2 Project Designs for Student Design Projects

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What. This chapter presents a method for supporting students in thinking about the focus of design projects and in devising a project design. A project design is an agreement among the project participants about the focus and structure of their project. Project designs are devised by articulating the project aim and starting to break it down into component activities.

Why. We contend that four frequently used project designs are flawed in the sense that their strength in one area important to design comes at the cost of severe weaknesses in other, equally important, areas. While there are several practical reasons for this state of affairs, student designers should know the flaws inherent in different project designs. In this chapter, we intend (a) to increase the awareness among students and supervisors of the complex considerations involved in the design of projects and (b) to stimulate more reflective discussions of the pros and cons of different project designs by dismantling unrealistic expectations of devising a flawless project design.

Where. This chapter is specifically about project designs for student design projects. The specific focus on student design projects means that the principal rationale for the projects is learning about design. However, student projects rely on learning by doing and thereby blend learning and doing.

How. The method consists of four questions. Each question targets a different element of the design process and points toward one of the four frequent but flawed project designs. Thus the question that a student feels most strongly about points toward a likely project design and also toward the main risk the student must consider in formulating a project.

1 Introduction

A project design sets the focus and structure of a project by articulating the project aim and starting to break it down into component activities. In this chapter, we are specifically concerned with project designs for student design projects. A design project can be broadly defined as a project that aims at “changing existing situations into preferred ones” (Simon 1996, 111), typically by exploiting the possibilities afforded by technology. Our specific focus on student design projects means that the principal rationale for the projects is learning about design, which is sometimes contrasted with doing design. It is, however, a premise for this chapter that the most effective way of learning is by doing. This premise makes design projects central to learning about design. Indeed, half of any study program at our university consists of projects in which the students identify a problem and research it. A core aspect of these projects is that the students themselves form their project groups and identify the focus of their projects. In the design-related study programs, it is therefore imperative that the project designs devised by the students, with support from their project supervisor, capture the essence of design. Otherwise the students will not get exemplary design experiences.

This chapter presents four student project designs that are derived from a simplified model of design projects. Collectively these four project designs capture a large part of the student design projects at our university and, presumably, at many other universities. We contend that all four of these project designs are flawed in the sense that their strength in one area important to design comes at the cost of severe weaknesses in other, equally important, areas. We elaborate this contention in the rest of the chapter. The many instances of the four project designs suggest that though their flaws may be avoidable in principle, they are difficult to avoid in practice. While the contention that frequently used project designs have severe flaws may sound pessimistic, the intention is otherwise. The aim of this chapter is (a) to increase the awareness among students and supervisors of the complex considerations involved in the design of projects and (b) to stimulate more reflective discussions of the pros and cons of different project designs by dismantling unrealistic expectations of devising a flawless project design.

In the following, we present the simplified design model from which the four project designs are derived (sec. 2), characterize the four project designs by analyzing their focus and limitations (secs. 3–6), propose a method for supporting student designers in thinking about the focus of their projects and in devising a project design (sec. 7), and discuss whether the limitations of the four project designs can be circumvented (sec. 8).

2 A Simplified Model of Design Projects

The literature contains a plethora of partly overlapping and partly inconsistent design models (e.g., Bødker, Kensing, and Simonsen, this vol.; Checkland 2000; Fallman 2008; Leonard-Barton 1988; Markus 2004). In this chapter, we adopt a simplified design model (fig. 2.1), adapted from Kensing and Munk-Madsen (1993). Our goal is not to

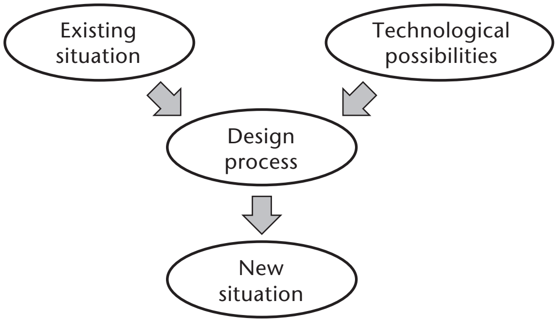

Figure 2.1
A simplified model of design projects.

