants begin discussing what might be better: open information sharing between all project members (the communication tool configuration), restricted spaces for working groups (the work space configuration), or perhaps even more distributed use where others who are not project assistants would be able to shape ProjectWeb in new ways. The project assistants also start discussing where exactly the explanations for these differences can be located. They discuss personal preferences – how some project assistants like to work with graphs and numbers and others enjoy graphics and visuals. They discuss the organizational culture of freedom to experiment and the flexibility of the ProjectWeb application and the difference in the amount of time and energy they spend on ProjectWeb - depending on, for example, the level of activity, current project phase and management prioritization.

I will not replay this discussion in detail, but would like to point out that the project assistants themselves start working out plausible explanations for the differences between ProjectWebs in the PPM department and the very different way in which ProjectWeb is set up and used in Kalundborg. The discussion revolves not only around locating an explanation, but also focuses on finding out which configuration is the superior. And, as explained by Marge, the designer's 'original intentions' become one marker for what might be more correct or better. Is use in line with the designer's original intentions better? Is open information sharing between all project members an improvement – or should ProjectWeb in contrast support the restrictions and confidentiality of development projects? These contests about defining what ProjectWeb is, and how it may be better, are also about defining the work and role of project management and the project assistants. Defining their position is layered into discussions of what is right and wrong use. Should the project assistant be the central gatekeeper through whom project information flows and is distributed, or should they abandon control over ProjectWeb and provide a more invisible support function while the real work takes place elsewhere?

Interfering ways of improving and making better: As researchers of systems development, we tend to speak of and for “the better”. This was exemplified in the first interviews where a descriptive mode of research slipped into discussions of the new and better. With ProjectWeb came promises and possibilities for easing collaborative work across geographical distances (from research agendas and from those studied). In the second section (the deliberate initiative to value the work of project assistants) we assumed that strengthening an existing group of enthusiastic users and their mediating work would be better. And in the meeting discussion, better multiplies into being use elsewhere in Kalundborg, what the designer originally intended, better for the project as a whole, better for project sub-groups, better for some project assistants and not others, and so on. Zuiderent (2002) discusses a similar problem. Zuiderent notes how, during his ethnographic study in a Dutch haemophilia care center, he was confronted with difficulties in univocally answering what a 'better technology' is. Asking this question led to another question: “better for whom?” and to an explosion of the field into eight different versions of what the care center is and should be. In examining these eight versions, Zuiderent shows that there cannot be one answer to the question of how to intervene and ensure the production and implementation of better technology. This case resonates with experiences from my case study. Should ProjectWeb be a communication tool from a project management center to peripheral project members? Should it be a set of private workspaces for ad hoc collaboration in project sub-groups? Or perhaps a malleable portal for employees to share events and news across entire departments? In addressing similar dilemmas, Zuiderent warns against falling back on overall humanistic or egalitarian values as implying the better for all. Instead he suggests that

research inevitably involves taking sides at particular moments and in particular places. He suggests researchers ought to be better equipped for situated choices (or politicized ethnography) and for suggesting provisional betters for now based on practical here and now considerations.

Analyzing this feedback meeting illustrates some of the ambiguities and open-ended outcomes involved in trying to take sides and support one particular group. But is this a plea to give up conducting exploratory case studies of user practices or abandoning any attempt to support particular groups and interests? What I want to do here is to turn the question around, to look at not only what we as researchers can support, strengthen, and make better, but also at what we might spark or set off. The concept of ‘interference’ is useful here since it is less deliberate and intentional than the term intervention and can encompass the way in which research initiatives co-construct the very object and practices studied.

I suggest that our deliberate initiative to value the ProjectWeb as a hybrid and the project assistants’ experimentation work as part of this hybrid becomes something else - an occasion for the project assistants to reflect for themselves upon their own position in relation to other project assistants, project members, project managers, and designers in NNIT. This is a subtle kind of unintended intervention where a deliberate effort – to strengthen the work of the project assistants for the better – interferes with other notions of what is better circulating in the field. I will specify this argument by presenting a final excerpt from the feedback meeting discussion.

