Service Design Research about Redesign Sedentary Office Guided by New Ergonomics Theory

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Abstract. Current office design is sedentary because it encourages users to work in one good posture as long as possible. Such sedentary office is lethal and inefficient. It needs redesign. To solve this problem, tendonitis experts came up with the new ergonomics theory. It encourages office workers to switch working postures periodically. This working status is defined as dynamic in the paper.

More and more well-known furniture manufacturers sensed this dynamic trend and applied the new ergonomic theory to their product. However, few of their products achieved big success. In order to better apply the new ergonomics theory in office design, a synthesis of context interviews, survey, and observation shadowing was carried out. A triangulation method was used to analyze the research results to get reliable apparent truth.

From the research, it was concluded that a successful new ergonomics office needed nicely designed multi-posture physical environment, proper posture-change stimulation system, and pleasant posture –change experience. This needs industrial design, interaction design, and user experience design to collaborate seamlessly, which actually is a typical service design process. So, only through service design, can a great new ergonomics office be created to encourage users leading a new life style.

This paper offered a brand new direction for office design.

1 Why Current Office Is Sedentary and Needs Redesign

Current Office environment originated from Industrial Revolution. “The booming of mass production technology and international trade created a huge need for information processing. Desks and chairs, which used to be luxury decorations, are changed into a daily necessity. “In a short period of time we've been sentenced to the chair.” (Katzmarzyk, 2010) With rapidly increasing data processing needs, modern office workers seldom have a chance to move, even compared to 20 years ago. Modern office became very sedentary.

Since the 1960’s, the public has come to realize the negative health conditions caused by sedentary office work. It is reported by New York Time on 2010 that such

P.L.P. Rau (Ed.): CCD/HCII 2013, Part I, LNCS 8023, pp. 175–183, 2013.

sedentary office life is lethal and exercise is not a perfect antidote for sedentary office life. (Vlahos, 2011) And now, an increasing number of company, such as Google, want to invest on healthier office environment. As a result, most of the famous furniture companies like Herman Miller and Knoll has started develop new products to encourage users move more. The need for redesigning office is emerging.

2 Redesign Should Be Guided by New Ergonomics Theory

For quite a long time, people tried to rely on classic ergonomics to update their sedentary office. The definition of classic ergonomics in The *American Heritage Dictionary* is: "Design factors, as for the workplace, intended to maximize productivity by minimizing operator fatigue and discomfort." Which actually is 'How to work (or play) long hours, performing repetitive motions, while using proper body mechanics to minimize the development of tendonitis and other repetitive motion Injury'. Classic ergonomics tried to help users using proper body mechanics by suggesting best working postures.

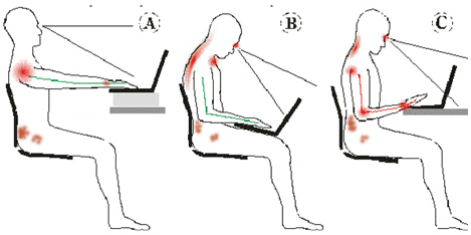

Fig. 1. Sit pressure analysis

First, sit was recommended as the best working posture. Ergonomic chairs were developed by the chair industry to address widespread complaints of back pain from workers. Lumbar support is deeply embedded in people's mind as a prime solution (Charis, 2010). However, as time goes by, back pain is still the most costly work related disability, although almost all offices in America are equipped with ergonomic chairs. (UHA, 2011) More recently people became aware of the fact that sitting can cause many issue. It forced the S shape spine into a C shape and put more pressure on the pelvis and spine. (Clark, 2002). (Fig. 1. Sit pressure analysis)

Fig. 2. Different Standing Stations

Then some experts suggested stand as an alternative for sit as work posture. Correspondingly a bevy of expensive standing stations showed up. (Fig. 2. Different Standing Stations). However, swelling legs and feet, which may result in the development of varicose veins, were among the problems caused by long time standing in addition to neck and shoulder stiffness.

Fig. 3. Perch Posture

Recently, NASA experts recommended a neutral body posture, which is called perching. (Fig. 3. Perch Posture) Perching is a status half way between sitting and standing. It balances our musculature between front and back. (Cranz, 2010). However long time working in this posture still can result in chronic disease such as varicose veins.

It is said by the New York Time, the reason why sedentary office was lethal was not because sit was a bad posture. It was because the users remained one posture for too long a time. (Charis, 2010) "The body shapes itself to the forces placed upon it." (Tucker, 2010). What classic ergonomics dedicated to only can slow that distortion procedure.

Up till recently, researchers realized that a new method for designing office environments was needed. A new theory "new ergonomics" was come up. Tendonitis experts defined new ergonomics as: A way of safely performing ongoing, repetitive motion activities. Understanding how the body interacts with strain and making ongoing adaptations to avoid the creation of a pain causing dynamic. In other words, the new ergonomics focused on ensuring people do repetitive motion in a new way, a new position, every day (Tucker, 2010). The key feature of new ergonomics is encouraging users to change working postures periodically. The state of periodically changing working posture is defined as dynamic working habit in the paper. Working dynamically can help users avoid harms caused by doing repetitive motion.