propose a consensus about how to model design projects but simply to capture four basic elements that recur in many models. First, the *existing situation* must be understood. Users may already have this understanding, but designers need to experience the use situation, and the two groups of actors need relevant structures on the work, which can provide a common language for communication. Second, the *technological possibilities* must be explored. Designers need to maintain an overview of various technologies. Designers must also make relevant technologies available for users to experience, because such concrete experiences improve the users' ability to contribute creatively to the design process. Third, the *design process* must be organized and managed. The process of organization and management is complicated by the gradual and nonlinear way in which users and designers normally work out the desired match between the situation and the technological possibilities. Fourth, the *new situation* must be envisioned. Users as well as designers need abstract descriptions of design proposals to assign priorities and make decisions, but to better understand and more thoroughly assess proposed designs, they also need concrete experiences with prototypes and changes in work processes.

The new situation is an independent element because it involves a fundamental breaking away from the present understanding of how the users' tasks and the technological possibilities define the situation. The new situation is unknown at the outset and is only realized gradually. The cyclic nature of this gradual realization is fundamental to design processes, though not explicit in our simplified model. For this reason and because the cyclicity is important to the argument of this chapter, the simplified design model is supplemented with the task-artifact cycle (fig. 2.2). In the task-artifact cycle, designers respond to user requirements by building artifacts, which in turn present or deny possibilities to users (Carroll, Kellogg, and Rosson 1991). This process is nontrivial and inherently cyclic because users' and designers' understanding is situated (Haraway 1988). The users' understanding of their tasks is

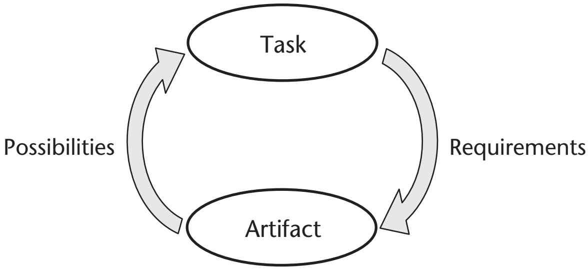

Figure 2.2
The task-artifact cycle.

determined by the artifacts they currently use, and at the same time, their understanding of their artifacts is determined by the tasks for which they are using the artifacts. Likewise, designers' understanding of the technological possibilities is determined by their knowledge of tasks that need to be performed, and at the same time, their understanding of users' tasks is determined by the possibilities and restrictions of the artifacts they currently know. Thus people's familiarity with certain artifacts and certain tasks shapes their understanding of what their tasks are and what technology has to offer. This understanding, in turn, constitutes a perspective that points to certain technological possibilities and makes people blind toward others (Naur 1965). The fundamentally important implication of such situated knowledge is that it is inherently difficult to transcend the current way of perceiving things and envision how tasks, users, and technology should interact in constituting the new situation.

3 The Analysis Project

The analysis project (fig. 2.3) takes the existing situation as its focal point and asks questions such as the following: Who are the stakeholders? What are they doing? Why are they doing it? How are they doing it? What is the problem? These questions call for understanding the users, their goals, tasks, present tools, and the broader context of use. In addition, the questions involve reaching an understanding of the users' experience both of the positive qualities of the use situation and of its negative aspects, such as inefficiencies, vulnerabilities to error, tediousness, and unappealingness. It is important to appreciate the positive qualities because they must be preserved—or changed very cautiously. In contrast, the negative aspects are important motivations for pursuing change and important starting points for the creative part of a design process. However, the positive and negative qualities of a use situation are often not readily apparent. What appears as a positive quality may, for example, be rendered