“What we really need”

As mentioned, we sought to acknowledge and center the work of the project assistants, suggest how it might be strengthened and supported (as an alternative to focusing on ProjectWeb’s design in isolation). Paradoxically, the meeting became an occasion for reflection on desired changes to the application design. Our proposals were left hanging, more a concern of academic debates than of interest to them. They would rather discuss an immediate rectification of the technical problems they dealt with daily. “What they really need”, comes out in an exchange on the changing relations to NNIT:

Isabelle: “New things come up constantly. You get new ideas when you sit and work with ProjectWeb. And new problems arise. Marge does a great job in collecting our requests, but what we need is an active contact to NNIT, a consultancy thing, where we can always contact them and say: ‘We need this and that, now’. That would be

optimal. They could get a sum for being there, on standby, and we could put that into the project budget. People [project members] often come to me and ask for new features: ‘can we do this or that?’ - it is so frustrating that we can’t use it more because of technical limitations that wouldn’t take an IT support person half a day to fix. We really do not have the optimal flow with NNIT, and that’s the main problem.” Petra recalls the days when she could call up Neal and ask him about a particular problem. “He’d say hang on, that’s in line 2048 (of the code), and he’d fix it on the spot. Then you could hear that he did it right then and there and then he’d ask, ‘is it working now?’” Isabelle: “Well NNIT is not as interested as we are in sustaining this product.” Louise: “Yes, they did a whole big sales job on it, and now it is like they let it go – in mid air. And I think it is pretty annoying. We have proposed new things all along, just little changes that they said were really minor issues, and peanuts they called them, giving me the impression that it would be in order in no time. For example, the fact that we can’t download the PowerPoint presentations or, the problems we’ve had with uploading large files. I mean that’s why its there, that’s the whole idea. I get complaints all the time from my users and it’s not peanuts.”

Marge: “Well it has been decided from the top management that PW is going to be shut down. That is one of the reasons that they cannot give us resources to keep developing it. It is too expensive to have a person in NNIT programming all the time. The plan is to leave it down here, lying around smouldering, let us get a few minor things done in an upgrade and then roll out a new standard system at the end of 2003. They are testing different ones now.” (Feedback meeting, notes and transcription)

This very meeting – our intervention initiative – creates a space for reflecting upon their shifting position and possibilities within wider networks. This is a moment for discussing “what they really need”: a budget, a consultant, ongoing development according to immediate needs and problems that arise, and a system developed specifically in accordance with their own evolving needs and demands from what they refer to as ‘their users’ (project members). This meeting is thus a space for working through their position and for assessing how collaboration with Neal and NNIT has been altered. And how current IT strategies in Novo are moving towards increased standardization. At this point the redevelopment of ProjectWeb has been cancelled, and as Marge explains, various new standard systems for a standard project ‘collaboration tool’ are being examined in the BIT group. Marge is active in this group and in the debates on new strategies for integrating existing document databases in Novo into one main system, “the main collaboration tool” for all development projects. Based on these experiences,

Marge is able to explain the vision of streamlining all systems in use and thereby gathering all document databases and repositories in a large knowledge fund. Whereas the company earlier has been characterized by a very loose “shopping basket “ IT strategy, new organizational restructuring plans are taking IT into consideration and laying out plans for streamlining all systems in the organization as a part of an overall organizational “knowledge management strategy”. The discussion in the meeting revolves around this tension between the advantages of the standard system, the new problems this will bring, and the specific solutions to immediate problems perceived as pressing. They negotiate their own ‘right to choose’ and joke about how even if they do try to standardize the use of systems in Novo, no one will adhere to it anyway. With a spark of admiration they discuss other employees in the Discovery department who are wild anarchists because they run Linux servers and use Netscape instead of Windows and the official Microsoft package.

