

Job design for good design practice

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Good design practice requires more than individual strategies and methodology. The work of designers has to be supported by the organisation to enable designers to interact with colleagues proactively, to share relevant information and to learn collectively. Based on a framework of proactive design and psychological theories, four criteria for job design are developed, i.e. control over the design process, availability and clarity of design-relevant information, feedback on results and management support. The tasks of 19 designers from large, medium-sized and service companies were assessed according to the criteria. The results highlight areas for improvement in the different types of companies.

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What can organisations do to support good design practice? There are various answers from design research so far. The condensed experience of expert designers has been transformed into normative models of good design practice and taught as part of engineering and design education (Hubka and Eder, 1996; Pahl et al., 1996; Cross, 2000). Alternatively, good design practice may be developed by means of experiential learning and reflection upon one's own practice (Schön, 1988; Valkenburg, 2000). Both approaches have been applied and tested with student samples, and there is evidence that good design can be taught (Wallmeier et al., 1999; Günther, 2001). Yet most of these methodologies and strategies refer to an individual designer and a task without any context. In practice, however, most professional designers undertake design as paid work that is either triggered by a client or internal request or ultimately aimed at a marketable product. That means that for effective design strategies in practice the organisational context becomes highly relevant while it could be ignored in experimental studies with student participants. It is encouraging to see that design research on 'real', industrial projects with explicit consideration of the task and the organisational context has



gained momentum in recent years (Frankenberger and Badke-Schaub, 1998; Boujut and Laureillard, 2002; Zika-Viktorsson et al., 2003).

However, most of this research is of descriptive nature and views the organisation as a given influence on design rather than an artefact of human actions in itself. Organisations are made and shaped, and the way design tasks are allocated and supported can have a huge effect on the work of the individual designer.

This paper provides a theoretical framework for good design practice and how to promote it by job design and design process management. The framework is based on theories of work motivation and job design from industrial psychology (Hackman and Oldham, 1974; Warr, 2002), and on quality management approaches (Juran, 1974; Ishikawa, 1985; Hackman and Wageman, 1995). Both have generated knowledge and understanding on how to empower people in the workplace to promote good practice and a reliable, high standard of performance. From the model, a methodology for assessing the jobs of designers in terms of the specified criteria has been derived. The methodology was applied to a sample of 19 designers from large corporations, medium-sized enterprises and engineering service companies. The implications of the empirical results are discussed on a practical and theoretical level.

1 Framework for good design practice

Good design practice in an organisational context refers to a purposeful, conscientious, attentive and critical way of working on one's own task as well as anticipating consequences for others. The concept was originally developed to describe 'heedful interrelation' in high reliability organisations where teams manage to operate safely despite high-risk environments, following Ryle's definition of heedfulness (Ryle, 1949; Weick and Roberts, 1993). In these high-risk settings, safety can only be maintained if all players attend to the situation and keep each other in the loop about their actions. The task of designers is typically less dynamic and the need for heedful interrelation with other team members, the client or prospective users may be less obvious. Yet Busby's (1999, 2001) analysis of failures in the interaction clearly illustrates the impact of lack of heedful interrelation, or, in his word, lack of distributed cognition, such as designers omitting to tell others about the assumptions they make, or failing to elicit needs or schedules of others, or not stating exceptional circumstances. The concept of proactive, heedful design is based on Hacker's (1994) model of goal-directed action regulation (Figure 1). It specifies good design practice

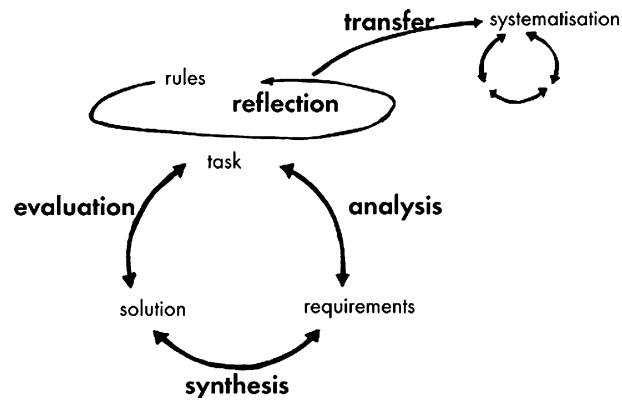


Figure 1 Model of proactive, heedful action in design

based on interview results (Lauche, 2001) and guidelines of design methodologies (Pahl et al., 1996; VDI 2221, 1993; Cross, 1984), such as analysing and questioning the design brief or maintaining analytical perspective during solution synthesis. The idea of heedful interrelation broadens the concept as it also incorporates reflection, knowledge sharing and systematic design management (Lauche, 2001).