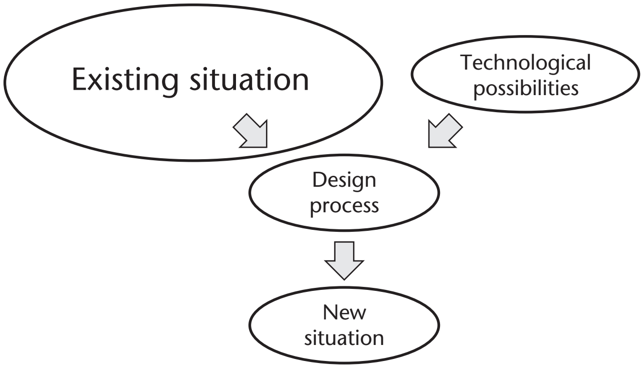

Figure 2.3
The analysis project.

obsolete by a new technology that removes some of the intermediate steps in a use process and thereby the need for the hitherto-appreciated tools for producing the input needed to complete these intermediate steps. Also, aspects perceived as negative by some stakeholders may be perceived as positive by others with different roles or responsibilities. Analyzing the existing situation involves reaching a balanced understanding of what must be preserved and what should be changed, that is, between tradition and transcendence (Ehn 1989).

The strength of an analysis project is the resulting rich understanding of the existing situation. Approaches that aim to reach such a rich understanding include science, technology, and society (STS) studies (e.g., Bijker, Hughes, and Pinch 1987), sense making (e.g., Weick 2001), and computer-supported cooperative work (Schmidt and Bannon 1992). However, reaching this understanding is often a project in itself, especially when the use situation is complex, the designers are new to the domain (as will often be the case with student designers), or both. For example, understanding the process through which patients receive medication at hospitals presupposes an understanding of, among other things, (a) the three subprocesses of ordering, administering, and giving medication; (b) the division of labor between physicians and nurses; (c) the documentation necessary to ensure that the right medication is given to the right patient at the right time; (d) the mundane practicalities that codetermine how the medication process is actually performed to get the work done; (e) the interrelations between the medication process and the other processes involved in treating the patient; and (f) the frequency with which physicians and nurses are interrupted during the medication process. To acquire this understanding, designers need to talk to physicians and nurses and, preferably, to observe them when they conduct the medication process. This takes time and effort.

Because reaching an understanding of the existing situation is often a project in itself, there is a considerable risk that the analysis project mainly accounts for the situation as is and pays cursory attention to needs for change and coherent ideas for satisfying such needs. This risk is exacerbated by the use of observation and (in situ) interviews as the main empirical methods in analysis projects. Observing the existing situation provides no input about alternative technological possibilities and thus little support for envisioning new situations that rethink user tasks and technological artifacts. Interviews have similar limitations, making it difficult for interviewees to formulate requirements that go beyond removing shortcomings in their current artifacts. Without a sustained focus on change during the analysis process, the acquired understanding of the situation as is will be unlikely to provide designers with sufficient information about the pertinent distinction between the elements of the use situation that must be preserved and those that should be changed, as this distinction evolves with each iteration of the task-artifact cycle.

4 The Construction Project

The construction project (fig. 2.4) focuses on the technological possibilities and provides answers to questions such as the following: How should the design's form reflect its function? What components are available as building blocks? How are any inputs transformed to outputs? Does it perform well? These questions call for understanding the available technologies, including their affordances, their look and feel, the extent to which their behavior can be configured or dynamically changed, and their openness toward integration with other technologies. But most importantly, the construction project calls for investigating the technological possibilities by actually constructing

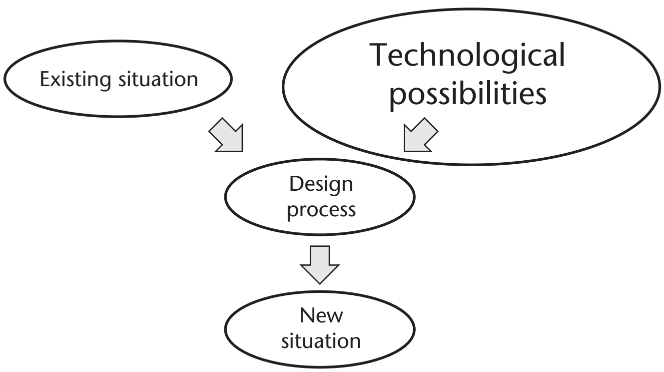

Figure 2.4
The construction project.