Thus many different versions of what constitutes the “better” circulate and are debated at this meeting in the space that was created by our initiative to recommend and propose valuing the work of the project assistants. Rather than meet our objectives, our initiative generated a discussion about what really might be better and how the daily use of and problems with ProjectWeb are caught up in Neal's and NNIT's disinterest in redeveloping this particular application and in IT strategy meetings elsewhere. The meeting intervention therefore comprises new reflections on what constitutes an improvement and on the shifting relations to management and developers.

Subtle and unanticipated interferences

In this chapter I have analyzed two research activities to discuss intervention practices that have played into the development of ProjectWeb: exploratory interviews and a subsequent interventionist effort. I have argued that the open-ended non-interventionist interviews were intervening in the sense that they participated in enacting ProjectWeb's potentials (that which I was studying). I have suggested that these interventions were not, however, imposed from outside. Interviewees also participated in providing a space for enacting ProjectWeb as an object of potentiality. Thus, research that sought to be non-normative ended up being normative after all, in subtle ways. Furthermore, I have argued that the intervention is a mutual enactment – not something undertaken or imposed by the researcher alone.

As part of my research, I (or my colleagues and I) later took explicit stance and sides and participated in a more deliberate intervention by linking up with and strengthening a group of active, yet under-recognized users. In this initiative we drew on notions of ProjectWeb as a hybrid configuration to be ‘cultivated’ in order to propose what should be done, what would be better. The proposals consisted of recognizing the work of the project assistants as a group of active use mediators, and in strengthening this work with time and resources, and through formalized possibilities for further education and the exchange of experiences among project assistants. Yet, this attempt to value the work of project assistants (to propose as good and better the different evolving configurations, the creativity and enthusiasm of the project assistants) turned into something else. By presenting excerpts from a feedback meeting discussion, I have shown how this initiative sparked new discussions of right and wrong use and a reflection on the project assistants' own shifting position in relation to management and to NNIT. The second point this chapter makes is thus that what started out as an attempt to be normative and prescriptive (to support and strengthen one community of users) became a different kind of intervention, acted out by the project assistants in the meeting. It became an occasion or space in which they themselves compare and evaluate the configurations we propose, reposition themselves, and reflect on shifting constellations and their possibilities for action and influence on the development process. This is the kind of intervention in which the researcher ignites a debate that seems to move out of the researchers hands and control. I have suggested the notion of ‘interference’ to understand this dilemma and to illustrate how our suggestions and recommendations as researchers meet with, invoke, and transform other notions of how ProjectWeb should be improved.

Debates and discussions continue, and the traces we leave have real material effects. ProjectWeb has since been redeveloped in a 4th version and is currently being tested out in a beta version in PPM. Between the conclusion of our fieldwork and now, a working report my colleagues and I wrote on ProjectWeb use has circulated within an IT-strategy group and has been addressed in the BIT group’s standardization debates, playing into the reconsideration of ProjectWeb as an appropriate standard collaboration tool. (This report was passed on to this IT-strategy group by NNIT as a part of the evaluation of other standard systems in comparison to ProjectWeb.) And the other day, while I was working on this chapter, the developer from the IT department called me to ask if we had written more papers or reports recently, because he was putting together a sales presentation for the new version and was using some of our work on how user

experiences have been incorporated in ProjectWeb's different versions. Here again, our research and interventions are not ours alone. In this sense, research and interventions are not imposed from the outside, but on the contrary, my research activities have been implicated and caught up in projects as diverse as the proliferation of new web technologies, project assistants' positioning and struggles for negotiation spaces, BIT strategies of standardization, and the redevelopment, marketing, and sales of ProjectWeb version 4. In closing, I suggest that these subtle interventions continue to leave traces after we are gone and our work in the field is supposedly finished.

8. The relevance of radical localism

In this final chapter I revisit the motivations for this study and discuss the contributions made in the thesis, namely how radical localism can be empirically and theoretically relevant and how it can be practiced.