It conceptualises designing as iterative cycles of analysing/investigating, synthesis/generating and evaluation (Jones, 1963). Analysing a design task is understood as decomposing the task into requirements. Following Hacker's (2003) concept of redefinition of tasks, the model assumes that people do not just receive and carry out orders but that they make sense of what they are being asked to do on the basis of their own experience and motivation. They then form a goal, consciously or unconsciously, how to carry out the task as they understand it. This redefinition of the task constitutes a very important logical step in design as it bears the potential for misunderstandings between client and designers, or proactive questioning of a potentially misconstrued design brief.

The synthesis is conceptualised as the heuristic search for a solution in the face of the requirements. The solution is carried out and tested, ideas are permanently and finally judged against the goal. This heuristic process can occur at any stage of developing a new product. It involves breaking down requirements into sub-goals but also modifying goals as the design progresses (Hacker, 2003).

So far design has been described as individual action. Yet within the existing division of labour, the conscientious work of individuals on its own does not guarantee high-quality outcomes. Designers need to

‘interrelate heedfully’ with colleagues, other departments, the client and user groups to ‘keep each other in the loop’ about changes to the design rationale, to feed back alteration or problems and to proactively anticipate the effects of any changes. Heedful interrelation refers to how teams communicate, such as leaving explanatory memos (physically or electronically) for changes, copying relevant parties into email communication, or consulting colleagues working on other components for the product. This usually works well on a local level within a team or community of practice. It is not as obvious but even more relevant for interface management with other departments or organisations. The information shared locally may not penetrate into all areas of an organisation that could be affected, or the locally successful strategy may turn out to be counterproductive on an organisational level. The framework therefore stipulates a managerial control loop to monitor design practices and introduce systematic solutions where appropriate in order to maintain an organisation-wide, systematic approach to proactive design.

Based on this concept of good design practice on an individual and organisational level, the following section outlines four criteria for job design to support it (Figure 2).

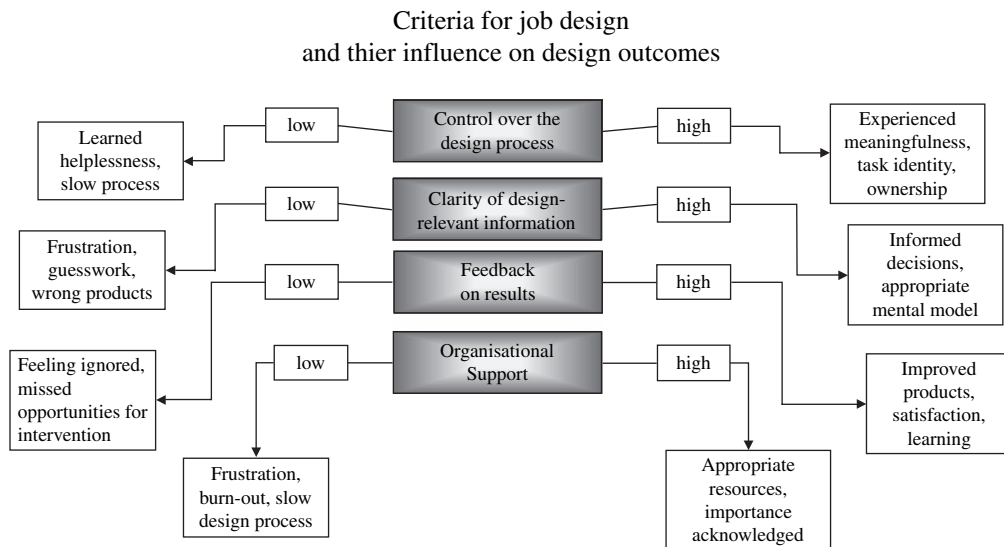


Figure 2 Criteria for job design and their influence on design outcomes

2 Job design to support good design practice

The following section describes a set of criteria for the structural prerequisites of good design practice. Heedful, conscientious practice is conceptualised as a high degree of task orientation in work psychology. To achieve task orientation, the task has to be meaningful, interesting and challenging and should employ a variety of skills (Hackman and Oldham, 1974; Warr, 2002). The task should allow designers to direct and monitor their effort, rather than leading to arbitrary results they can hardly influence. If jobs are designed so that people know and enjoy what they are doing, most people are more likely to care about the quality of their work and the consequences of their actions (Hackman and Wageman, 1995). The design of effective work processes is therefore an excellent means of promoting good design practice. The following set of criteria is proposed to foster proactive design strategies:

- 1) Control over a meaningful part of the design process was stipulated as an antecedent for accepting responsibility. The degree of control is partly dependent on the complexity of the product. For anybody to accept responsibility for the entire design process, they have to be able to exert some form of control. The criteria therefore include personal control, environmental clarity, feedback and supportive supervision.
- 2) Availability and clarity of design-related information about requirements and background of the design problem was seen as essential to inform action. It may be necessary for designers to obtain this information themselves.
- 3) Feedback on design results was conceptualised as an important element for corrective action and learning.
- 4) Organisational support for design in terms of attributed importance and allocated resources was stipulated to be essential for designers to operate successfully and in order not to destroy the positive motivational effects of the task itself.