Redesign office according to new ergonomics theory is good for increasing work efficiency as well. The time adults can focus on a specific task with 100% focus is only 20 minutes. In order to get refocused, rest is needed. (Wikipedia, 2012) During prolonged work periods, workers tend to spontaneously fidget in order to entertain themselves, such as rotating a pen or shaking legs. Dr. Roland Rotz explained this in his co-authored book that fidgeting is a rhythmic sensory stimulation in our body's natural way of activating our under stimulated brain to facilitate focus which allows

us comfort and rest (Roland Rotz, 2005). However, the sedentary office environment usually discourages office workers from taking any rest. As a result, many office workers have to pretend to be working hard while they cannot focus and feel exhausted. The new ergonomics theory can turn the office into a more dynamic environment and improve users' work efficiency.

For all the reasons above, it's necessary to update our old sedentary office into dynamic new ergonomics office.

3 New Ergonomics Offices Needs Both Mental and Physical Support

The new ergonomics theory has already been successfully applied to classroom furniture design AlphaBetter Desk or "stand up desk" (Fig. 4. AlphaBetter Desk). The desk, which was originated by Abby Brown, is an outstanding alternative for children, teens and adults. AplhaBetter Desk is higher than normal desk and it is paired with a high stool. Such a design enable the users easily switch between good study postures, sit, stand and perch. Another feature of the desk is it has a swinging footrest. The users can fidget with the swing to consume their surplus energy. This design used to be tested in Minnesota and Wisconsin primary schools and became a fad. The kids felt energetic all day and want to have one at home. The teachers commented, "I've never seen students with their heads down, ever." "I can stand at their level to help them." (SAULNY, 2009)This new ergonomics furniture empowered the users both mentally and physically. It naturally encouraged the users to change working postures and develop a new dynamic study style. It fit perfectly into the classroom environment.

However, office environment is quite different from classroom. Although, many famous furniture manufactures, such as Herman miller and Knoll, try to develop more dynamic product, none of them come up with similar breakthrough solutions for office.

Fig. 4. AlphaBetter Desk

From all the analysis above, it can be inferred that a successful dynamic office should meet the following rules:

- Should properly stimulate posture change.
- User experience of posture switch should be simple and pleasant.

In order to confirm the hypothesis, a research was carried out. This research focused on administrative assistants. It was because there were a lot of administrative assistants and they lead typical sedentary office life. "According to the Bureau of Labor Statistics, in 2006, secretaries and administrative assistants held about 4.2 million jobs, ranking among the largest occupations in the U.S. economy. About half of them suffer from musculoskeletal disorders. (health, 2010) Americans spend more than $126 billion a year to receive Medicare for back pain (UHA, 2011).

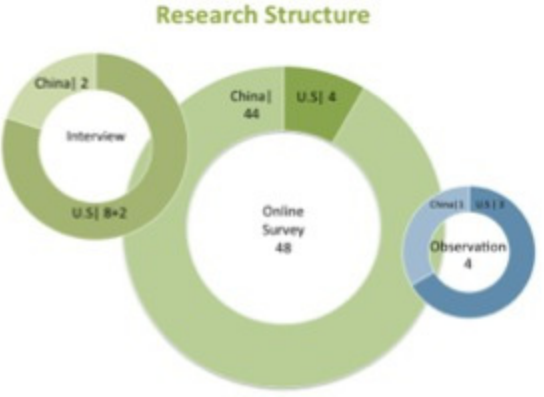

Fig. 5. Research Structure

The research was a synthesis of context interviews, a survey, and an observation shadowing. (Fig. 5. Research Structure.) Interview used similar structure of the survey of the questionnaire. The questionnaire had 17 questions in total. There were prescreen questions, life style questions and questions about users experience. Full version of the questionnaire can be found at http://www.surveypie.com/survey101132. In total, 10 American and 2 Chinese subjects participated in the interview research. Forty-four Chinese and four Americans participated in the survey. Three American offices and one Chinese office were observed.

The research results were analyzed by using triangulation technique. Triangulation is the process of combining several different research methods to illuminate one area of study- in other words- using several research tools to examine the same thing. (Jennifer Visocky O'Grady, 2009) And the research results confirmed the hypothesized design guidelines.

3.1 Should Properly Stimulate Posture Switch

Several research data showed that few of the subjects realized that they needed to stay dynamic. More than 50% of respondents had never seen others avoid sitting for a long time or breaking up during the pro-longed sitting. Less than 50% of respondents personally tried to avoid sitting for a long time or breaking up the time spent sitting. Only 30% of the respondents thought activities designed to prevent pro-longed sitting was a good idea. During the observation research, 0% office worker was observed intentionally stretching or attempting to be active. This confirms that reminders stimulating users to switch posture is necessary in redesigning a dynamic office.

Respondents' answers for these questions were interpreted and analyzed. The research result showed that many subjects thought exercising and living a more dynamic office lifestyle was unnecessary and forbidden in current office culture. One of the subjects said, "The office is always so quiet that you dare not to say a word loudly. Let alone do other stuff. Sometimes I really feel depressed." Current offices discourage employers from being dynamic. Stay quite and sedentary in office is deeply embedded in office workers' mind.