Motivations revisited

I first encountered research on information systems and systems development during my graduate studies and work on my master's thesis, for which I conducted an STS study of online publishing as a gray zone spanning both technology consumption and production. In this study I developed an interest in the area of design and use of information technology and found an STS commitment to practice, particularity, and localism to be a fruitful resource. A Ph.D. scholarship provided the possibility of continuing this line of study. I was fortunate to become part of a wider research group, the DIWA program, working inter-disciplinarily and addressing a range of issues pertaining to the design and use of web-applications in particular. Here, I met and worked alongside IS and ISD researchers and experienced first hand the ISD research tradition as marked by a quest for solutions, models, methods, and explanations that can order the complications of ISD practices. I have discussed this at the outset of this thesis as a more general characteristic of the research tradition of ISD. At the time, this orientation towards models and methods contrasted sharply the practical realities of online publishing that I had studied earlier, which were largely self-taught, experimental, and amethodological. Starting up fieldwork in NNIT I was likewise confronted with practices that seemed to lie far from discussions of systems development methodologies or depictions of ISD as a set of generalized determinants. In fact, development methodologies were not really an issue for developers in NNIT when discussing ProjectWeb.

In an early interview, a developer in NNIT for example explained that for the earlier version of ProjectWeb they had not applied any development methods at all, and in the most recent version they were doing so mostly for purposes of documentation and to adhere to the ISO standards that the development company recently had decided to achieve as a quality stamp of their products, now that they were seeking new customers and market areas outside Novo Nordisk. The employee creating 'Use Cases', a technique

for capturing requirements as part of the method Rational Unified Process (RUP), was curiously doing this *after* most of the programming for the new version was in place.⁴⁶

In presenting these findings to my DIWA research group, I was met with a lack of surprise. Apparently the fact that developers often do not use methods or use these for other purposes than intended was a well-known and well-established fact, and I was referred on to literature discussing why methods fail and are ‘faked’ in practice (e.g. Parnas and Clements 1986, see chapter two). This led me to the line of research pursued in this thesis and to the conviction that the ISD research tradition could benefit from studies that left prescriptive methods aside, bracketed generalized recommendations as the central research theme and way of informing ISD, and instead explored the specificities of how a web-based information system comes into being through a variety of practices going on at several locations. Empirically I sought to explore the practices not captured by notions of ISD as an orderly project or in terms of methodology: for example, ‘extra-method’ practices and ongoing design-in-use at distributed locations. These were practices that were somewhat deferred and under-examined in the field.

I see this re-orientation towards openly exploring and engaging the complex of practices involved in ISD as my main contribution to the DIWA research program in which I have been involved throughout my research, and as relevant to ISD researchers more widely. I see this work as strengthening an existing tradition that already relies on inspiration from a range of other disciplines and an interdisciplinary optic. Whereas some researchers have discussed the need to clean up the field (e.g. Checkland and Howell 1998), I suggest that these different theoretical positions, interdisciplinary perspectives, and multiple normative repertoires that currently make up ISD research also provide the fruitful possibility for questioning and challenging the objects of research – thereby developing new scientific knowledge and invoking debates on what qualifies as useful and beneficial knowledge on ISD. I find further work in this interdisciplinary line important in constructing a critical perspective. I will explain this by returning to another one of my experiences from the DIWA discussions and seminars.

A second striking experience was the expectations from my colleague ISD researchers, a group into which I was by now included, to ‘improve’. I was expected to provide

⁴⁶ See <http://www.rational.com/products/rup/index.jsp> and Fitzgerald et al. (2002, pp. 67-72) for more on RUP.

improving recommendations pertaining to at least one of the following areas: how to re-design ProjectWeb through new specifications and design suggestions based on my empirical studies of use practices, recommendations as to how the developers in NNIT might organize their work better (for example, in better compliance with systems methodologies), or, how the implementation and use of ProjectWeb in NNIT might be made more effective. These expectations, and my reluctance and disability to provide such recommendations, led me to work further with the question of how we as ISD researchers can come to terms with, improve, and intervene in processes of ISD, given that the process include diverse and distributed practices not easily condensed into and overviewed as one model or set of determinants.⁴⁷

In addressing these themes of interest that emerged in the tension between fieldwork and academic discussions in the DIWA program, this thesis has aimed to develop and illustrate a new theoretical perspective from which to view ISD practices under the heading of ‘radical localism’.