Each criterion and its theoretical basis is described in more detail in the following sections.

2.1 Control over the design process

The criterion of control can be found in a number of psychological theories about job design. In one of the earliest sources, Emery (1959) postulates two conditions for task orientation: that the task induces strong forces within the individual to complete or continue it, and that the individual has considerable personal control over it. Hackman and

Oldham (1974) propose task identity and autonomy as constituting factors for experienced meaningfulness and responsibility for the outcomes of one's work. The assumption is that a higher degree of control will lead to more ownership of the task. As Wall et al. (1990) have shown, more local control makes work systems more effective because problems can be remedied faster. Lack of control, on the other hand, can slow down work processes and lead to feelings of helplessness.

For design tasks, a high degree of control means that designers can make or influence decisions such as the strategic direction of product innovation, the design concept, the verification procedure or the choice of materials and suppliers. They are accountable that their decisions conform to the overall aims of the company and the appropriate norms. For very complex products that are designed in large teams in one or more organisations, it may not always be practical that every single designer exercises control in the same way. The criterion predicts that in a more fragmented design process or for very complex products, individuals are less likely to feel responsible for the whole product and it becomes more challenging to engage in heedful interrelation with the other actors involved. More importantly, the criterion predicts that lack of control caused by undue interference from superiors or other departments will undermine designers' inclination to be proactive and conscientious in their own work.

2.2 Availability and clarity of design-related information

In order to formulate suitable goals for proactive design, designers need to know or be able to clarify the criteria against which the product will be judged. This clarification of requirements is of strategic importance for the design process to avoid solving the wrong problem. It is also of psychological importance as it helps designers to formulate goals for their actions. Action regulation theory assumes that people generate a conceptual representation (Oschanin, 1976) about the intended outcome of their action. The successful completion of the task is then perceived as closure of the *gestalt* of the design task.

Design-relevant information refers to market demands, client request, technical constraints and production optimisation. More or less of this information about the context of use, the desired quality, the planned costs, specifications of material stress or feedback on previous products may be available at the start of any project. The criterion states that making this information available and accessible to designers is not only of practical benefit but also serves motivational purposes.

The specific challenge of design tasks as opposed to managing or running existing systems is that the information about the desired outcome is often incomplete. Designers have to understand the context of use to make valid assumptions about how this context may change by introducing the product they are designing (Schmidt, 2000; McCarthy, 2000; Lauche, in press). The criterion of clarity of design-relevant information also pertains to the availability of background information on the strategic aims of the design projects, technical trends and previous products.

2.3 Feedback on design results

The concept of proactive, heedful design as proposed here implies that design organisations attempt to learn from mistakes and near misses and continuously improve the way they design. This means that good design practice depends on feedback to monitor and correct actions both for the current project and as learning opportunities for future developments. Feedback about the product in use can also be a motivator for designers and increase the personal responsibility for quality (Frankenberger, 1997). Not surprisingly, feedback is also a generic criterion for job design. Both Hackman and Oldham (1974) and Hacker (2003) argue that feedback provides knowledge about outcomes and thereby allows to monitor achievements and correct strategies and mental models accordingly. Feedback is a powerful mechanism for behaviour modification if it is timely and related to one's own actions. Hackman and Oldham (1974) differentiate between process feedback from the job itself and feedback by agents such as colleagues and superiors. The design process typically offers opportunities for feedback in the form of mathematical modelling, simulation, prototyping and testing. However, feedback on the ultimate criterion, i.e. the success of the finished product, remains distant by the very nature of the task. Early trials with prototypes and constant contact with clients and end-users may compensate for that. In the same way, design reviews with colleagues and corrective information about production problems can serve as sources of feedback, making feedback by agents an important component in work design tasks.

2.4 Organisational support for design

The fourth criterion pertains to the attributed importance of design and support from management and other parts of the organisation. As stated in the introduction, good design practice cannot be achieved on an individual basis if the context is not supportive. Proactive design and heedful interrelation pose requirements not only on the designer but also on their colleagues in other departments whose collaboration is

required. For example, integrated product development teams can improve the cross-departmental communication and understanding for design (Lauche et al., 1999). A proactive design approach is typically very resource intensive at an early stage during which results remain conceptual and difficult to materialise. The introduction of innovative products therefore requires the commitment and support from senior management (West, 2002). Aspects of good design practice may need to be implemented systematically to ensure that all projects are carried out to an identified standard. This requires organisational support for training and resources. Management commitment can also entail to reduce the impact of interruptions, time pressure and multi-tasking (Hacker, 1995) that can be detrimental to good design practice.

