OFFICE DESIGNING AND PLANNING
FOR KNOWLEDGE WORKERS

BY

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THESIS
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ABSTRACT

Traditional office design is largely concerned with human ergonomics to provide office users with the maximum comfort and efficiency. As office automation developed in the late 20th century, the major tasks in offices shifted from manual work to knowledge work, which required more concentration and communication than ever before. Responding to this trend, user behavior studies became more emphasized in the office design process – a successful office design should be a holistic system consisting of users, furniture, and space.

In this paper, the history and trends of office design are investigated. Interviews with knowledge workers from various industries were conducted to uncover how they work in and with their work environment. Through discussions with the interviewees, office design guidelines are revised based on the knowledge worker behavior. Office designing and planning need to facilitate the information and knowledge flow in the workplace. Appropriate flexibility should be achieved so that the workers can work efficiently in either concentration mode or communication mode as they need.

At the end of the research, an office desk design is presented to serve as an example of how a product can reflect and address the needs of current day workspaces.

Keywords: office, knowledge work, communication, user behavior, design guideline
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CHAPTER 1 INTRODUCTION

1.1 What Is an Office?

An office is “generally a room or other area in which people work” according to Wikipedia, or “a place where a particular kind of business is transacted or a service is supplied” according to the Merriam Webster dictionary. The task performed in offices was shifting from manual work to knowledge work as office automation developed in the late 20th century.

Table 1.1 Comparison between knowledge work and manual work

<table>
<thead>
<tr>
<th>Knowledge work</th>
<th>Manual work</th>
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<tbody>
<tr>
<td>Invisible, holistic, changing, emphasizes changing</td>
<td>Visible, specialized, stable, emphasizes running</td>
</tr>
<tr>
<td>things, less structure with more decisions, focus</td>
<td>things, more structure with less decision, focus</td>
</tr>
<tr>
<td>on the right questions</td>
<td>on the right answer</td>
</tr>
<tr>
<td>Teachers, librarians, lawyers, architects, designers,</td>
<td>Secretaries, assistants, bank tellers, receptionists</td>
</tr>
<tr>
<td>physicians, nurses, engineers, scientists, managers</td>
<td>Construction workers, factory workers, wait staffs, shop</td>
</tr>
<tr>
<td></td>
<td>attendants, maintenance workers</td>
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Source: Reinvent Your Enterprise, by Jack Bergstrand

1.1.1 History of Office

“The earliest ‘offices’ can be dated to the moment one person crouched down and bartered with another for goods or services and some kind of record was made of the exchange.” (Klein, 1984) In the 13th century, the word “office” appeared in English referring to a position involving duties. Often these duties were performed at home. It was not until the Industrial Revolution (18th and 19th century) did offices establish outside of the home. Multi-story buildings were built at that time for clerks to make business transactions in areas of banking, railroads, insurance, retail, telegraph industries, and etc. Office furniture and machines were then designed in response to the increased paperwork.

Office automation occurred in the late 20th century in order to augment the productivity among white-collar workers. Computers and software enabled most office functions, including typing, filing, mailing, and faxing, to be accomplished digitally. Since technology is taking care of the most tedious labor, office tasks become more knowledge work rather than manual work. Huws, Korte, and Robinson (1990) argued “the conventional workplace as a fixed geographical space will be replaced by more abstract notions of the
working context as a set of relations, a network, and an intelligent space” (as cited in Li, 1998). The way people work dramatically changed:

For several decades the developed world has been shifting from industrial-based national economies to an information-based global economy. (Hill, Ferris, Martinson, 2003)

1.1.2 Literature Review

The function of office has been widely discussed from efficiency and management perspectives. In Doxtater’s research (1990), he stated, “speculative office construction frequently lays primary emphasis on economically efficient building production and marketability as a consumer object.” Architects and interior designers work together to develop marketable workplaces to satisfy the basic requirement of offices – being productive.

Besides productivity, there are other facets of the office that needs exploration. As cited by Doxtater (1990), Wineman (1982) defines three categories of present research: (1) Physical comfort and task instrumentality; (2) Privacy and social interaction; and (3) Symbolic identification.

Within the first category, ergonomic study has been playing a dominant role. Carayon and Smith (2000) suggested that, “the objective of ergonomics is to improve both performance and health and safety.” The emergence of macroergonomics in the 1980s drew attention to “establishing a work culture that promotes and sustains performance and safety improvements.”

In reference to the second category, Baldry (1997) argued that:

Uses of space represent sets of strategic choices which, while they may be made on functional grounds (for surveillance, or to facilitate work organization), also create a semi-permanent physical configuration, the built environment, which send its daily messages to the people who work within it, boosting the status and sense of autonomy of some, while denying status to others and stripping them of autonomy.

Thus, office spaces need to be planned with strategies. A report by Steelcase (2000) shows that workspaces need to be specifically designed according to the nature of the task, and there is “no such thing as an effective, all-purpose workspace” that supports both high-privacy and high-interaction.

The last category represents the “usage of ‘objects’ to communicate identity and status” according to Doxtater (1990). Baldry (1997) pointed out that the “concept of personal space is often expressed by workers in terms of ‘privacy,’” which implies that the workers have some control over their environment.
The workplace usually depicts the culture and style of the organization (Turner, G. & Myerson, J. 1998). However, the users’ personal cultures lack presence in office designs, and the users are usually left dealing with spaces that do not reflect their values (Doxtater 1990).

1.2 Why Is It Important to Design Offices for Knowledge Workers?

The investigation into the history of and literature on office design shows that the traditional office design guidelines focus on the ergonomics, or in other words, the physical comfort that enhances the workers’ productivity. The study of ergonomics often was lumped together with office design and thus, office design has often been considered equivalent to office furniture design, even though it rarely considered the surrounding work environment.

This approach works well with manual workers, because physical satisfaction does ensure manual work output and the workers’ health condition for productivity in a longer term. However, as the global economy enters a knowledge work economy and main tasks in offices become knowledge work, thus, the traditional approach needs much revision.