Positioning

At the outset of this thesis I introduced the field of ISD as a briar patch – as a conglomerate of intertwined research orientations and concerns. In Hirschheim and Klein’s (1989) work, ISD was presented in three versions: First as a value free scientific activity that aims to develop true representations of the world, modeling these in a rationalist manner. ISD here belongs to an expert domain of engineering and management. Secondly as sense-making, where what counts as ISD-relevant knowledge is extended to include human and social issues. Here, the human and social side of ISD are not only included, but centered as the main concerns. In the third story of radical structuralism, ISD is depicted as a political activity through and through. Here, the politics of the process are focal, and it becomes necessary for developers and researchers to take sides.

I used these stories to present different versions of where the ISD process is located, who acts, and why. These stories center different subjects and objects and present attempts to conceptualize and picture ISD. Also, these stories serve as pointers as to how researchers might intervene in order to improve the process and whether the primary

⁴⁷ The ‘we’ again indicates that I was now part of the research field.

concern of researchers is technical, social, or political. Each story is thus normative in the sense that these versions of ISD also indicate how the process (as scientific/objectivist, social, or political) can be informed and should be improved, how it should be made more efficient, better aligned with the social, or more egalitarian and democratic. Today, ISD research is increasingly oriented towards the way in which actual ISD practices do not relegate neatly into such clear-cut and ideal stories. Nevertheless these stories continue to serve as resources for conducting ISD research as was the case in the DIWA research program. These stories can be seen as different repertoires researchers can draw upon when ‘improving’ specific information systems or ISD more generally as process. Different ways of being normative and improvement thus co-exist and mix in practices of ISD research.

I questioned the given nature of any one particular way. Or, that any one way can be argued for by reference to a universal claim such as – technologies should be rationalized and efficient (functionalism), technologies should be developed according to users voices and needs (radical structuralism), or consensus on technology development can be facilitated through balancing need and interests with help from the researcher (social relativism). Not only are new conceptualizations of ISD necessary, likewise new logics of improvement are pertinent.

As entry into a second positioning, I presented two critical articles by Truex et al. (2000) and Ciborra (1998) which both point to the emphasis upon the methodological, order, and universal models that suffuse the field. This way of informing ISD is traced into the scientific/objectivist story that then has ‘leaked’ into the other two traditions and ways of dealing with the social and the political nature of ISD. These two critical articles pinpoint aspects of ISD that have been obscured from view in research debates as a result of the field’s emphasis upon systems development methodologies. For example, the messy, unpredictable, and fragmented character of ISD practices or practices that take place ‘outside’ the boundaries of the formal development project and team. Truex et al. (2000) and Ciborra’s (1998) critiques widen the view for what should be included in an ISD research agenda in order to develop renewed understandings of the practical realities of ISD. The process is technical, it is social, it is political, and it cannot be clearly contained in one model or universal methodology. How can we then picture and engage with the process? The thesis has addressed this question and confirms that it can be worthwhile to bracket and shift away from a preoccupation with systems development methodology.

As some examples of work that similarly seek to rework the concerns of ISD research drawing on STS research I presented the work of Büscher et al. (2001), Aanestad and Hanseth (2000), and Hales (1994). Their contributions have provided inspiration as an alternative way of approaching ISD by bringing complexities out of the process rather than aiming to reduce and control. These authors thus bring new themes of unpredictability, distribution, and localism onto the ISD research agenda. And these authors inspired two pivotal ideas: one, that the development of ‘better’ technologies does not necessarily stem from in depth analysis and finding out about the work practices in question, but might be a matter of doing, trying things out, and tinkering with the resources available here and now, two, that ISD may involve more than one style and object of design.