3 Method

For this study, 19 professional designers from 10 companies who had 3–20 years of practice in employment were interviewed about their work. As part of a purposeful sampling strategy, the sample was deliberately drawn from a range of organisations as the appropriate structure was assumed to be contingent on the primary task and size of the organisation. Three types of organisations were included: (1) four large corporations with specialised design departments and formalised design approaches ($n = 5$), (2) three medium-sized enterprises where designers worked on new products as well as dealt with updates, modification and maintenance ($n = 8$), and (3) three service providers who designed a variety of products for different clients while maintaining core engineering competencies ($n = 5$). The participants were recruited through personal contacts and other research projects in the mechanical engineering sector in Switzerland.

The interviews followed a task analysis method based on the four criteria of control, clarity, feedback and organisational support (Lauche, 2001). The method involved a narrative account of the design task and a series of open questions about several aspects of the job design for each criterion. The interviews were conducted in the local Swiss German dialect of the interviewee, tape-recorded and transcribed as Standard German. For the analysis, all answers were categorised according to the concept of proactive, heedful design, descriptions of the design process, and the four criteria for job design, using a Filemaker™ database application (<http://aqua.klapt.net>). The categorised material contained shorthand references linked to the original quote and all context information (question, person, company). The results were checked for consistency and completion for each person, and then sorted according to the theoretical categories. As a means of

communicative validation, the results were presented to, and discussed with the participants after the analysis was completed. The results contained explicit and implicit evaluations of whether the criteria were seen as sufficiently satisfied or not. These verbal evaluations were used to generate rankings for all three types of companies, which were then used to visualise the results.

4 Results

The following section reports examples of proactive, heedful design as provided by the interviewees with descriptions of the design process, and results for the four criteria of control, clarity, feedback and organisational support. Each section is subdivided into results for large, middle and service companies.

4.1 Examples of good practice in three different design processes

In the descriptions of the design task and work environment, 63 quotations were identified that related to good design practice according to the concept of proactive, heedful interrelating. Although there are some commonalities, the understanding of proactive design varied between the three types of organisations.

Only 11 of the 63 quotations relating to good design practice came from *large corporations*. They emphasised the need to ‘think first before starting the design’ and to ‘innovate carefully in a tricky situation’. The designers did not describe how they designed in much detail yet all four large organisations managed product innovation systematically with documented guidelines such as innovation justification, review and approval procedures, risk assessment, FMEA, and life cycle cost. A potential explanation for the discrepancy between the not very elaborate personal accounts and the detailed guidelines could be that the procedures were seen to incorporate good design practice. The organisations then rely on compliance with a corporate process rather than individual heedfulness.

On the contrary, the designers from *medium-sized companies* emphasised their personal strategies and use of experience in a total of 25 quotations. The design process was described as mainly pragmatic, a mixture of planned actions and troubleshooting at any point in the process until commissioning of the product. New products were triggered by customer requests rather than innovation initiatives on behalf of the company, and whenever possible, existing solutions and previous experience were utilised. The designers described good practice

as their own attempts to do a good job that they themselves are satisfied with such as ‘thinking ahead’ ‘quick response to problems’, ‘early consultations with production’, ‘keeping target cost and delivery time in mind’ and ‘anticipate that things may go wrong’.

In the *service companies*, the 27 quotations relating to good design practice showed that designers are painfully aware that heedful interrelating with the client can make or break a project. They described their design process as very structured, and their product-neutral terminology resembled that of guidelines like VDI 2221 most closely. All designers in this group highlighted the importance of appropriate definitions of scope—one project ended in court because both parties had different assumptions about the agreement and no written documentation was kept. They also explained the social implications of identifying the appropriate informant and the need to consult more than one person on the client side. Being proactive could mean early consultations with production staff, addressing potential problems with the client as soon as they become apparent and generally investing time and resources into the design concept to avoid problems later. One of the service companies also addressed the need to establish a culture where people feel comfortable to ask their colleagues:

‘I want my team to have a vision of the entire product we develop so that they are aware of the consequences of their decisions. If one implements a pneumatic cylinder then his colleague in controls need to monitor that cylinder. The people need to know what others are doing so that they don’t always come to me as project leader’.

4.2 Control over the design process

The model assumed that in order for the designers to feel responsible and accountable for the quality of the design result, they should possess significant control over the design process to make decisions and modify the course of action.

In the *large corporations*, four of the five designers describe the amount of control they had as limited. Compared to a larger design team and the size of the organisation, their personal impact seemed smaller. Their products were always influenced by the technology and market demands, they had to comply with regulations and a corporate design style and to match costs as budgeted. Again, the dependency on suppliers or technology partners was described as a limitation. They faced some disruptions but also had the freedom to withdraw to concentrate. All companies in this category had documented design

guidelines that described the overall process, quality management procedures or CAD conventions.

'I suppose you could influence the design process but the handbook is defined'.

All eight of the designers from *medium-sized companies* felt that their influence on the product was high: they decided on the design concepts with implications for costs; they chose the material, dealt with suppliers and planned the project. The designers showed a strong sense of identity with their project, as the following two quotes illustrate:

'The whole concept and architecture were done by me. Yes I can say: that is my work. It was 14 h a day but it is my work.'