Table 1.2
Comparison of Taylor’s thinking on manual work with Drucker’s thinking on knowledge work

<table>
<thead>
<tr>
<th>Frederick Taylor on Manual Work</th>
<th>Peter Drucker on Knowledge Work</th>
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<tr>
<td>Define the task</td>
<td>Understand the task</td>
</tr>
<tr>
<td>Command and control</td>
<td>Give autonomy</td>
</tr>
<tr>
<td>Strict standards</td>
<td>Continuous innovation</td>
</tr>
<tr>
<td>Focus on quantity</td>
<td>Focus on quality</td>
</tr>
<tr>
<td>Measure performance to strict standards</td>
<td>Continuously learn and teach</td>
</tr>
<tr>
<td>Minimize cost of workers for a task</td>
<td>Treat workers as an asset not a cost</td>
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Source: Reinvent Your Enterprise, by Jack Bergstrand

Knowledge workers differ from manual workers for they work intellectually and interact much more with other people and environment. Thus, it is crucial to investigate into their distinct user behavior and set new guidelines for office designing and planning to facilitate the information flow in the office. Ergonomics is still important, but there should be other parameters to help knowledge workers to work efficiently with their intelligence, not just physically.
CHAPTER 2  OFFICE DESIGNS AND TRENDS

2.1 Traditional Office Design

2.1.1 A Traditional Office

The word “office” sometimes reminds people of the stereotypical open office with desks in lines or of masses of cubicles. In traditional offices, each individual is assigned a personal workstation – either a desk in an open plan office (shown in the above left picture), or a cubicle (shown in the above right picture) or an individual room. The workstation often consists of a desk, chair, computer, telephone, storage, and a means of separation (panels or dry wall).

For the office structure, the space can be arranged differently according to the functions, managerial fashions, and specific company cultures. When planning, it usually involves the decision of how many people should be working in the same room to achieve the maximum productivity. At one extreme, each individual will have their own room; at the other extreme, a large open plan office can be made up of one main room with tens or hundreds of people working in the same space.

![Figure 2.1 Typical offices (Picture source: Wikipedia “Office”)](image)

2.1.2 Design Guidelines: Ergonomics

Traditional offices are designed under the assumption that a worker comes to the office building and stays in his 30-square-feet territory for eight hours a day. Thus, traditional office design focuses heavily on
physical comfort, because comfortable work environments can increase task instrumentality, especially for manual workers.

Ergonomically correct furniture has been considered the most influential piece in an office design. Most office furniture in the market is designed following strict ergonomic principles to provide the users with the maximum of comfort and productivity, physically. Herman Miller has pioneered the furniture industry’s use of ergonomics since 1976. According to their website, their “goal is to enable individuals to work at their most safe, effective, and motivated levels.”

Among various office products, designers have put tremendous efforts in developing chairs especially. Steelcase (2010) has proved by a year-long study that people who received a good chair and office ergonomics training achieved up to a 17.8% increase in productivity.

Figure 2.3 Office chair icon: Aeron Chair, in a meeting room environment

2.2 Megatrends in the Knowledge Economy

The global economy is transiting from a post-industrial economy into a knowledge economy, in which the knowledge itself is a product, whereas knowledge was just a tool before. In such an economy, specialized workforce continually innovate on how to generate knowledge from information. Trends in workforce and technologies are emerging, either facilitating the economy or as a result of it.
2.2.1 Main Character: Knowledge Workers

Knowledge workers are valued for their ability to act and communicate with knowledge within a specific subject area. A report by Steelcase (2001) shows that around 75 percent of American office workers are knowledge workers. They are often found across a variety of information technology roles, but also include professionals like teachers, librarians, lawyers, architects, physicians, nurses, engineers, and scientists (Wikipedia).

Since knowledge workers use their intellectual capital to work, they need more than just physical comfort at workplace. An ergonomically correct chair assures the worker of good posture and thus better health condition, but it is not enough to encourage innovation. Knowledge workers need to be able to concentrate, to collaborate, to learn, to be self-motivated and reflective. The productivity can be increased if the arrangement of office and furniture can facilitate those needs.

Gensler substantiated the statement that effective workplace design directly correlates to improved business performance by a survey in 2008. Using a special measurement tool (Workplace Performance Index), Gensler found out in both top-performing companies and average companies, better profits are made when the workplace score goes up. This evidence shows that the quality of the work environment does influence knowledge workers’ productivity.

2.2.2 Digitalization

In an industrial economy, people work on tangible materials; however, in a knowledge economy, both information and knowledge can be transferred digitally. Or to say this conversely, it is the digital technology that enables such an economy. Nowadays, information can be accessed anywhere, any time, meaning that people no longer have to sit together at a specific location to work — they can work remotely. Exaggeratedly speaking, people can work from anywhere as long as there is a computer and Internet access. New forms of workplaces such as home offices and shared workplaces emerged responding to the possibility. Offices are no long just a place to work, but instead they are an effective management of all resources.

2.2.3 Globalization and Workforce Diversity

The convenience brought by digitalization makes a global market possible. Companies extend their global offices and factories to other cities or countries to get best access to the target market or resources. Offices communicate between each other by means of email, telephone, video conferencing and online file sharing system.
Trends of digitalization and globalization in the knowledge economy offer people equal work opportunities, and thus, the composition of the workforce becomes complex in terms of gender, age, with/without disabilities and culture. A company with such a diverse workforce needs to provide workplaces that can accommodate all different needs.

For example, Asian workers are becoming a larger population in the job market, and this trend is increasing the demand of smaller chairs. Executive chairs usually have a 20”-22” seat depth, which is standard for Caucasian males but not for some petite workers. Smaller people sometimes feel pressure on the thighs and backs of the knees because the chairs are too high or too deep in the seat; discomfort and numbness in the legs and feet can follow. (Herman Miller, 2008)

Some newer chair models can adjust the seat depth to fit a larger range of people. *Leap Chair* by Steelcase offers an adjustable seat depth feature. Leg and torso lengths can vary independent of a person’s height. Adjustable seat depth accommodates different body shapes for long-term comfort.

Gender differences also calls for chairs that consider more about women’s bodies and postures (Herman Miller, 2008). Women are more pear-shaped than men, and tend to lean forward when they sit. The *Lei Chair*, by Monica Förster, is an office chair designed especially for women. The armrests come out from the back instead of from the seat, and this gives the female users more space for the bottom. Also, since women tend to put their elbows more towards their backs and less at their sides, the surrounding armrests
make a good fit. *Lei* has a more pronounced lumbar support because women do not lean back as much as men do.

Figure 2.5 *Lei chair by Monica Förster*

### 2.3 Impacts of Megatrends on Office Design

Let’s break an office down into areas of hardware and software. The hardware includes its physical location and a series of standard office furniture and products; the software refers to the organization and interrelationships within the office. The trends in the changing workforce and economy now demand for better software. It is still meaningful to design a comfortable chair regardless of the environment; however, it becomes more crucial to understand how the objects and space can reflect the flow of information, the interactions between people, and the relationship between people and environment.