designs. By making hands-on experience with the technologies a driving element in the projects, one shifts the focus from principles to the application of principles and thereby to the complexity of handling the multiple practicalities that are abstracted away in principles. In the words of Schön (1983, 79), this complexity arises because the design situation "talks back," and it is handled by engaging in a "reflective conversation" with the situation. Construction is pivotal to this conversation because it is the construction of an initial design and the subsequent revisions of it that constitute the designer's moves in the conversation and thereby also constitute the material on which the situation talks back. The conversation becomes reflective when designers listen to the back talk and use it to form new appreciations of the situation and to refine their design. Conversely, the conversation remains unreflective if the designers merely apply principles without attending to the characteristics of the situation at hand.

The strength of the construction project is the reflective conversation that may ensue when constructing a design or a design prototype for use in a specified situation. Areas amenable to this type of project include architectural design, graphic design, industrial design, and IT design. However, the amount and quality of the back talk and reflection depend on the extent to which the use situation and its important details are impressed on the designers. When the designers are new to the use situation, the involved technologies, or both, it may be a project in itself to construct a design that matches even a simplistic use situation, thereby leaving little room for attending to the real complexity of the situation. For example, a project comprising the construction of an interface for flying a small, camera-equipped drone (unmanned aerial vehicle) by tilting a smartphone in three dimensions involves, among other things, developing a practical understanding of (a) the protocol for communicating with the drone, (b) the commands for operating the drone and reading its camera, (c) the protocol for communicating with the phone, (d) the command interfaces for accessing the phone's gyro that senses its tilting and for displaying a video stream on the phone, (e) the programming language used for developing apps and installing them on phones, and (f) the actual construction and testing of the app that reads the gyro, sends commands to the drone, receives the video stream from the drone, and shows it on the phone. To make room for addressing the technical challenges in this design, the use situation is virtually abstracted away, and back talk is reduced to the designers' own experience of the tilting interface.

Because it is often a project in itself to construct a design at even a prototype level of completion, there is considerable risk that construction projects become product-centric and dissociated from an understanding and appreciation of the use situation. This risk is exacerbated by the technical tools and skills necessary to construct actual designs but unhelpful when it comes to exploring the use situation. For example, constructing the app for maneuvering the drone creates little information about situations in which a tilt-controlled drone may be useful or appreciated. Such information is unlikely to emerge as a side effect of the construction activities. Construction projects predominantly study the artifact and technological possibilities, analogous to how analysis projects predominantly study the task and user requirements. Neither of these two project designs engages in a cyclic exploration of how requirements and possibilities mutually define each other, and both project designs therefore risk misunderstanding what users require, as well as what the technology has to offer.

5 The Process Project

The process project (fig. 2.5) focuses on the design process and asks how change is accomplished. This involves subquestions such as the following: What information is needed? How is it brought about, documented, and transformed into designs? How are designs evaluated and refined? How is the process managed? Are its outcomes reliable and valid? At an overall level, these questions call for knowledge about the organization of project activities into a linear or iterative process and the dual use of estimates to enforce plans and status information to enforce realism (Hertzum 2008). At a detail level, they call for knowledge about individual project activities, the methods available for performing them, and the pros and cons of the methods. The study of design processes is complicated by their situatedness. Processes, as prescribed in, for example, method handbooks and procedure manuals, are inherently underspecified. That is, their application to real-world situations involves a number of interpretations, steps, and prioritizations that are not specified but rather brought about by the local circumstances (Suchman 1987). The underspecified nature