'For new products we have quite a lot of freedom in what we do, what it is going to look like, whether it is expensive or cheap, whether you manage to reduce the number of parts through a clever arrangement. But you have to stop optimising at some point to meet the deadline.'

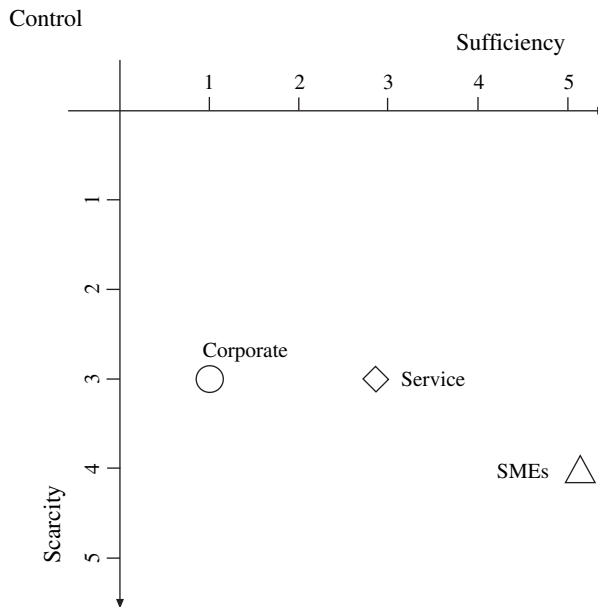
However, six of those eight designers also mentioned limits of control, such as dependencies on other departments or suppliers, limited time or interruptions from clients, production and maintenance staff. Four of the eight designers described how they influenced procedures as bottom up initiative. Yet the same people also felt they lacked influence on strategic plans.

In the *service companies*, the designers referred to their control in terms of the design method and, mediated through negotiation with the client, also on the product. The choice of methods was described as the personal 'signature' of the project manager. Apart from one more senior service designer, all saw a limitation to their control in that they had only marginal influence on selecting staff for a project, and no influence on the person of the client representative. Market success was perceived to be completely beyond their control, and only one company had made it part of their strategy to collaborate closely with their client and influence decisions such as choice of technology. Again, the lack of control in strategic terms resulted in frustration.

'We had a workshop about the new strategy, and we naively assumed that we would discuss what the future direction will be. But the direction wasn't discussed at all—it was only about how to implement it. We felt really pissed off. We never got as far as making suggestions about the new organisation.'

As shown in [Figure 3](#), the control over the design process was perceived as high in the medium-sized companies, intermediate in the service companies and low in the large corporations. On the other hand, the designers also reported lack of control over organisational issues: in terms of strategy in large corporations, due to interruptions and in

Figure 3 Results for the criterion of control



medium-sized companies, and in terms of team composition and impact on the product success in service providers. The model predicts that designers subsequently focus on the product but do not feel accountable for methodological or organisational improvements.

4.3 Results on clarity of design-relevant information

The criterion of clarity was defined as availability of information to the designer about requirements and context of use of the product in order to develop appropriate mental models of the design. The designers reported that they use a multitude of sources of information such as trade fairs, the Internet, brochures from other manufacturers and direct contact to the end-user as information for the conceptual work.

In three of the five *large corporations* the definition of requirements was a formalised and systematic process that could involve a broad search with trend monitoring, observations of end-users, estimation of the market potential and quantification of ideas for a business plan.

'The entire innovation process is described until death [fade out of product]. Those people always think they need to do something new. Our work is still the same, and the initiative for new products usually comes from us.'

Two of the five large corporations provided design guidelines on design for manufacture, usability and sustainability. The designers in this

group used a variety of sources to keep updated about technical trends, such as searching the literature, contacts with universities, patent searches and attending conferences and trade fairs. Although in the large companies these resources were mostly available, the designers complained about lack of time to use them.

In the *medium-sized* companies, six of the eight designers described obtaining clarity of design information as an active process of deciding on specifications and setting design parameters. Complete specification lists were the exception rather than the rule. The designers described it as part of their duty to gather the necessary information and transform the very general ideas or specific wish list of the client into appropriate design requirements and specifications.

'That is the part that the sales people can't tell you: how to make it. They can tell you how it should look on the outside and what it is supposed to do but the details are down to us.'

The medium-sized companies also carried out some form of market analysis but not as a standardised, professional process. Instead, the designers collaborated closely with sales staff and the client and thereby felt well informed about requirements. Only in one company that had a separate sales organisation, the designers complained about lack of information. The general direction of product development was mostly opportunity driven and seven of the eight designers therefore felt the future direction was not transparent to them.

While in the large companies information on new technologies and innovation was available but not the time to study it, in the medium-sized companies this information was often insufficient.

'There are no journals here. They are passed around the entire company, but we need them as a reference library. We are investing time in knowledge about problems that are already solved.'