#### 2.3.1 Flexible Office – Objects and Location

The physical structure of an office becomes much more flexible due to digitalization. Technology has freed people from working at fixed physical locations. An office design should no longer be limited to a designated workstation with a desk, chair, computer, telephone and storage shown at the beginning of this chapter. Does the worker need to stay in his own spot all day? Does the worker need to have a designated space? Or does the worker have to go to a specific place to work? Not necessarily.

The concept of mobile working grows as telecommunication technology develops, and popularizes in the recessionary economy because it keeps expenses low. The modern concept of small office/home office, or
SoHo, became popular at the end of 20th century and at the beginning of 21st century. Employers see this as a means of attracting employees because they do not need to relocate; while employees understand that they are in a better position to ask to work at home to reduce employers’ facility cost.

About half (55%) of US companies allow employees to work at home occasionally and one-third allow employees to work at home or off-site on a regular basis (Galinsky & Bond, 1998, as cited by Hill, Ferris, & Martinson, 2003). An article from Fast Company (2009) stated, “three years ago, 5 million Americans worked from home full-time, according to a Census study. That was before the Great Recession turned us into a nation of home-based entrepreneurs.” In the same article, the author introduced several furniture solutions for home offices. Furniture for home offices evolved from a clean tabletop to an all-purpose workstation due to the extending hours the user works at home. This kind of furniture is usually foldable or multi-functional to accommodate compact living spaces.

Figure 2.6 Home office furniture designs. Left: L.O.F.T. Workstation by Maciek Wojcicki, which is a customizable work area where every item is adjustable; Right: Trunk Station by Japanese designer, which can fold away when not in use

Turner and Myerson (1998) pointed out that “new fashions in interior design are starting to suggest that the distinctions between the office and domestic domains – in furniture, lighting, materials, technology and so on – may no longer be meaningful.” Below showcases a work desk design, which can be easily transformed into a dining table when in need.
Figure 2.7 Doppelleben (“Double Life”), designed by Ahhaproject. Left: work desk mode; Right: dining table mode

Though the separation between working and living is weakened, it does not mean that objects from these two categories should all blend together. Japanese designer Yuko Shibata approached the home-office trend from an interior design standpoint. He designed this Switch system, which can turn a small apartment into a workspace and library during the day, and back to a living space at night.

Figure 2.8 Switch by Yuko Shibata

People not only work at their homes, but also at any place where they can get electricity and Internet access – including coffee shops, book stores, and on public transportation. Davenport and Pearlson (1998) described, “Work is becoming something you do, not a place where you go.”

To embrace this trend, Urban Station, a café in Argentina, started offering task desks and conference rooms. Labarre (2010) commented on this place as “a trendy workplace that happens to serve coffee and croissants,” which is an interesting way of understanding the combination of office and café. Urban
Station states that “it is not a coffee shop, it is not an office. But if you are a mobile worker, it is something much better than both things together.”

Figure 2.10 Union Station Coffee Shop, with well-designed lighting, convenient electrical outlets, and conference rooms.

2.3.2 Complex Interrelationships – People and Environment

Working in an office building instead of remotely, knowledge workers tend to spend a relatively large amount of time making conversations. Dynamic interactions take place besides solitary work, and through these interactions more knowledge is generated. Knowledge workers meet, discuss, collaborate, and make decisions together. Besides the communication and resources provided by the office platform, knowledge workers could technically work solo offsite. Thus, the most important role of office transits from a physical address for working to a “marketplace” for exchanging information and thoughts.

2.3.2.1 Inside Office Buildings

Flexibility of office structure is the most challenging problem when designing an office. This is the result of the seemingly contradictory needs of knowledge work – concentration and collaboration. When people shift between different work modes, there need to be certain places allowing them to do so. When a couple of workers need to discuss something, is there a way that they can talk without disturbing others? When one worker wants to get out of his cubicle and socialize with others at work, is there a communal area for him to go? When the company evolves to be more collaborative, is there an easy way to break down the individual offices? If the office design is flexible enough, there is.
Christopher Budd, Principal of STUDIOS Architecture, discussed what is “appropriate flexibility” with Herman Miller. He noted that, total flexibility is expensive and nearly impossible, but appropriate flexibility can be achieved without changing major facilities (Herman Miller, 2005). There are three kinds of solutions for appropriate flexibilities – temporary, semi-permanent, and permanent solutions.

Temporary solution can be built up immediately on demand. *Ditto* is a smart interior building material. When serving as dividers at workplaces, they provide a certain level of privacy and transparency at the same time. It is highly efficient, very cost effective, and offers the user the maximum of customization.

![Figure 2.11 Different Ditto configurations](image)

Semi-permanent solutions usually involve furniture and separations (panels or moveable walls). The configuration of office can be changed from time to time. The re-configuration takes more time and effort, but it is still easier than breaking down the walls or making changes architecturally.

The *Action Office System* designed by Robert Propst from Herman Miller in 1968 is still a classic example of flexible office furniture. It was the first open plan office system, and it was built to last. The system can adapt to the ongoing revisions in workplaces by providing “space-saving benefits, durability, design options, and interchangeable components” according to the product description. Forty years later after it was introduced, *Action Office* is still brilliantly designed today for it can still adapt itself to different users and different needs.
Steelcase has an innovative architectural solution towards privacy – the Privacy Wall. It is a steel-frame moveable wall, which is better than a drywall because it is easier to build up and thus much more flexible when office layouts need to change. It allows the users to change the whole floor plan of the office according to their needs.

Permanent solutions are well-planned architectural solutions that take the whole system into consideration at the very beginning. In these offices, there are designated places for the knowledge workers to focus and learn, while other communal spaces for them to collaborate and socialize.

Jensen Architects got inspired by city planning method and designed the Kirshenbaum Bond & Partners West office. It resembles a small version of a city neighborhood, and Fast Company’s Co. Design commented, “It’s just like being outside! Except not really.” The workspace is very flexible as the four meeting rooms in the three-wing conference center can either be closed off for privacy, or opened to merge into a single meeting hall for larger gatherings.
Parisian architect Christian Pottgiesser designed this award-winning office design for the Pons + Huot headquarters, which cleverly enhanced privacy. This futurist workspace consists of a large organic-form table inserted in the nave and two side mezzanines. It is a collaborative workspace with open view, but at the same time, people can work in their own “bubbles” without being disturbed by the noise. The bubbles serve as sound barriers and territory protectors between employees, while maintaining sight lines through the space.