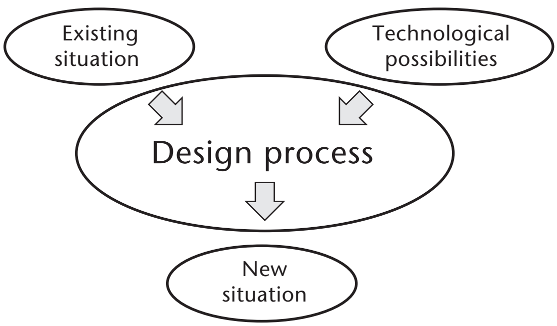

Figure 2.5
The process project.

of processes creates a tension between the process-as-prescribed and the process-as-practiced. This tension is central to process projects. The good process-as-prescribed provides guidance where needed but leaves sufficient freedom for the process-as-practiced to complement rather than contradict the prescription. At the same time, prescribed processes are intended to institute "best practices" and thereby to shape behavior to safeguard against error, produce outputs needed in other parts of the design process, comply with legal requirements to design documentation, or reduce quality variation through standardization.

The strength of the process project is the scrutiny and maturation of design processes. These processes include methods for work domain analysis (e.g., Vicente 1999), sketching (e.g., Greenberg et al. 2012), usability evaluation (e.g., Rubin and Chisnell 2008), and many other design processes. However, scrutinizing and maturing a design process is not easily integrated with an analysis, construction, or vision project because the design process becomes the end rather than remains a means. For example, investigating whether the process of thinking aloud affects how users in a usability test perform tasks involves, among other things, (a) knowledge of thinking aloud as originally prescribed by cognitive psychologists and as commonly practiced in the context of usability evaluation, (b) competence in conducting a thinking-aloud test, (c) knowledge of the aspects of the test procedure that may trigger thinking-aloud effects, (d) collection of data about these effects, (e) data about how users perform the tasks when not thinking out loud, and (f) analysis of any differences between the users who thought aloud and those who did not. In addition to introducing additional activities (e.g., activity e), the focus on the design process as an end also means that some otherwise similar activities grow in magnitude. For example, it is necessary with deeper background knowledge of thinking aloud.

Because it is often a project in itself to scrutinize the design process, or a part thereof, there is considerable risk that the process project loses sight of the design product. This risk is increased by the related risk of a dissociation between the process-as-prescribed and the process-as-practiced. For example, an overemphasis on the process-as-prescribed likely leads to processes that are too principled to be practically relevant, as when Carroll (1996), in his work on designing secure computer systems, states that "passwords to confidential information should be changed daily." In addition, the methods most useful to student designers may prescribe the design process in more step-by-step detail than the methods most useful to experienced design practitioners. The methods most useful to an experienced designer may instead provide a scaffolding that enables the designer to determine the right steps. This distinction between methods with scriptlike and maplike qualities (Schmidt 1999) further limits the possibilities of combining a process project with one of the three other project designs.

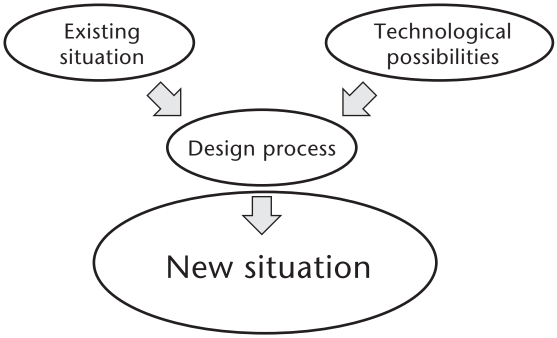

Figure 2.6
The vision project.