Based upon these insights from the literature, I presented two analytical strategies for refocusing on local practice in a theoretical chapter. This was done to elaborate upon ways of studying ISD as local practice and a way of working up against the tendency to view IT artifacts (the objects of ISD) as single, stable, and ‘the same’, every time and everywhere. This strategy was based on the assumption that ISD research might benefit from a more local engagement with the technological artifacts and their specificity. In a discussion of the work of Orlikowski (2000) and de Laet and Mol (2000), I introduced a notion of technology in practice as ongoing enactment. In this view, technology does not follow a trajectory, moving from being instable and under construction to a state of stability and completion, as we commonly tend to think, but is made stable due to recursive practices. This way of talking about systems is, for example, radically different from the figure of a ‘systems lifecycle’ embedded in most methodology thinking, where a systems life has a beginning and an end. In a practice view, structure and stability are instead thought of – and analyzed – as an emergent phenomenon, always an outcome of ongoing practice. This theoretical discussion laid out the grounds for studying differing practices and allowed me to think about stability as recursive practice. In the chapter I coined this approach as an analytical trick for working empirically more than an explanatory theory. In working through the selected case stories I also eclectically brought in additional STS and ISD literature along the way.

This thesis has thus applied selected literature and an empirical study of ProjectWeb to develop radical localism as a framework. This framework always attends to *ProjectWeb as practice* and studies an information system not only in context, but as something that does

not exist outside of context – outside of a practice in which it becomes designed, used, and known as such. This strategy implies bracketing many of the explanatory resources we have available and a destabilizing of many of the boundaries we tend to take for granted.

ProjectWeb as practice

Framing practices: In the first analysis chapter I described observations from a design workshop organized by employees in NNIT. This workshop preceded the development of a version 4 of ProjectWeb. In the course of this workshop, ProjectWeb was described and presented as discrete technical entities, as a typology of users and usage, as an onion, as Lego blocks, and as a social or technical problem. To scrutinize these different depictions, I analyzed this workshop event as a situation in which ProjectWeb, a complex and distributed information system, was made visible and available for discussion through various mediating representations and figures, lists of features, and metaphors. These were investigated as different ways of seeing and delineating ProjectWeb as an entity, different ways of overviewing it, and making it an object of discussion, evaluation, and redevelopment. I explored how these different depictions of ProjectWeb were intricately linked to the particular situation of NNIT, to the DIWA research practices, and to the particular embodied experiences of the workshop participants. Based on this analysis, I developed the argument that these ways of seeing and delineating ProjectWeb as an object can be seen as a product of these practices as well as an outcome of the very workshop event. Through this analysis I developed and exemplified the concept of *framing* to illuminate these findings and such delineating practices through which an information systems comes into being.

Assembly practices: In the second analysis I focused on selected use-situations in the offices of project assistants in the project management department of Novo. Here, ProjectWeb is set up, deployed, and maintained for wider use in distributed pharmaceutical development projects. In one situation I found that ProjectWeb was a good tool for pharmaceutical projects, while in another it was slow, not secure and not confidential enough. ProjectWeb came to work successfully at one moment but presented problems and obstacles in the next. ProjectWeb came to work or fail in more ways than one. I have therefore scrutinized how this relative success and failure can be seen as an effect of particular situations. The analysis investigated the circumstances and relations of specific use-situations, and showed that the project assistants play a central part in tinkering and

adjusting ProjectWeb as well as in linking ProjectWeb to the particularities of pharmaceutical project work. Their work, the support of a 'head gardener', other desktop applications, the phase of a project, or content of a meeting are elements we tend to think of as outside and separate from technology. Yet, in the analysis I foregrounded how such elements play a part in constituting and in a sense 'redesigning' ProjectWeb in use. In this analysis I developed the analytical concept of *assembly* to get at another kind of practice through which an information system is held together through temporary arrangements of diverse and heterogeneous elements.

