Machines as a social system

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Abstract

Through an analysis of service engineers' activities and interviews, this paper describes how a mobile technology works for engineers to make their service area visible, and how various norms and controls are embedded in it in order to maintain and manage copiers as a social system. It explores how artifacts as reified indication systems are achieved through everyday practice. It indicates that the introduction of new artifacts carries re-designing the relations or the divisions of labor in the workplace.

Introduction

Things, tools and machines are usually treated, or analyzed as an individual physical object. However, they are not a single physical object but a social system, since even a single object embeds the relations. Considering that any social systems are realized from designing or reorganizing the relations, it can be said that things, tools and machines are the embodiment of the design of a social system. Copiers are no exception, particularly as they are often leased products accompanying with repair and maintenance services. Without these services, copiers would not be able to act as stable products on the market as they are relatively unstable machines.

Copiers on the market rely on the social integration of technology development and service arrangements. In this context, service technicians' social organization and teamwork artifacts are well developed. One of these artifacts is a mobile self-dispatch system with which service technicians monitor a list of customers' request to repair machines in their service area. Through the analysis of service technicians' activities and interviews, this paper describes how the mobile self-dispatch system works for technicians to make their service area visible, and to maintain and manage copiers as a social system. It, then, argues that studying machines, artifacts and technologies is to study the social systems.

The mobile self-dispatch system embeds various norms and controls in it in order to maintain and manage copiers as a social system. It is deeply held indicators and controls regarding what service engineers should pay attention to and how they should work. Thus, this paper also describes artifacts as reified indication systems achieved through everyday practice, and as carriers of re-designing the relations or the divisions of labor in the workplace. It, then, argues that to design social systems inevitably includes the design of politics such as control, conflicts and tension. This paper also indicates that the introduction of mobile technologies into workplaces proceeds with the large-scaled reorganization of the division of labor.

Copiers as a social system

1.1 copiers as commodities

Copiers have two special features as commodities. As everybody knows, copiers break down frequently, compared to other machine products. The first feature of copiers is closely related to it. Copiers are unstable machines without maintenance & repair services. Copiers are often leased products with accompanying repair and maintenance services. Without these services, copiers would not be able to act as stable products on the market. Due to industry competition, development and design divisions prioritize the creation of advanced technologies rather than creating stable machines. Thus, the commodification of copiers relies on the social integration of technology development and service arrangements.

The second feature of copiers is about the state of copiers on the market, where many types & models of machines are dispersed in the area. This feature requires a team service system per area unit, in which every engineer takes care of every type and model of machine dispersed in the area.

Copiers are the products that integrate these two features such as originally unstable machines and many types and models of them being dispersed in the area into the team service system. With this integration, copiers become stable machines on the

market. In this way, copiers as products carry multiple layers of the relations. A copier is a social system, in which the multiple relations among machines, people and artifacts are reorganized and redesigned.

In this context, service engineers' social organization and teamwork artifacts are well developed in the customer service department we visited. For instance, a record of machine histories that is a kind of medical record for a copier filled out by each engineer at each time he visits the machine, conveys information about diagnoses, repairs, maintenance work on the machine to other engineers in the team. There is another important artifact for the team organization. It is a mobile self-dispatch system, which we focus on intensively in the following sections.

1.2 Design of social organization with the introduction of a mobile technology

The customer service department introduced a self-dispatch system into the work of service engineers in 1997. When an operator in the telephone center receives a customer's call, she operates a terminal of FWSS that is a server of Field Work Support System, to send the customer's call to a certain team whose service territory covers that customer's office. Each service engineer in a team monitors the list of customers' calls in the field, arranges his work schedule in accordance with the situation and allocation of other members, and decides where to go next by himself.

Before the introduction of the self-dispatch system, telephone centers received request calls from customers, and controllers (dispatchers) in the center called engineers in the field by a pocket bell and allocated them to the customers along with monitoring a list of customers' requests. Only controllers in the center could watch a list of customers' requests at each time in each area on the computer monitor. The telephone center those days might be regarded as a kind of modern panopticon, since it had a bird's eye view of each area.