Overall in the medium-sized companies, clarity of design-relevant information was not necessarily provided by the organisation as part of the design process and depended on local practice.

All *service providers* portrayed it as one of the foremost tasks of a designer to obtain and elicit as much information about requirements from the client as possible. Typically, the client initially knew more about the product context so it was seen as important to build up trust and collaborate closely with the client. Sometimes it was seen as problematic if the client was unsure of the strategic aims and unwilling to share information or commit themselves to a decision. All three companies used a systematic checklist, and one designer also mentioned

soft information about the corporate identity and culture of the organisation.

'I try to get hold of a vision and mission statement of the client. Are they a high tech company or a traditional mechanical engineering firm? I'll get information from the web about the client and ask other team members who have worked for this client in the past: What was relevant? What kind of person is the client?'

In two of the three companies, only the team leader was involved in direct client contact and passed this information on to their team members. In one company, team members also had to check and sign tender documents. Two of the companies held regular internal seminars, which the informants saw as useful provided they could apply the theoretical knowledge on their own projects.

Across all types of companies, information from production and about existing products was available in half of the companies but described as a real problem by the rest. Technical drawings, data sheets, cost calculations and failure reports were usually filed somewhere but in two companies it seemed to be a matter of chance to find them.

In conclusion, designers regarded availability and clarity of design-relevant information as important and emphasised how they actively seek information about the product and its context. As shown in [Figure 4](#),

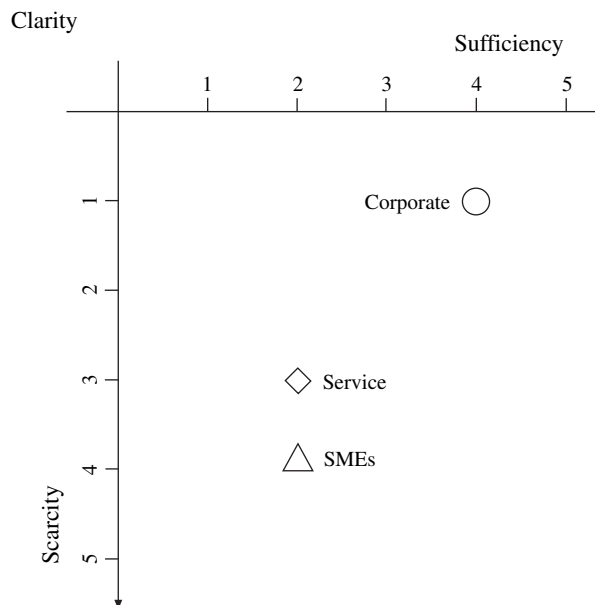


Figure 4 Results for the criterion of clarity and availability of design-relevant information

large corporations were generally best equipped to provide access to the necessary information and designers only complained about the lack of time to study this information. In the medium-sized companies, less information was available and lack of clarity became an issue where the designers depended on second-hand information from other people or departments. The service companies also had to work with incomplete information but did not perceive this as active restriction on behalf of other departments.

4.4 Results on feedback

According to the model, feedback is required as a prerequisite for proactive design. Without knowledge of results, no one can monitor their own action, learn from mistakes and modify strategies.

In the large corporations, designers named long-term, indirect feedback from clients such as sales figures, recalls or complaints.

'We usually get the sales figures half a year after market introduction. Customers contact us, or we hear about a problem from after sales. The people in production always turn up immediately if something doesn't work.'

Cost was portrayed as the most relevant performance factor in the eyes of management. Two of the five designers mentioned feedback from pilot lots in production, three described prototype testing in their own usually well-equipped laboratory and all carried design reviews or internal audits.

The designers in medium-sized companies mainly referred to feedback from agents rather than sales statistics: in five of eight cases, the designers received feedback from assembly and production staff if things went wrong or were late—as long as everything was OK nobody wanted to know why. They described in detail how they obtained feedback during the design process from prototypes, sketches, analysis of own errors, or number of iterations needed. Two mentioned a preference for physical testing rather than calculations or modelling but one company was beginning to establish virtual reality and testing of the digital prototype.

'We have got a complete laboratory downstairs, and we do a lot of testing. It is all done manually—to do modelling we would need a specialist and there is just not the volume of work for it to pay off.'

In the medium-sized companies, the designers also addressed a lack of feedback from testing and cost figures as well as management and customers.

For the service companies the task typically ended with handing over drawings, and the designers used every opportunity to elicit feedback from the client, users or colleagues internally. Two companies also operated formalised customer feedback forms but the designers felt awkward about them in cases where they had developed a personal relationship with the client.

'I usually meet the client once a month. So I naturally learn about problems or notice something that is not addressed directly. I go away and think about it.'

'That is a bit dissatisfying here. Each year I do a new project, which is nice. But very rarely can I work on a product for an extended period. Sometimes we get to know that production has commenced. Maybe we get the first faulty items and can eliminate a design problem. But after that we received no feedback on what is happening. So I am always hungry for information. It is my baby so I want to know.'