Besides the flexibility factor, office designs often times reflect the philosophy of the organization. Knowledge workers who work inside these offices get influenced by the atmosphere created by the
material landscape, and can be emotionally pleased. Google’s offices are known for the fun factor. The working environment encourages the employees to be creative by providing a vital and energetic space. Usually there are entertainment facilities to let the employees to relax. IDEO’s office is full of interesting and inspiring objects, as David Kelley, CEO and the founder, believes that the company’s fun work environment is crucial in fostering its high level of innovation. The Pixar Office is very relaxing and personalized to provide a creative atmosphere.

Figure 2.16 Left: Google, London; Right: Google, Zurich

Figure 2.17 IDEO, San Francisco
Leading companies such as Microsoft and IDEO discussed and predicted how some technology gadgets can facilitate knowledge work. Microsoft Office Labs are looking into how screen technology can shape the office, together with augmented reality. The link between the physical world and things on the screen is sizably strengthened, and the information can go easily back and forth between physical and digital media. The knowledge and information are real-time accessible, which enables more effective communication, and thus facilitates collaboration. The screen technology also helps expand the working surface – not only can people use horizontal desk tops, but they can also use vertical surfaces, such as window and wall, for brainstorming, information collecting or presentation.

IDEO asked the question, “What happens when the reading experience catches up with new technologies?” in the five-minute video, “Future of the Book.” Three concepts are presented, among which the Coupland concept is closely related to the office structure in an information era. “With all the information available, it’s getting harder and harder to stay on top of what’s truly worth knowing.” This might be the biggest dilemma in this age. The Coupland “creates a new group-licensing model for digital books and helps busy professionals stay up-to-date in their fields. People can easily keep up with industry ‘must reads’ by checking out what colleagues are reading.” This blue-sky experiment expanded the meaning of book by making reading a social experience — the readers are linked to diverse discussions, connected to the readers in the same group, and are bound to create storylines together.
It is important for knowledge workers to understand how they are working in order to get them motivated, so it is good idea to visualize the progress or efficiency. It is also helpful to show the organization’s status to the public. In 2010, the United States Patent and Trade Office (USPTO) launched the *Patent Dashboard*, a web-based visualization and crowd-sourcing tool. The efficiency and performance of the office are clearly communicated to the audience through this visual chart.

2.3.2.2 Outside Office Buildings

Even if people can now choose where they feel most comfortable and efficient working, there are some important resources neither home nor a café can provide – including expertise, collaboration, and equipment. Entrepreneurs are beginning to realize the importance of bringing these resources to mobile workers and starter businesses. Co-working is an emerging form of mobile working. Co-working is the social gathering of a group of people, who are still working independently, but who share values, and who
are interested in the synergy that can happen from working with talented people in the same space (Wikipedia).

*Citizen Space* in San Francisco is the first work-only co-working space. Their description on the website clearly depicts co-working as:

> We take the best elements from a coffee shop (social, energetic, creative) and the best elements of a workspace (productive, functional) and combine them to give indie workers the chances to have their own, affordable space. *Citizen Space* was built on the co-working philosophy. Our residents are: software engineers, web developers, small startups, social media strategists, entrepreneurs, designers, writers, public relations specialists, and more.

*Figure 2.22 Citizen Space, San Francisco*

*Xindanwei* is another co-working space based in Shanghai, China. Offices and meeting rooms can be rented on hourly, monthly, or yearly basis. One unique feature this workplace offers is on-site expert teams, or “New Mentor” as they are called. These experts help startup businesses and individuals with knowledge and resources, which is more convenient and cheaper than outsourcing.

*Figure 2.23 Xindanwei, Shanghai*
The co-working concept is spreading worldwide – there are over 400 co-working spaces over the world spanning six continents (Wikipedia). It is so popular not only because it provides an affordable place to work, but also because it offers a platform to connect one person to another, people to knowledge, and people to resources. In other words, it is performing the core function of office in a knowledge economy – a marketplace for exchanging knowledge.

Business park is another model that changes the interrelationships in offices, in a larger scale. A business park or office park is an area of land in which many office buildings are grouped together, performing commercial tasks (Wikipedia). The emergence of business parks is blurring the boundary between work and life. Companies offer amenities for the workers to live there without having to leave. It is beneficial for the workers to have all the convenience at work and thus they do not have to spend time commuting. Considering a whole business park as an enlarged office, how to balance between work and life becomes an interesting landscape planning problem.

![Image of Highlands Business Park in Cookeville, Tennessee](image-url)
2.3.3 **Design Guidelines: Concentration and Collaboration**

From the previous examples and conclusions, we can learn that the office design defines the interrelationships at workplace, which play a key role in knowledge economy. To set the design guidelines, it is worth looking again into the nature of knowledge work.

Knowledge work requires high level of concentration for the worker to process and generate knowledge without being disturbed. The ability to work uninterrupted is particularly important to today’s knowledge workers who regularly perform complex tasks requiring their full attention (Steelcase, 2000). However, on the other hand, knowledge work itself demands for more collaboration than ever before for the workers to get inspired, learn from each other, and produce more knowledge. Effective collaboration space allows users to move freely in the space, visualize their ideas, and contribute their thoughts. It is importance to engage the participants to achieve peak performance (Herman Miller, 2009). Jenny-Lynn Geogiades, Director of Architectural and Design Support Services at Waldners Business Environments, also mentioned in an interview that:

> One of the biggest trends in the office furniture industry today is the decline of the cubicle. The cubicle walls are coming down and they are allowing employees to interact and collaborate.

Since collaboration is so vital and frequent in knowledge economy, workplaces are becoming more communal as opposed to personal. Workers can work remotely if they do not have to meet and be together with others. Kate Davis, associate in Gensler, mentioned one such example when interviewed by Herman Miller (2007):

> … A CEO was asked by an employee how big the employee’s new workstation was going to be. The CEO said quickly, “40 acres.” The new building was sited on 40 acres, and it belonged to everybody – you could work wherever you want. This is a great shift in thinking from the Boomers, who are so territorial about space.