It is obvious that this controllers' dispatching system was problematic. Main problem was that the controllers did not know the detailed situations of each area such as histories of machines, traffic conditions, and the details of geography, while they might grasp the overall situation of it. In contrast, engineers had detailed knowledge of their own area, but could neither grasp the whole situation of their area, nor coordinate their work schedule in a timely way that was responsive to their local situation. As a matter of course, there were always conflicts and tension between controllers in the center and service engineers in the field.

In 1990s, before the introduction of the self-dispatch system, whenever engineers returned to the office, they watched a dispatch table to make up an inconvenience caused by invisibility of the status of the area and their own work schedule.

In 1997, engineers' self-dispatching system was introduced in the service field. Since then, each service engineer monitors a list of customers' request calls in their own area. The customers' list also includes the information such as who is repairing which machine, what time he started working, when he finished repairing, and so on. In addition, a self-dispatch system displays short description of trouble and customers' phone numbers in a menu of detailed information. At the same time, engineers can input some information such as where he goes next, he is facing trouble, he has lunchtime, etc.

The members can observe each other's work. So the status of the area is made visible to all the members of the team. The members of the team of the area make a work schedule and allocate work by themselves. One of the engineers talks about this system as follows: "Previously we felt we were worked, but now we feel we work by ourselves."

For the first three years, this system involved a mobile computer connected to a server with a mobile phone. Recently this system has worked with a mobile phone directly connected to a server.

1.3 How do service engineers actually use a self-dispatch system and a mobile phone in the field?

Following Yamada's case (Ueno, N. & Kawatoko, Y. 2003), let us take a look at how a service engineer uses a self-dispatch system in the field.

One day after repairing a machine in a customer's office, Yamada watched the screen of his self-dispatch system. And he told us the current situation of his area. He said, "Two members of my team are out of field because of injury and cold. One engineer participates in a training session and the other is repairing a big machine. It takes time to repair a big machine, so he will be occupied with this machine for a while. It's going to be very busy today!"

Monitoring a list of customer's request calls, in order to decide where to go next, Yamada noticed that one of the team members, Tanaka, was allocated to repair three copiers this day, though he had not finished repairing the first machine yet.

So, Yamada decided to go and repair one of Tanaka's allocated machines that was located in a hospital. Yamada inputted his name under the hospital on the customers' list.

Before starting for the hospital, Yamada checked a list of engineers on duty to see whether a technician, Suzuki, who knew the model AVX in the hospital very well was busy in his work or not. Yamada, then, called Suzuki by a mobile phone to get some advice of repairing the model AVX. According to Yamada, the model AVX is an old machine that appeared on the market 5 or 6 years ago. He said, " I think I can repair it. But, it is not worth repairing. It must be a good time for them to exchange the AVX for a new model".

Meanwhile, Yamada called to the hospital, informing that he would arrive there around noon. After that, he telephoned to a person in the sales section in this area. Yamada said to a sales person. "Why won't you recommend the hospital to exchange the AVX for a new model? It takes too much time to exchange a ramp cable and scan rails. If I fix it now, the same problem will occur soon." After calling to the sales person, Yamada went to the hospital. Immediately after he opened the machine, he noticed that the scan rails were not parallel as Suzuki suggested. He made temporal repairs on the machine. It took about 30 minutes for him to do this procedure. Yamada called the sales person again and asked him to negotiate with the customer about the exchange of the old machine for a new model.

After that, he checked the self-dispatch system. There were still seven request calls on the list. At this moment, one of the team members, Tanaka, called to him to talk about their work schedule. On the self-dispatch system, Yamada was planed to go to NK office in the techno-city building, and Tanaka was planed to go to TK office across from the hospital. However, earlier this morning, Yamada came to the hospital instead of Tanaka, and now he is very closed to TK office. On the other hand, Tanaka was still in the techno-city building. So, they decided to exchange the places to go. It would save time, since it took at least 20-30 minutes to go to the techno-city building from the hospital.