Interfering practices: In the third case story I focused on my own research interventions. This chapter was motivated by paradoxical experiences while doing research as well as DIWA discussions on improvement and the improvement expectations/obligations mentioned at the beginning of this chapter. I looked at different ways in which ProjectWeb was acted out through my own research questions and presentations of findings to my informants in interview situations, in a feedback meeting, and later in a circulating report I had written with my co-researchers. Through these practices ProjectWeb becomes attached to new possibilities and potentials, figured as a hybrid configuration, and as a site of contests and struggles among the project assistants. Furthermore, these research situations were all suffused with various notions of the new and better, the problematic and the necessary. Scrutinizing these research experiences, I bring out how we as researchers in very subtle ways interfere and shape that which we study, and, how we do not always have control over the outcome of our initiatives. In this analysis I illustrate the concept of *interference* to foreground these practices and problematize the notions of intervention and 'making better' that lie at the heart of ISD research.

Developing analytical concepts

The analytical concepts developed are thus translations of field observations and experiences. I suggest that these analytical concepts illuminate my own case material while addressing issues of wider relevance to future studies of ISD. These are thought of as sensitizing concepts (Fujimura 1991) that offer new perspectives from which to view the process of ISD. In the following I expand upon the issues to which these concepts can sensitize the ISD research traditions.

The concept of *framing* addresses the wider dilemma that there is not any place where researchers, developers, or anyone else can stand, look down upon, or have immediate access to a phenomenon such as ProjectWeb. To see, discuss, and evaluate new information systems (under development or in use,) it is necessary and productive to ‘frame’ these through different mediating devices that are both discursive and material. I suggest that the concept of framing helps us to become more attentive to the ways in which the phenomenon ProjectWeb comes into being as a bounded and knowable entity. Furthermore, this concept brings forth how information systems can be framed in more than one way and how any framing is a particular enactment in a particular place and time. Implied in the concept is the idea that framing is a continual practice, never total, and that different framings may co-exist and overlap. Further research might address how inconsistencies and conflicts between different framings are dealt with in practice.

The concept of *assembly* brings into focus how an information system’s properties may be seen as an extended effect of use practices and wider arrangements. The concept of assembly allows us to think in new ways about what it means for a technology to be a success or a failure, and about the heterogeneous elements and practices involved in making it one or the other, or both. The concepts assist an analysis that moves away from the tendency to view information technology or information systems as a fixed entity (the same every time and everywhere) that professional developers design and redesign, which users can comply with or resist. The concept opens for further exploration of the array of social and technical elements that hold together phenomenon such as ProjectWeb and how over time assemblies and elements of assemblies transform. This concept deliberately destabilizes the boundary between design and use, and the notion that use lies outside and after ISD. Further research might explore in more detail the nature of practices that appear to lie somewhere between design and use as an important and ongoing practice through which an information system continuously comes into being.

Lastly, the concept of *interference* sharpens the implications of the other two concepts to suggest that ‘what ProjectWeb is’ is mediated by ongoing diverse material and discursive practices, including interfering research practices. This view renders it possible to analyze discursive practice (such as interviewing, conversations, and discussions) as not lying outside or above ProjectWeb as a symbolic or communicative reflection of the material world, but as interfering with the world and objects discussed and having very real

material effects. The notion of interference thus erases the distinction between material and symbolic as a way of analyzing ProjectWeb as always enacted and re-enacted in practice. This concept reiterates the relevance of thinking about technology as emerging across many differing local practices and across both material and discursive dimensions, and in addition, repositions the researcher as taking part in constituting the information systems and practices explored.

The case stories thus provide empirical insights and illustrate analytical concepts. The cases together illustrate an alternative way of approaching and studying systems development – an approach I have referred to using the term radical localism.

A localized methodology?