When designing an office, how does one provide an efficient and healthy office structure so that information and knowledge can flow fluently? How much privacy does a worker truly need? When does he want to be alone to focus? How does he show others that he does not want to be disturbed? How much interaction does a worker need? When does he want to communicate with others? How does he want to communicate? The answers to these questions might relate closely to the worker’s work content and work style. In the next chapter, interviews will be conducted with knowledge workers from various industries to understand their behaviors in the office.
CHAPTER 3 KNOWLEDGE WORKER BEHAVIOR

3.1 Method

Traditional office design focuses on the ergonomics – how people work physically and comfortably. From the investigation of office trends in the previous chapter, we can learn that the new design guidelines for office design should be providing knowledge workers with an environment where they can concentrate and/or collaborate according to their needs. What does a knowledge worker do in his office? What does his typical day look like? What is his workflow? How is his office reflecting his work content and method? It is now crucial to observe and understand office user behavior. The behavior is not limited to the interaction between user and products, but also should include the interactions involving other people and the space. The assumptions are:

- The office design is somehow related to the type of industry.
- The office design is somehow related to the worker’s position in the organization.
- The office design is somehow related to the worker’s work style and personal characters.

To verify these assumptions, a qualitative method – onsite face-to-face interviews, is used in this research. This kind of interview is ideal for getting in-depth first hand material, without much influence from others. Being onsite guarantees the validity of observation, because the observer can listen to what the users say and watch what the users do at the same time. Also, it allows the observer to ask questions spontaneously on certain design details in the users’ offices.

![Diagram](image)

*Figure 3.1 Understand office user behaviors through looking, listening and discussing*

3.2 Interview Overview

The target interviewees are frequent office users who spend at least 20 hours a week in their offices. An administrator, an architect, a software engineer, a lawyer and a lab technician were interviewed. These five
very different professions all fall in the scope of knowledge work, and they are chosen based on the assumption that, workers in those industries that require a lot of creativity and time for collaboration, tend to pay more attention to the possibility of interaction; workers who do mostly individual work and use more logical thinking value privacy so that they can concentrate better.

Figure 3.2 The interviewees profile

The result of the interviews slightly differs from what the author initially anticipated and can be concluded as:

- Collaboration does not happen very often with any of the five interviewees; instead, communication is a more accurate term.
- Office design slightly relates to the type of industry.
- Office design is heavily influenced by the worker’s position in the organization.
- Office design is also largely related to the worker’s own work style and personal characteristics.
3.3 Interview Highlights

3.3.1 Collaboration versus Communication

Administrators, architects, and lawyers are considered to be highly collaborative professions for they have to work with other people, or are even required to work with others for input.

Carol, the administrator, spends around six hours a day in her office on average, and two other hours for meetings. When in the office, she does her administrative work and research, which are mostly solo tasks. During meetings, she coordinates and makes decisions together with other people, which counts for collaborative work. However, that is only 25% or less of her work.

Bob, the architect, stated that he spent approximately 90% of his time on solo tasks. For the remaining 10%, he reports his work progress directly to the principal and receives feedback. He does not have to work together with other team members. In other words, architects in this firm work individually on different parts of projects and report to managers; they do not often exchange information within the team. Bob is convinced that the principals are experienced leaders so that getting feedback directly from them is much more efficient than discussing amongst a group of junior architects.

Helen, the lawyer, goes to court for five hours a week, and spends the rest of her time in her office. According to her, being a lawyer is a solo practice. She works with the clients, legal assistants, and the court, but she does not collaborate with them. Instead, she exchanges information with them; in other words, she communicates with them.

Solo tasks that require concentration and in-depth thinking are still the most critical part in work. The software engineer and lab technician work similarly to the architect – they focus on their individual tasks and report to their managers periodically.
In regard to the interactions taking place in offices, it is mostly *communication* rather than *collaboration*. According to the Merriam Webster dictionary, “collaborate” means to “work jointly with others or together especially in an intellectual endeavor”; “communicate” means to “convey knowledge of or information about.” Thus, we can conclude that the five interviewees do have a real need for communication, but little for collaboration; concentration is still the prevailing mode in offices, which sets it to be the primary design concern.

### 3.3.2 Offices in Different Industries

According to the previous discussion, the five interviewees from various professions all spend most of their time performing solo tasks. Reflecting this upon office planning, there should not be much differentiation between industries, for the most important thing for the workers is their personal workstation. However, there are some subtle differences.

Lawyers are very strict about working in individual offices. Law requires confidentiality, meaning that each lawyer can only share information with clients, legal assistants, and the court, and they cannot share information with other lawyers. Helen, the interviewed lawyer, also mentioned that she needed the “professional distance” and “authority” built up by the separation. Thus, for lawyers, open plan office is not an option.

Comparing the other four interviewees, it is noticeable that the administrator and architect are more tolerant towards interruptions. The administrator gets drop-in visitors often, and she does not get bothered. She also mentioned that she would in fact prefer to share an office with someone else, for she likes “human contact.” The architect prefers open plan offices as well, for he is used to this kind of environment since school, and feels more breathable in an open space. When asked if others would disturb him, he explained that if he was very focused others were not able to disturb him at all.

On the contrary, both the software engineer and lab technician expressed their preference towards working alone. The lab technician appreciated that fact that “people don’t talk much” in the office. The software engineer also stated that, “my job really requires a lot of concentration. So I don’t like any kind of distractions.” She clearly stated that she liked individual offices better.

This difference of tolerance might correlate with their professions. Software engineers, lab technicians, and even the lawyers are mostly “left-brainers” who are logical and linear thinkers, while architects and administrators are mostly “right-brainers” who are inventive and empathic (Pink, 2006). Right-brainers have more capacity for dealing with people and unexpected situations at work, and thus they are more tolerant with interruptions in the office.
3.3.3 Office and the Worker’s Position

High-level, especially manager-level employees usually get their own offices, and they have more control over their work environment. Lily, the software engineer, was working in a cubicle in an open plan office before she got promoted to the leader of the R&D Department, and was assigned an individual office immediately after the promotion. Carol, the administrator, has an individual office for the only reason that she is the director of the school. Owning an individual office is important for two reasons. First, a private space shows authority; and secondly, it makes it easier for the managers to meet with his/her employees in an enclosed office.

Helen, the lawyer, worked in a large law firm before she started her own office. In the large firm, every lawyer had an individual office; however, the higher-level lawyers had the opportunity to choose which office they wanted – and most of them chose offices with windows. On the contrary, lower-level employees rarely had control over where they would sit.

Managers communicate a lot more at work. According to Bob, the architect, the project leaders in the architecture firm may spend 70% of their time in meetings. They meet clients, check with lower-level employees, and report to the principals. Lily, the software engineer, also noticed that she was now meeting much more after promoted. As a result of managers’ mass communication, they usually have a sofa or extra chairs in their offices for guests. Carol, the administrator, also mentioned that she would like to have a sink in her office, so that she can make coffee or tea for guests without having to go somewhere else.