6 The Vision Project

The vision project (fig. 2.6) focuses on the new situation and aims to answer questions such as the following: What is the solution? Why is it desirable? How does it line up with a larger vision? What problems does it solve? How do we get there? These questions call for a coherent account of the envisioned new situation to show what the future may be like and expose the qualities of the vision. In so doing, the vision project seeks to short-circuit the task-artifact cycle by moving directly to the solution, thereby using the solution as a pivotal element in the design process rather than as its end point. However, a vision is normally not readily available, at least not in detail, but must be created. Even if a vision is available, it must be linked to user goals and technological possibilities to become convincing. This process of spelling out the vision is, according to many descriptions of design and creativity, most effective when the designers are knowledgeable about the current tasks and artifacts. For example, Petroski (1992, 22) asserts that "form follows failure" in the sense that the driver of design processes is the failure of existing designs to function properly. Also, more creative designs arise from carefully attending to constraints, whether they are imposed by the use situation, the technological possibilities, or the designers themselves (Stokes 2006). An important feature of targeting situation-defined and technology-defined constraints is that what initially appears an unwavering constraint may on closer scrutiny become more plastic.

The strength of the vision project is its coherent account of the new situation, not merely of a new technology. This account supports prospective users and other stakeholders in experiencing use, which adds context, meaning, and emotion to the technology. Methods for creating such visions include scenarios (Lindgren and Bandhold 2003), future search (Weisbord and Janoff 2007), and future workshops (Jungk and

Müllert 1987). However, an inspiring vision must strike a delicate balance to avoid both shortsightedness and getting lost in the degrees of freedom. This is often a project in itself. For example, a vision project about an electronic multikey that replaces all a person's keys with one device involves, among other things, that (a) the appealing reduction in the number of keys is not obtained at the cost of security; (b) the ease of using the multikey matches that of the keys it replaces; (c) a key owner can add a key to another person's multikey and subsequently revoke it; (d) the concept of keys may be extended to access cards, PIN codes, passwords, and so forth; (e) a unified security infrastructure is established across door keys, car keys, private keys, on-the-job keys, and so forth; and (f) many key producers adopt the system. In practice, it will only be possible to treat some of these topics in detail in any single student design project.

Because it is challenging to short-circuit the task-artifact cycle, there is considerable risk that the resulting vision will be unconvincingly linked to user goals and technological possibilities. An unconvincing vision appears to lack coherence, to make unrealistic assumptions, or simply to be vague. The vision may, for example, not handle existing constraints well, or it may presume widespread adoption of a single technological infrastructure across a large number of independent actors. If insufficiently linked to user goals, the vision may appear as a solution in search of a problem, indicating that the vision has failed in conveying a new situation, though it may have described a new technology. Alternatively, the vision may be convincingly linked to user goals and technological possibilities but be unconvincing in its short-termism. That is, it may lack vision. In this case, the scenarios or other methods have neither short-circuited the task-artifact cycle nor iteratively transcended the initial understanding of how tasks and artifacts codetermine each other.

7 The Four-Question Method

As a method for supporting student designers in forming groups, identifying a project focus, and devising a project design, this chapter proposes four project-design questions (fig. 2.7). Each question targets a different element of the design process (analysis, construction, process, and vision), and because the elements are interrelated, an answer to one question helps narrow down the possible answers to the other questions. In this way, the four questions offer four different entry points to the demanding process of devising a project focus and a project design.

A student designer may know neither what problem to work on in her next project nor what process to use, but she may have an interest in exploring the possibilities of growing plants without the use of soil, a technology known as hydroponics. That is, her starting point is a technological solution. From this starting point, she may, for example, go on to consider what problem hydroponics may solve, what kind of

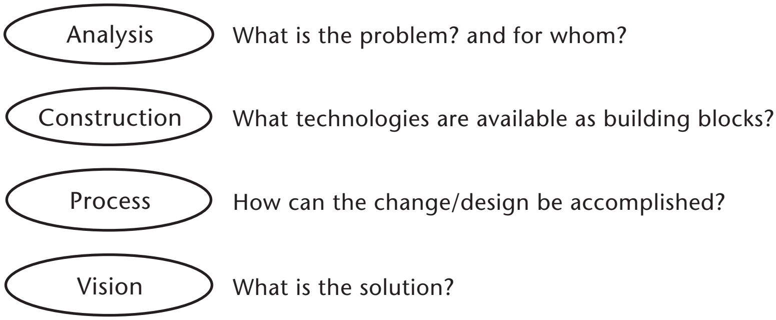

Figure 2.7
The four project-design questions.