With this work I hope to inspire future empirical studies of ISD and provide inspiration to my colleagues in DIWA as well as other ISD researchers. Throughout this thesis I have referred to *radical localism* with soft terms such as ‘approach’, ‘commitment’, and ‘sensitivity’ in order to shift away from preoccupations of systems development methods. Yet, in closing I might, after all, characterize radical localism as a methodology, a localized methodology. I have in the analysis illustrated how radical localism has added to the empirical study of ProjectWeb and allowed me to develop insights into differing and under-examined practices involved in ISD. This methodology opens such practice for scrutiny and thereby also provides suggestions as to how distributed information systems can be explored from within local practices. Neither the approach nor the concepts are exhaustive in relation to ProjectWeb nor will they necessarily be the most salient concepts in the next study I currently am planning to carry out. In my own future research I expect to find that these concepts will need to be adjusted and supplemented. Radical localism is thus not a method in the sense that it offers a fixed recipe of prescriptions to be tested out, proven, and falsified in another organizational setting or in relation to other ‘types’ of information systems than those involving web-technology. Yet, radical localism *is* methodic in the way that it systematically abandons claims to universality and incorporates the possibility for problematizing and placing at stake what we know.

I thus deliberately refrain from providing solutions on what should be done to improve ProjectWeb, or how to better support the work of NNIT developers, the project assistants in the Project Management Department, or ISD in any general terms. Instead, the approach of radical localism allows me to take a different kind of standpoint than

that of recommending a course of action. Radical localism opens a critical space in relation to the very expectation of developing prescriptions for how development should be undertaken. Radical localism differentiates the question of improving ISD and complicates the notion of better technology. Radical localism shifts the discussion of improvement away from a naturalized good we can steer towards and emphasizes that better is always dependent upon particular actors, locations, and practices. Urgent to the ISD research tradition becomes the question of what kind of pathways and spaces of possibilities we want a particular research project to constitute, what practices the researcher should engage in, connect to, and strengthen, or disconnect from. I have chosen to connect to practices currently under-exposed in ISD research in order to rework established conceptions of ISD as a process that can be overviewed and modeled.

ISD as a distributed and emergent process

Brought together, the approach and the analyses problematize and extend existing ways of understanding and engaging with ISD as ongoing, distributed, and local practices. The analyses foreground the complexities and uncertainties of ISD processes and the difficulties of controlling the process in practice or condensing it theoretically.

The analyses emphasize how people involved in the fields we study are continuously engaged themselves in processes of defining technology, aligning it with here and now practices and orientations. Such practices seem to be always ongoing and often unfinished, and more than merely matters of interpretation. At the same time, the examples thus illustrate my encounters with three variants of what the object is and how it might be studied: as a technical system that can be mapped out into parts and studied in relation to other systems and redevelopment, as ongoing work to be meticulously recorded and acknowledged through detailed observations, or as future potential and change invoked by the researcher's active involvement. The research strategy of juxtaposing multiple locations and working across different variants has served to question the nature of the phenomenon under study, and subsequently, to open a productive space for further analytical work on how distributed information technologies emerge through a range of differing sites, practices and concerns, that may be only partly overlapping.

This thesis targets the challenge of mapping out ISD in one overall picture or model. The research design and organization of the thesis addresses this very problem. I have illustrated snapshots of the process, instead of working towards an exhaustive map. This creates a picture of ProjectWeb as practices continuously acted out in many locations.

In conclusion:

- The analyses and concepts together problematize what lies inside/outside development and thus belongs/does not belong to an ISD research agenda. The study puts additional practices and situations onto the agenda, such as disorderly 'extra-method' activities of setting up the conditions of a development project, design-in-use practices, and unintended research interferences.
- The analyses and concepts together question the notion of ISD having a beginning and an end, a notion that is embedded in most methodology thinking. For example the image of a systems lifecycle where phases of analysis, design, implementation, and use follow one another sequentially. The cases illustrate how such phases are not clearly delineated and how design and use co-exist and continuously feed into one another.

Bracketing the notion of ISD as project and as centered in a professional design realm is worthwhile, and redirecting empirical focus to practices that lie somewhere between the distinction of 'design' and 'use' becomes a critical task. This thesis demonstrates that it is fertile for ISD researchers to enter ISD processes from several locations and through differing local practices. Radical localism proposes a new orientation and identifies relevant resources for this endeavor.

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