In comparison, the service companies made the most use of simulations, numerical methods and CAD functions such as collision control and assembly checks. These calculations became part of their core competencies although they could hardly even test their models against the actual product and therefore could not improve the modelling. Two of the service companies also maintained their own laboratories and had internal procedures for cross-checking. Given the importance of design

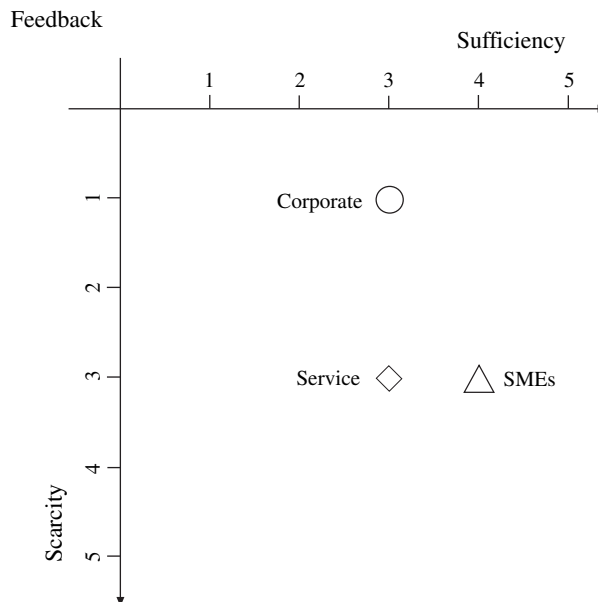


Figure 5 Results for the criterion of feedback

methods for service companies, the designer in one company felt that the feedback they received during the annual appraisal was too infrequent to be of any practical use.

In conclusion, it was clear that the designers felt that feedback was vitally important for them to do a good job and that they actively searched for knowledge of results where that was not evident from their own tests and checks (Figure 5). In large companies, feedback was indirect and slow but not described as insufficient. In medium-sized companies, the designers had a lot of direct contact but complained about the lack of systematic testing and analysis of results. The design contractors used elaborate simulations but they had to cross organisational boundaries for feedback on the finished products.

4.5 Organisational support

The fourth criterion specifies that proactive design is not only individual action but has to be implemented on an organisational level to be effective. The criterion also states that task orientation may be compromised by lack of organisational understanding and support. As hypothesised, all designers across the companies and sectors described their work as intrinsically motivating: ‘a challenging task’, ‘always something new’, ‘to be involved in the whole product development process’, or ‘to be able to work with a considerable degree of freedom’. Their quotes illustrate how design as a vocation can instigate high task orientation as it typically offers variety and involvement. The results do however show that this motivation can be spoilt by other sources of frustration.

In the *large corporations*, organisational support was mentioned explicitly in terms of financial support and positive PR reports. Two of the companies also practiced a bonus system. In one case this was positively described as a project appraisal system based on clearly defined indicators. In another case, the bonus system was criticised for spoiling the intrinsic motivation of design.

‘Innovation doesn’t result from money, it comes from the curiosity to do something new’.

Three designers mentioned the lack of information and understanding for design issues on senior management level as de-motivating.

The *medium-sized companies* had no explicit reward systems. The designers mentioned indirect indicators such as more trust and fewer problems internally. On the other hand, all but one interviewee in this group felt strongly about the lack of support from management for their

task in particular or any attempts to improve the design process, and the negative effects of time pressure and fragmentation due to interruptions. Rather than concentrating on designing, the interview partners felt they spent far too much time and energy fighting resistance and problems.

In the *service companies*, designers described it as motivating that they felt in line with the design philosophy of their company and were proud to work in an organisation with a certain drive and reputation.

'I prefer to work according to a methodology—that is what I was taught and I never found that in industry, so I appreciate it here.'

All three companies had no reward system but one explained they shared a 'corporate perspective' in that it was clear to team members they had to be efficient. In one company, the designers described it as dissatisfying that they could not influence team composition and strategic direction. Others mentioned that the constraints of a budget and the client's expectations put a limit to how innovative they could be in their design.

In summary, the designers across all three types of companies described implicit and explicit means of organisational support for good design practice but also expressed concerns about the lack of support, particularly in the medium-sized companies (Figure 6).