Yamada's activities with the mobile self-dispatch system show the following things. All the members of the team can monitor the list of customers' call and observe the situation of their service area anytime they need: how many requests there are at the time, how many are left unattended and where request calls come from. In addition, members can monitor each other's work and contact with each other: where team members are and how their works are going and so on. Thus, service engineers schedule their own work flexibly and spontaneously in view of other members' work, and allocate themselves to an appropriate place in an appropriate timing.

The above short description of engineers' activities with dispatch systems makes clear that copiers are in presence on the market only through the certain ways of deployment or integration of machines, people, artifacts and technologies. A Copier is actually a social system. The performance of copiers is identical to the performance of the social system. The quality of copiers means the quality of the social system. If you ask about what is machine trouble, the answer is "the trouble with a social system". Once, the service engineers described by Orr (1997) said that "do not fix machines, but fix customers." Those engineers appropriately formulated machine trouble as a social issue. Their knowledge of practice allows us to extend more. We claim that machine "trouble" is regarded as the breakdown of the social relations, or the social system.

What is the nature of artifacts?

So far, we saw the mobile self-dispatch system work as one of the important teamwork artifacts in order to maintain and manage copiers as a social system. Next, we argue about what kind of artifact, or technology it is. In other words, what is the nature of the mobile self-dispatch system as an artifact? Alder's study, "Making things the same, 1998" gives us hints for thought.

Alder (1998) studies the technological and political transformations of late 18th-century France, through the history of standardized production for weaponry on the eve of the French Revolution. Alder described how standards of production emerged out of social conflict in the ancient regime's military-industrial complex, and how the division of labor among military engineers, artisans and merchants were reorganized through the efforts of state military engineers to produce interchangeable parts manufacturing that was accompanied with the introduction of standardized artifacts such as technical drawings, gauges and jigs in the workplace.

2.1 Gauges as the "reified" object of social control

In order to enforce new standards for each individual gun part, and to superintend the fractious provincial manufactures, military engineers adopted new kind of technical drawings and ordered artisans to construct the objects conformable to the drawings. But drawings do not, in and of themselves, discipline artifacts or control labor. An artisan can make some kind of artifact from almost any technical illustration.

In order to mediate between their drawings and the artifacts they desired, military engineers designed gauges and jigs, so that they embodied their instructions in physical `instruments'. Engineers substituted mechanical authority for personal judgment. They objectified and impersonalized instructions and control. Thus, gauges are regarded as the reified object of social control. In this way, artifacts embed social relations.

2.2 Division of labor among manager-inspectors and worker-artisans

The manager-inspectors who were the physical bearers of manufacturing `tolerance', entered the workplaces as outsiders, having gauges with them. This event reorganized the division of labor among manager-inspectors and worker-artisans who used to have a property right in the whole production process and their labor. The manager-inspectors set standard of production, directed separation of production process and tasks, stratifying the relations between planners of the artifact, designers of machinery and practical workers of the task. The manager-inspectors also had all gauges made in Strasbourg by `a single hand', which brought the hierarchy of artisans together with the

hierarchy of standards. These historical procedures show that the design of artifacts or technologies is inseparable from the design of social systems.

Alder's study suggests two things. First, artifacts embed social relations, and second, exactly as manager-inspectors with gauges proceeded to reorganize the division of labor, the design of artifacts or technologies is inseparable from the design of social systems. Alder's study also shows that the design and the use of artifacts are the outcome of socio-historical conflicts and the production of future conflicts.

3 What is the nature of the mobile self-dispatch system as an artifact?

Referring to Alder's study, let us return to our subject, and discuss about what is the nature of the mobile self-dispatch system as an artifact.