3.3.4 Office and the Worker’s Own Character

Personal work style and character are the most influential factor when designing offices. When interviewees talk about why things are this way in their offices, often times they start with “because I’m female,” “because I’m a big guy,” or “because I’m dyslexic,” all of which are directly related to themselves as distinct individuals – not necessarily relating to their work content.

Thus the situation is very different from person to person. For example, when the architect was talking about personalizing the space, he said he would not care to do that, but women in his office usually enjoy personalizing their offices with objects that are meaningful to them. He also indicated that one reason he liked open planned offices was he felt claustrophobic in enclosed rooms because he is a large-built person.

This finding asks office planning and office furniture to be flexible enough to let people do what they want to do. Workers need to have options to work in their preferred way. Also, people who “inherit” the office from someone else need to be able to “turn it into something that they (you) can use.”
3.3.5 Work Surface

Every single interviewee mentions work surface. There are two crucial criteria for a useful work surface: big and clean.

It is of great importance that the surface is big enough for users who tend to lay things out when working. In Bob’s architecture firm, every architect gets two large desks for laying out drawings, tools and computer. The administrator has a table full of document piles and she explained that by laying everything out on the work surface, she was able to work visually:

So piles are really important to me, ‘cause it’s the placement and what the relationship is. It’s a visual thing for me… The piles do actually have meanings. I’ll do this for a little bit (pointing at one pile), and this reminds me that I have to get back and do this. But in my job, there are so many things that I have to accomplish. It would be very difficult to finish one thing, like be done with it. It’s almost impossible. So you have to be okay with the idea of “I’ll get this far today, and now I’ll work on this, and work on this.”

When the existing work surface is not sufficient, the following tend to happen. Helen, the lawyer, has to spread documents on the floor when she produces a file for clients so that she can see them and work visually. The software engineer complained about her paper piles on the desk for they occupied too much space, but she did not want to clean them up because, “I don’t want to put half-done tasks into the shelf, because I’ll forget. So I have to live with it.”

The other standard for work surface is to keep clean. A messy desk not only forces the user to spend time looking for his tools or materials, but also frustrates the user. All interviewees in the research keep their work surface relatively clean for high productivity. Helen, the lawyer, also mentioned that by keeping the office clean and neat, it maintained a professional image.

3.3.6 Furniture Orientation

The interviewees unexpectedly brought up the furniture orientation issue. Furniture orientation, especially desk orientation is a big concern to office users. According to the administrator, it is “rude” to show one’s back to the guest entering in the door. She tried to sit facing the door, but the light coming in from the window shone straight on her computer screen and made it difficult to read. She eventually oriented herself with her side towards the door and her other side towards the window. In a similar case, the software engineer, who did not care much about the office layout and furniture, insisted to:
…make changes if the desk faced to a weird direction. When I sit by the desk, if the door or window is right behind me, I’ll feel extremely uncomfortable. And thus I’ll change the layout of the workspace. Once, I forgot why, but I had to work at a colleague’s office for a while. People could see my back right through the door. I felt very unsecured. I don’t know. Also I felt like they might be reading my screen when they passed by. They probably wouldn’t. But it just felt like being watched. I couldn’t stand this and moved the desk to a corner of the room.

Desk orientation is discussed in Feng Shui theory, in which it is believed that the desk is the seat of power, and its placement determines whether you succeed or fail. According to the theory, an office desk should be placed with the door visible to the user, but not in line with the door; and it would be good to sit against a wall for support, which coincides with the interview results. (Thomas, 1996)

### 3.4 Revised Design Guidelines: Concentration and Communication

Table 3.1
*Revised design guidelines for office planning for knowledge workers*

<table>
<thead>
<tr>
<th>PRIMARY</th>
<th>SECONDARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilitating user’s concentration</td>
<td>Reflecting the user’s position</td>
</tr>
<tr>
<td>Allowing some communication</td>
<td>Reflecting the user’s thinking pattern</td>
</tr>
<tr>
<td>Appropriate flexibility</td>
<td>Proper furniture orientation</td>
</tr>
<tr>
<td></td>
<td>Sufficient work surfaces</td>
</tr>
</tbody>
</table>
CHAPTER 4  DESIGN OPPORTUNITIES

4.1 Design Objective

Interviews are an effective way to understand office user behaviors, and they have provided guidelines for the design process later. This paper does not aim at delivering specific designs, but rather offering some meaningful insights. Therefore, the design concept in this chapter serves as an example of how the insights can be implemented.

The design example in this chapter is a task desk, intended to be flexible for both teamwork and individual work settings, since all interviewees have addressed the balance between interaction and privacy. The objective of this desk, or more precisely the desk system, is to provide maximum flexibility, so that different offices can choose to arrange the desks according to their own needs.

4.2 Understanding Office Layout

A simplified model is made to understand the spatial relationship between desks — how can one establish an arrangement of six people in a small office to achieve different levels of interaction? These six people work in parallel, and the desk system needs to provide them with enough privacy when they want to concentrate on individual tasks at hand and yet offers the possibility of communication. To approach this issue, we need to explore where the desk stands in the space and how it connects to other desks for they determine the level of interaction in the office.

To achieve the objective, the desk system needs to:

- Facilitating user’s concentration
- Allowing communication when needed

Color paper pieces are used to build up quick sketch models. Shown in the above pictures, a white board of 20” x 10” represents an office that is 26’-8” x 13’-4” (4m x 8m) in a 1-to-16 scale from top view. Grey pieces of paper represent desks, blue for chairs, and the red bars symbolize separation panels.
Since this is a team environment and is within one small room, the informational privacy and acoustical privacy should not be the main focus. The focus should point to visual privacy and territorial privacy. In the interviews, one interviewee (the software engineer) expressed discomfort when people passed behind her; another interviewee (the administrator) considered it rude to turn her back to people. Therefore, it might be most comfortable for the office users to sit against a wall or at least separation panels.

![Figure 4.2 Layout A, B, C, D](image)

Above are a few examples where users sit against the aisle instead of a wall. Layout A, B, and C are typical open office plans, in which people sit back to back. Layout D consists of cubicles, and offers a balance between open plan and individual rooms. However, in all the above layouts, people walking by on the aisle easily disturb the others who try to concentrate. One may feel that they are “being watched” or are easily distracted.