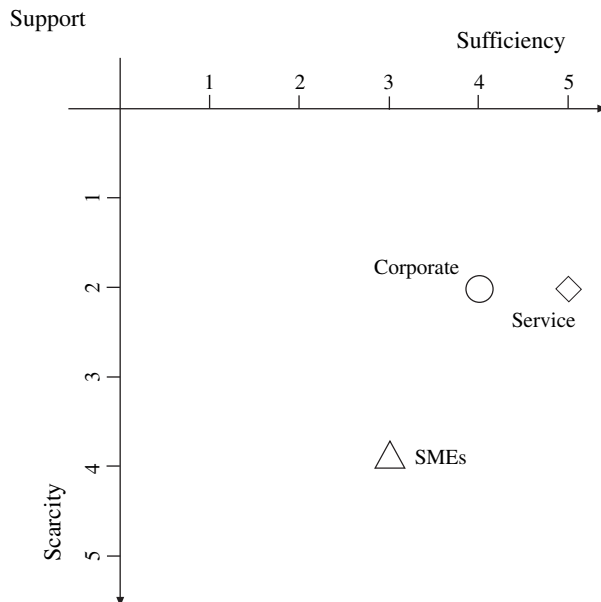


Figure 6 Results for the criterion of organisational support

5 Discussion

The framework of proactive, heedful action in design and the criteria for job design were introduced as an organisational approach to good practice in design. Making design tasks intrinsically motivating and providing organisational support cannot be a replacement for high-quality design education but a necessary complement to maintain and develop skills and motivation. The results also highlight some differences between types of organisations.

- *Large companies* managed their design processes formally and explicitly, and good design practice was documented and codified. This created both guidance and limitations for the designers. Designing was treated as a corporate process which individuals could attempt to influence. Yet the art of managing one's superiors is not what designers get taught as part of design methodology. Design-relevant information on requirements, technology and trends was available to the designers more than in the other types of companies. Feedback mechanisms were established in the design process and also in terms of systematic albeit slow market review. Organisational support was rated sufficient with limited problems. Overall, in the large companies of this sample the design process seemed to support proactive, heedful design apart from perceived lack of control. The recommendation would therefore be to empower designers to actively influence codified good practice, to involve them in consultations about the overall strategy and to create a sense of identity with the products they design. Given the fact that only one of the five companies produced a complex, multi-organisational product, empowerment should be a feasible intervention.
- The *medium-sized companies* often followed a more informal approach to design and based their work on existing solutions. This style of working is generally acquired through practical experience but also not necessarily taught as part of design methodology. Proactive, heedful design seemed to be a result of local practice rather than systematic design management. For most criteria, the medium-sized companies were as 'yellow': positive aspects of job design were co-present with negative ones. The work was characterised by a high degree of personal involvement and control over the product but also lack of control in terms of organisational issues. The designers had access to feedback but insufficient information up front and felt they lacked organisational support. The frustration voiced by this part of the sample seemed to stem from inconsiderate management

style, and designers felt they could have contributed more. The recommendation from this sample would be to professionalise the design process with dedicated resources and recognition of the strategic importance of design for the future of the company.

- For the service providers, clarity of design-relevant information and feedback were always an issue as it was dependent on communication with the client. Similarly, the control over the design process was restricted to the part they had been tasked to do. In this case, the job design is largely the result of the status of the organisation as a service provider, and even the best organisation in the world would need to address the quality of the design brief and feedback from the client. The designers compensated for this lack of control and information by applying systematic methods. What they did as a result most closely resembles good design practice as captured in textbooks and guidelines (Cross, 2000; Hubka and Eder, 1996; Pahl et al., 1996).

These results are based on a small and regionally and technically specific sample, and it remains an open question whether they represent a general trend. So far the generic criteria from work psychology have been successfully transferred to design tasks and the investigation has produced meaningful results on improving design management in this sample. It is assumed that the framework and the method are sufficiently generic to be applied to a wide range of design tasks and organisations. However, the results should not be interpreted as the basis for generic recommendations. By its very nature, task analysis always requires investigation of the actual work and specific environment in each organisation to identify relevant areas for improvement.

Although the model proposes causal links between structural aspects of the task and good design practice, any qualitative field study like this investigation cannot proof causality beyond the evidence provided by the interview partners. This is the case for any type of design research that considers the organisational context crucial to designing because in real-world companies experimental control is virtually impossible to obtain. The closest resemblance of experimental manipulation would be a longitudinal study of organisational change with some independent measure of good design practice. A larger sample and the inclusion of observations and document analysis would also allow corroborating the information provided by the interview partners, which in this study had to be taken at face value.

The criteria for good design practice follow an ethical line of argument about human needs in the workplace. The criteria were seen as appropriate for traditional mechanical engineering companies but they may not always be practical when dealing with complex, large-scale products. Any such complexity of the task may render it impossible to provide complete control, clarity and feedback for the individual designer, and they are less likely to feel responsible for the entire product. Judging from this sample, the more severe stumbling block to implement any of the recommendation would be that not all companies regard it as desirable to have an empowered, informed and well-resourced workforce. Often it may seem more lucrative to outsource designing to whoever provides the cheapest service or to absorb what designers know about good practice into corporate knowledge bases so that the company is no longer dependent on individuals to act proactively and heedfully. It is in the long-term interest of producing safe, reliable, high-quality products that providing the right conditions for good design practice really pays off.

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