As a conclusion, reminders, which can properly stimulate posture change is crucial for introducing new dynamic office design. Such a reminder system can both educate customers and help them develop new working habit. A proper reminder should be able to fit into the silent and serious office environment. Also it must be pleasant for users to follow.

3.2 User Experience of Posture Switch Should Be Simple and Pleasant

By asking subjects about their aesthetic preference for healthier office furniture design and office exercise, it can be tell that subjects prefer to choose the options which are low-key, simplicity but versatile. (Fig. 6. Customers' aesthetic preference for office hi-tech, Fig. 7. Appropriate office exercises) So in order to encourage administrative assistants to adopt new dynamic working style, the user experience of posture switch should be simple and pleasant.

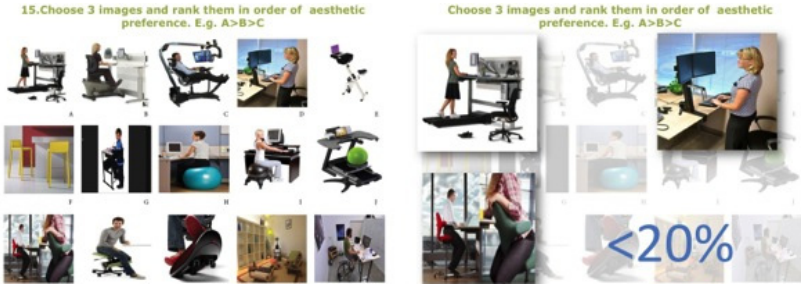

Fig. 6. Customers' aesthetic preference for office hi-tech

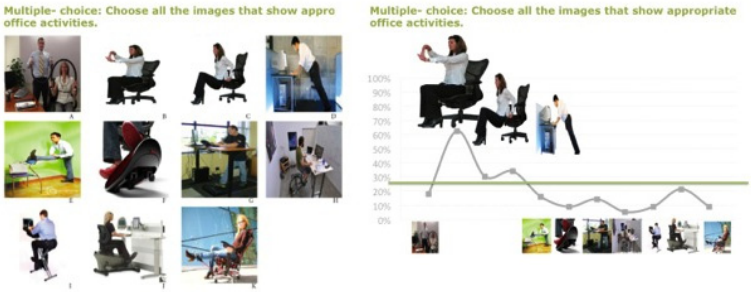

Fig. 7. Appropriate office exercises

4 New Ergonomics Offices Design Is Service Design

New Ergonomics Offices Design is Service Design. It is because new ergonomics office not only makes users' life more convenient but also tries to encourage users develop a new life style. There are three things needed when design a new ergonomics office. They are scientific multi-postures, proper stimulation and pleasant posture change experience. In order to meet the requirements, nicely product design, interaction design and user experience design must collaborate seamless. This actually is a service design process.

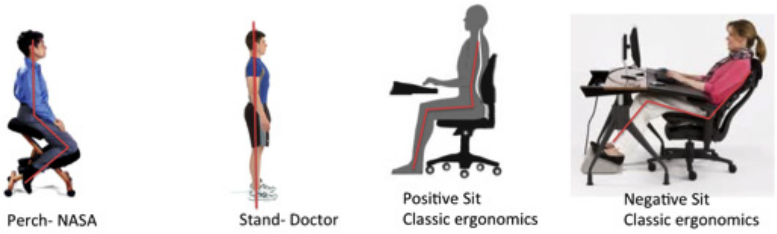

Fig. 8. Four Scientific Work Posture

They are perch, stand, positive sit and negative sit. (Fig. 8. Four Scientific Work Posture) The more work postures the office can offer, the more dynamic the new ergonomics office can be.

First, according to the research, four scientific multi-postures were recommended. Second, since the new ergonomics theory meets the needs of human body, it was found during the research that there were times and ways to sent proper stimulation in office environment already. When asked, "Once you sit down, how long will you remain sated?" 88% of respondents confirmed that they needed to stand up and walk around every one or two hour. This is because after one or two hours of work, they naturally felt tired and bored. They needed a break to help themselves refocus. And these are natural pauses happen in work time. These pauses can be the proper time to send out reminders without interrupting users' normal work and create pleasant user experience.

And many of the subjects decorate their office with their family members' or friends' photos. This indicates that users' memory with their friends and relatives are pleasant experience for the users in the office. So customized reminders by users' relatives and friends may work better than normal reminder.

Third, the reminders must be sent during the natural pauses, through proper way. So, physical furniture needs to be able to monitor the users' working status. At the same time, it must offer at least two of the four scientific postures.

All in all, a new ergonomics office must have physical environment, which enable the users to easily switch between different working postures. This needs industrial design support. Also it should have a nice service system to offer appropriate reminders. Such as a system enable the users or their friends to customize pleasant reminders. This needs interaction design. Last but not the least, the product system and the service system need to collaborate to sent out the reminders properly. Only through such a service design process, can a great new ergonomics office be created to persuade the users to develop a new working life style.

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