As shown earlier, during 1970s to mid-1990s, controllers in the center dispatched engineers to their service area. This implies that controllers controlled engineers' labor. As a result, there were always conflict and tension between controllers in the center and engineers in the field. Looking back over those days, engineers talked to us as follows: "Controllers controlled everything. We always felt like driven to work from them. Work schedule was hard. Sometimes we hardly had lunchtime." On the other hand, former controllers criticized the attitude of former engineers: "Engineers always complained about dispatching. Their contact with us was slow in coming. They didn't even know how troublesome the controllers' work was."

In 1997, the mobile self-dispatch system was introduced in the service field. Are there no more conflicts and tension in the field? Do engineers get autonomy in their workplace? In reality, there are still conflicts and tension in the field. Conflicts and tension occur both in individuals and between team members. Engineers say that they find themselves urged, or pushed by someone or something. Anyhow, they feel uneasy, whenever they watch a mountain of customers' request calls. Engineers feel themselves forced to work by something invisible. There are also various tensions and conflicts among engineers within a team. For example, young engineers see veteran engineers only take charge of easy customers. The young engineers think that is why they have to take care of difficult cases or new types of machine trouble. Thus, after the introduction of the mobile self-dispatch system, there are still conflicts and tension in the field. In addition to that, engineers do not even feel themselves work autonomously.

3.1 Mobile self-dispatch system as Alder's gauge
As we have seen in Yamada's activities with the mobile self-dispatch system in the field, what service engineers should pay attention to and how they should work are embedded in the system. Without being conscious of engineers, something that controls engineers' ways of working is embedded in the mobile self-dispatch system. The "center" embeds various norms and controls in the mobile self-dispatch system in order to maintain and manage copiers as a social system.

At this point, the mobile self-dispatch system can be compared to Alder's gauge. The "center" embodies their instructions in mobile `instruments'. In other words, it substitutes technological authority for controllers' judgment, and shifts authority over good workmanship to an impersonal arbiter. Thus, the mobile self-dispatch system is regarded as the "reified" object of the social control. This mobile artifact embeds not only control, but also conflicts and tension.

3.2 Reorganization of the division of labor with mobile technologies
In Alder's case, the division of labor among manager-inspectors and worker-artisans was reorganized when manager-inspectors entered into the artisans' workplaces, having gauges with them. In our case, the division of labor is also reorganized when the team of engineers manages its area with the mobile self-dispatch system.

Even in controllers' dispatching system, a team of engineers took care of one service area. But those days the team was a nominal team, in which each member was dispatched by a controller and could not know where other members were and what they were doing. In the engineers' self-dispatch system, a real teamwork is actualized in the field. The members of a team constantly communicate each other to manage customers, repair processes and ways of work by themselves with the mobile technology. The mobile technology introduced in the field reorganizes the division of labor of a nominal team in one of a real team.

The mobile technology also tends to reorganize the division of labor among the members in a team. As young engineers complain, they are often allocated to difficult cases in technology. This type of division of labor among engineers has resulted from the mutual observation of members' work through the mobile technology. In this way, design of technologies (artifacts) is inseparable from design of social systems.

Conclusion

What is different between the "center-control system" and the "team-management system"? The typical center-control system is the Ford production system and Alder's manager-inspectors' control of the tolerance, in addition to the controllers' dispatching system. On the other hand, the typical team-management system is the Toyota production system and the mobile self-dispatch system. Between these two systems, there is difference in who and how controls the production process, work process and the efforts of work, exactly as the contrast between panoptic ways and collaborative ways.

What occurred in the shift from the controllers' dispatch

system to the mobile self-dispatch system was not change over from the center's control to the worker's autonomous management, but re-design of control and tension, or ubiquitous-ness of control and tension. Control and tension never disappeared, nor moved from between controllers and engineers to engineers in the team.

The research on the use of mobile self-dispatch system in the copier's service engineering field makes us project that the introduction of mobile technologies into workplaces proceeds with the large-scaled reorganization of divisions of labor and the re-design of social control and conflict.

Reference

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