Also, in these configurations, the level of interaction is low for this default setting because it shares little working surface and allows very limited eye contact.

Given a very small room, the users may get too close to the aisle that can be noisy if they sit facing the wall. In the following illustrations, the aisles in layout E and F looks much more open than those in previous layouts, and thus users should be less bothered by people walking behind them. However, people have less personal space and can easily invade others’ personal territories. Layout G performs well to give each user enough space and privacy thus far.

In these layouts, people can interact better, for there is plenty of connecting surfaces, and personal territories are less strict.
Sitting beside the wall is a good choice if not against the wall, because interviewees mentioned “if there’s someone at my side, I don’t mind it that much.” Layout H looks similarly to a classroom layout – all people face the same direction, but what they are doing can be seen by the person behind them. The alternative of plan H uses tables with separation panels. In this case, every person has a defined territory and enough privacy, and still it is a much more open space than cubicles. Layout I is a similar case. Both H and I are good plans for work requiring little communication.
If all users sit against walls, the configuration will look more or less like Layout J or K. Layout J provides privacy, and it will work even better if panels are added in front of the desks. However, this plan does not encourage interaction.

On the contrary, Layout K allows the maximum degree of interaction. It reduces the visual and acoustic distractions from behind, but does not prevent distractions coming from the front and sides. The personal territories are closely connected.

![Figure 4.6 Layout J, K](image1)

These problems may be solved by shifting the alignment or simply adding more separation panels as shown below. Layout L still works similarly to K, but M and N both provide more visual privacy while maintaining a level of interaction. M takes up too much space in the given room, but should work well in a larger space.

![Figure 4.7 Layout L, M, N](image2)
By adding the panels in Layout O, the users get less distracted by what happen in front of him. In this case, only people who sit on the same side can talk. If one person wants to talk to another sitting at the other side, he will have to stand up and walk over.

Figure 4.8 Layout O

Layout P is a revised version of O with breaks in between panels, so that people on different sides can talk over the breaks, as shown in the right picture. In this plan, it might still be good to stretch the desk to separate the interactive areas from personal territories.

Figure 4.9 Layout P
So far there are three good layouts for solo tasks and three for collaborative team tasks, as listed below. Most office desks in market can be easily arranged into these layouts, except P, which requires special paneling. Thus, designing an appropriate desk/paneling system for Layout P is crucial for offering the maximum flexibility in an office.

Figure 4.10 Good layouts for individual tasks and team tasks
4.3 Study Model

![Image of study model]

Desks are put together to form a teamwork space. Every user has a defined personal space – his own desk with a separation panel in the front. Visual privacy and territorial privacy are guaranteed when the user needs to concentrate. When there needs to be communication, he can easily talk to his/her colleague from various directions. Surfaces that are not separated by panels will serve as communal space so that people from both sides of the table can look at each other and exchange materials.

![Image of desks together]

Figure 4.11 Overview of the model and rough measurement

Figure 4.12 Putting several desks together
This desk design can be easily configured into other office layouts as discussed before. The following two pictures show alternative layouts for individual tasks.
4.4 CAD Model

Figure 4.16 Desk concept with a chair (chair model: SAYL, by Herman Miller)

Figure 4.17 Desk with a desk lamp, a monitor, and a mug
Figure 4.18 Different views of connected desks

Figure 4.19 Different work modes – concentrating / communicating
Figure 4.20 Countertop and panel details

Figure 4.21 Alternative configuration 1

Figure 4.22 Alternative configuration 2
4.5 Suggestions

Office design is not only related to objects, but it also reflects the managerial issue of assigning workplaces. From the interviews, we see that not a great deal of thought is put into this issue in current practices. High-level employees usually have relatively private spaces or even individual offices. However, lower level employees can hardly influence where they will sit – they are not asked about their preferences. Generally, the manager decides for them according to whatever is available. The administrator who was interviewed prefers to share office with others, but she has an individual office; the software engineer was working in an open office for a long time, where others often disturbed her.

Worker’s work content and method can be investigated before he gets an assigned space. There is a very simple approach we can borrow from an apartment-matching questionnaire. Many landlords effectively assign their residents according to the result of these surveys. Office managers can also provide a questionnaire asking about the employees’ work habits and concerns before assigning spaces. People who share similar preferences might work well together than those who do not.

Figure 4.23 Sample roommate match questionnaire by Southern Oregon University Housing Office
CHAPTER 5  CONCLUSION

5.1 Summary

In the first chapter, the history of the office was studied and literature on office designs was reviewed; current megatrends on office design were investigated in the second chapter. From the investigation, we learned that the changing economy is shaping the content and method of work, and also with the shaping of the work environment – offices.

In the current knowledge economy, knowledge itself becomes a product in addition to a tool. With knowledge and information able to be transferred digitally, office automation developed when technologies became available. People are no longer bound to the physical location and structure of offices – they can choose to work remotely. Work becomes something people do, not a place where people go. As a result, tangible forms of the office grows to be more flexible – a space with a work surface, a computer and Internet access could be defined as an office.

However, on the other hand, knowledge workers spend more time communicating with others to create new knowledge, which makes the interrelationships in offices complex. Office designing and planning must be more than understanding the relationship between people and products, but it needs to emphasize the relationship between people, and people and the space. Offices become marketplaces for exchanging information and knowledge, and office design and planning ought to facilitate this flow of knowledge in the space by providing office users with environments for both concentration and communication modes.

To better understand how the knowledge and information flow in the office, or in other words how knowledge workers work in the real world, interviews were conducted with professionals in various industries. Face-to-face interviews were held onsite with an administrator, an architect, a software engineer, a lawyer, and a lab technician. These profiles were chosen for the variety in work content and methods. Interview insights were summarized and discussed in the third chapter.

According to the interviews, in-depth solo tasks that require high-level concentration still remain the most common work mode in offices. Collaboration does not happen as much as the author has anticipated. The standard workflow shifts between solo work mode and sharing information mode. Instead of collaborating, all knowledge workers interviewed needed to share information (communicate) with other workers, and the frequency and accumulated time depended on the workers position in the organization. Manager-level workers have more meetings and spend less time at their own workstations compared to other workers.
Office planning does not differ largely depending on the industries. However, it might relate more to the workers’ thinking patterns in different industries. In the interviews, the administrator and architect behaved more tolerant towards interruptions when working, whereas the software engineer, lawyer, and lab technician preferred absolute privacy. It is then reasonable to presume that inventive and empathic thinkers or so-called “right-brainers” (including designers, teachers, consolers) were more adaptive to shared workspace and frequent communication; logical and linear thinkers or so-called “left-brainers” (including engineers, lawyers, accountants) would prefer not to be interrupted in enclosed individual spaces. However, this presumption needs to be proved by further research.