empirical work she can do on this topic, and whether these analysis and process considerations appear interesting or her main interest is hydroponics as a vision. In the former case, she may proceed to think about the role she would want the empirical work to play in her project process. In the latter case, she may recognize that she, at present, does not have a good idea about how to work with the topic of hydroponics in her project.

The four questions serve the additional purpose of supporting the formation of groups by providing four dimensions along which students can state their interests and across which they can look for possibilities for collaboration. For example, a student with an interest in problems related to urbanization may discover that hydroponics provides a concrete way for him to work with urbanization by formulating a project about the problem of providing people in large, polluted cities with inexpensive, healthy food. His mainly analytic, problem-focused interest may or may not be compatible with the project designs envisaged by the other students interested in working with hydroponics. The question that a student designer feels most strongly about points toward a likely project design and also toward the main risk the student must consider in formulating a project. Thus the four questions may inform decisions about whether to team up with students who have a similar interest in a preferred project design or to seek out students who have complementary interests to avoid a risk that is perceived as too limiting.

The four questions may also be useful after the initial formative stage of a project. They may, for example, be used in discussions of whether the project focus has drifted or how it may need adjusting. The most important role of the four questions during the middle and late stages of a project may, however, be in helping student designers think of the flaws of project designs more as part and parcel of project work, that is, as normal, natural troubles (Garfinkel 1967), than as indications of bad project designs.

Project supervisors may play a role in promoting the use of the four questions as a vehicle for reflection on the consequences—both positive and negative—of the project design on the design solution.

8 Discussion

The four project designs discussed here do not exhaust the ways in which student design projects can be focused. A project design that may appear obvious is one that focuses evenly on all four basic elements in figure 2.1. Such a project design would avoid the shortcomings of the analysis, construction, process, and vision projects, but it is rare in practice, for several reasons. First, project designs that focus on a single basic element tend to require an effort that makes them full projects. Thus including all four elements in a student design project is likely to be unrealistic. Expecting all four elements appears a bit like expecting every research paper to include a formal theory, a survey, a laboratory experiment, and a field study to overcome the shortcomings of employing each of these research methods individually (McGrath 1981). Second, if a project focuses evenly on all four basic elements, it runs a considerable risk of attaining substandard performance on all four elements. In attempting to avoid this outcome, such a project design is under constant pressure to evolve into one of the four other project designs. Third, rather than focusing evenly on all four elements, a project may include all four elements but focus more on one than on the others. In such uneven projects, the analysis part, for example, has a strong foundation, whereas the other parts are more speculative. This imbalance will likely reinforce itself by directing more attention to the element that already receives most attention—to sharpen the project focus and clarify its contribution. Fourth, design is a cross-disciplinary area, at least in the sense that the four project designs call for different kinds of competences, considerations, and project deliverables. However, many supervisors of student design projects have their background in one discipline. Consequently, a supervisor may be more comfortable with one project design than with the others (e.g., a supervisor with a computer science background may be more comfortable with construction projects) and may therefore gravitate toward that project design rather than support students in balancing all four basic elements in their project designs.

The four project designs discussed here are defined by their main activity. Another way of defining project types is by distinguishing different areas to which design projects contribute. For example, Fallman (2008) distinguishes between projects that contribute to design practice with its focus on commercial and industrial considerations, to design studies with their focus on creating academic knowledge about design, and to design exploration with its focus on how design may be a voice in societal discussions about possible futures. Analogous to our argument, Fallman argues that the most interesting projects interrelate different positions rather than contribute to either design practice, design studies, or design exploration. The interrelations are interesting because they concern the dynamic and negotiated aspects of projects and point toward possible tensions or reinforcements. Thus bypassing the interrelations transmutes the design situation by making it less multifaceted, convoluted, and dynamic and, conversely, more orderly, linear, and artificial. This is contrary to the goal of project-based learning, which emphasizes "the connection of knowledge to the contexts of its application" (Barron et al. 1998, 272). Emphasizing that knowledge is situated implies that when a project design curtails the design situation, it also reduces the learning that student designers can gain from the project.