Personal work style and characters that vary from person to person are the most influential factors concerning the users’ perception towards office design. Thus, office design and planning need to provide the users with sufficient flexibility so that they can choose how to work based on their own preferences.

These interview insights set the design parameters. The primary parameters of the design and planning should be assuring users with the ability of concentration, and allowing communication when needed; appropriate flexibility should be achieved. Secondary parameters are more detailed — design should reflect the user’s position and thinking pattern; ideally, it would provide proper furniture orientation and sufficient work surfaces.

Based on the design guidelines set by the research, a product solution was proposed as an example in the fourth chapter, which included a desk system that could be configured for both concentration and communication.

5.2 Conclusion

In a knowledge economy, an office is a holistic system consisting of workers and their work environment. When planning an office, it is no longer enough to just offer ergonomically correct furniture. Furniture, space planning and knowledge worker themselves build up a complex information structure in the office. A good structure can facilitate the information flow and thus augment productivity, whereas poor structures can impede efficiency and frustrate the workers. Thus, it is critical to comprehend the relationship between people, people and furniture, and people and space in the office.

In this paper, the author has observed that the most common work modes in several industries are concentration and communication. Thus, the office structure should provide the workers with an environment that helps them to concentrate and/or communicate. Communication is a distinct feature in the knowledge economy, and thus should be given more attention. Some other work modes that are not
observed in the interviews, including collaborating, socializing and learning, may happen commonly in some specific industries or companies, and those issues should be addressed accordingly.

Offices should also be as flexible as possible from the workers’ standpoint. For example, in such an office, workers are not assigned a designated space. However, they can choose freely where in the office they would like to work – perhaps in a semi-enclosed workstation, in a teamwork space, in the cafeteria, or even outdoor. Each employee can make the choices based on their own work style and current task at hand.

In practice, every office design case should be specific and creative, because every company is structured differently in terms of workflow. Before planning an office there are several questions to be consulted with the company. What does the company do? What is the structure of the company? What is the workflow in the office? What is each person’s role in context? It is especially important to understand who should work on his own, who should communicate with whom often, who collaborate, and who reports to whom. By understanding the human resource structure, people with the same task and level of interaction can be grouped in one area, and shortcuts can be made between areas that often communicate.

5.3 Future Directions

The research and design practice can be furthered in the following directions if time and funds allow.

5.3.1 Profile of Interviewees

First, even though not a lot of collaboration was reported in the interviews, the author still believes that it happens frequently in this knowledge economy. It might occur more often in a consultancy setting, where different disciplines collaborate, and organizations work directly with their clients. Design consultancies or advertising consultancies are good options to investigate in the next step. If collaboration does happen as a tremendous portion of their work, the design guidelines for the consultancy industry should focus more on team tasks rather than solo tasks.

Secondly, decision makers of office design, likely to be office managers or facility managers, should be included in the research in addition to office users. In this paper, typical office users discussed how they use their workspace. However, a large proportion of them cannot influence the decision of how the office should be arranged or what furniture to buy. Thus, it is important to understand the decision maker’s criteria as well. Even if they are office users at the same time, their insights on office design might be very different. The assumption is that, they are concerned more about the cost, safety, employees’ health condition, efficiency, and sustainability. These criteria that are not covered in the user interviews may lead to more comprehensive conclusions towards office design.
Also, if decision makers of office design are included in the interviews, office-planning opportunities can extend to a managerial dimension. Design is not limited to objects. In this specific case, it might even be more practical to solve the problem with creative management solutions, for example, using questionnaires to determine office assignment.

5.3.2 Number of Interviewees

Five interviewees from different professions were chosen in this research. Due to the small size of the sample, personal preference and bias might have influenced some conclusions. Ideally, the number of in-depth interviews should exceed 20 to get a more accurate result. Also, other professions dealing with knowledge work, such as librarians, physicians, designers, marketers, and managers, should be included as well.

5.3.3 Quantitative Research

Qualitative research methods were used in this paper to uncover user behavior and needs. Usually a qualitative research is followed by quantitative research that supports the result with solid data.

Standards and tools need to be set up to evaluate office designs. For example, in the Design + Performance Report (Gensler, 2008), they developed a measurement called Workplace Performance Index (WPI), and proved that the profit growth correlates to the WPI score. Such quantitative data helps both clients and designers tremendously.

5.3.4 Various Design Solutions and Concept Evaluation

The design concept in this paper is only one of many solutions that come from the user behavior study. Following are a few examples of what else it could be:
Figure 5.1 Desk with moveable screens
The sketch in Figure 5.1 showcases a concept of moveable screens. It provides the users with possibility of stating whether they are open to interactions or are focusing on their own work and do not want to disturbed. It provides flexibility not only for different types of office users, but also for those users who want to shift between various work modes.

The concept in Figure 5.2 pays more attention to the territorial privacy. Even if the user has an open view, his/her “territory” is protected by the surrounding workstation, and will not be intruded. This concept also offers a larger work surface for the users to spread materials out, and yet easy to reach.

Figure 5.3 is another screen solution. In this concept, the screen can serve as a divider, an information display, or a clear panel when the user needs to communicate. Again, given such flexibility, the user can choose how he prefers to use the product.
Figure 5.3 Interactive screens
One thing is still missing in this paper. The design concept in the previous chapter demonstrates that investigating office user behavior through interviews can help improve office comfort and efficiency. However, to make this a successful argument, the design concept itself needs to be tested. The concepts — either furniture, or space planning, or a management solution, demand for an evaluation process to demonstrate that can work better than existing products. A set of functional prototypes should be used in a real work environment. If observation and follow-up interviews support this concept, this thesis will be more credible as well.

5.3.5 Architectural Solutions

A product solution can influence the office environment to some extent, but to resolve the problem comprehensively, product designers need to collaborate with architects and interior designers to develop a coherent office system. Designing an efficient office, the real question should be, “How does information and knowledge flow fluently in the space?” The relationships between “people and people,” and “people and space,” are becoming critical in a knowledge economy. Does the worker have to have a designated spot? Can the worker choose different types of rooms to work in when the work mode shifts? What does an inspiring communal space look like? Is it possible to provide an enclosed quiet space for workers to reflect or contemplate? These questions need architectural solutions.
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