Interrelations between positions may be realized after the fact when looking back at a project, or they may be used proactively in planning and conducting a project. Major interrelations between the four project designs, defined by their focus on analysis, construction, process, or vision, are given in the simplified model of design projects (fig. 2.1) and in the task-artifact cycle (fig. 2.2). A project may, for example, aim to interrelate analysis and process to explore challenges in, and possible ways of working with, analysis throughout the process. In the next chapter, continuing our discussion of project designs, Nielsen and Andreasen make recommendations about how to foster and enhance learning from the collaborative activities of problem-based design projects.

Student designers may use the four-question method in thinking about the focus and project design of an individual project, but they may also use the four project designs in thinking about the series of projects that enters into their study program. One possibility is to focus on one basic element, such as the technological opportunities, in one project and on another in the next project, thereby devising a portfolio of projects that collectively cover all four basic elements. This strategy comes, however, at the cost of not experiencing how iterating among the elements leads to designs that transcend the existing situation and produce new ways for users, tasks, and technologies to interact. Another possibility is to create a personal profile in the series of projects by devising project designs that consistently give priority to a favored subset of the basic elements. This strategy builds on the rationale that most real design projects are staffed with groups of designers, each responsible for only part of the project.

To encourage project designs that comprise all four basic elements, supervisors and examiners need to acknowledge the required integration effort more than they criticize the flaws in the performance of the individual elements. In addition, supervisors need to provide models for student designers to follow. As an example, the method provided in chapter 4 of this book by Bødker, Kensing, and Simonsen may constitute a model for design projects in the area of information systems design, though with some risk of trivializing the technological possibilities. Alternatively, supervisors may support students in devising series of projects, in which the first project focuses on one basic element and provides input for the next project, which focuses on another basic element, and so forth. Such support could be educationally beneficial by providing for progressively more depth in the projects and for more coherence across study activities. In addition, it could be practically beneficial by rearing student designers' awareness of the importance of learning across projects, an activity that is associated with uncertainty in much practical design work (Hertzum 2008).

9 Conclusion

Design projects produce change by creating a new situation on the basis of input about the existing situation and the technological possibilities. Perceived in this way, design projects have four basic elements: the existing situation, the technological possibilities, the new situation, and the process through which the new situation is brought about. Each element contains complexly interrelated subelements and poses considerable challenges to the designer. This makes it even more challenging for student designers to handle competently the interrelations among the four elements. These interrelations, however, are fundamental to understanding the particularities and possibilities provided by the concrete situation and are thus central to situating the design successfully by emphasizing, de-emphasizing, and transforming these interrelations. Because the interrelations among the four basic elements are challenging to handle competently, project designs that focus predominantly on one of the basic elements are common but forgo important aspects of design:

- The analysis project focuses on the existing situation, aims to understand what the problem is, and risks becoming detached from change.
- The construction project focuses on the technological possibilities, aims to build something, and risks failing to appreciate the use situation.
- The process project focuses on the design process, aims to model how change is accomplished, and risks losing sight of the design product.
- The vision project focuses on the new situation, aims to explore where we want to go, and risks becoming an unconvincing extension of user goals or technological possibilities.

No matter which of these project designs the student chooses, the choice has serious limitations. Design students should be aware of this when they devise their project designs. This raises the question of whether the limitations can be circumvented by choosing a fifth project design. A project design that comprises all four basic elements is potentially highly rewarding but risks attaining substandard performance on all four elements. This risk creates a pressure toward evolving the project into one of the four other project designs.

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