Objects-in-use and Organizing in Action Nets: A Case of an Infusion Pump

Introduction

> The focus is on organizations as ongoing performances involving heterogeneous modes of action and materialization, both of which must be actively affiliated and aligned across a range of often unruly contingencies.
>
> (Suchman, 2000, p. 313)

During recent decades, organization scholars have shifted their focus of attention away from organizations as stable entities, divided from their environments by boundaries, toward *organizing* as a process, making it possible to understand how organizations emerge and are accomplished (e.g. Feldman, 2000; Weick, 1979; Weick, Sutcliffe, & Obstfeld, 2005). From such a perspective, organizations are seen as temporary reifications as the process of organizing never ceases (Czarniawska, 2002). But, as many authors have pointed out (see, for instance, Latour, 2005; Law, 1994; Orlikowski, 2007), this process cannot take place if no objects or material arrangements have been added in order to enable humans and non-humans to perform their duties. Schatzki (2006) pointed out that organization is, in fact, a bundle of structured spatial-temporal manifolds of action and material arrangements, and that the happening of organization "… is the performance of its constituent actions" (p. 1864). The challenge researchers thus face lies in dissociating the notion of practice from its sole fixation with human dispositions and habits, and from the connotation of iterative procedural routines (Knorr-Cetina, 2001). Czarniawska (1997; 2004) has suggested studying *action nets* rather

than organizations, in order to "… minimize that which is taken for granted prior to the analysis" (Czarniawska, 2004, p. 780). The pattern of organizing that emerges from a study based on an action net perspective documents a process by means of which collective actions – i.e. objects, quasi-objects like organizational units and documents, and people acting – are continually being connected and reconnected with one another.

In the study reported on in this paper, we followed this thread and conceptualized organizing as the construction and maintenance of action nets. We focused on the actions undertaken, the connections between the actions, and the effects of such connections over a time period of more than 2 years. We also use the concept of *boundary objects,* introduced by Star and Griesemer (1989), as an aid to understanding how coherence can be developed and maintained across different but intersecting worlds. Boundary objects, as they have been defined by Star and Griesemer, are objects that bridge over various types of boundaries; thus, they help the actions of different groups to connect. Thus, we wish to demonstrate that the concept of boundary objects is not only useful for understanding the crossing of boundaries, but also, more generally, the practice of organizing. Further, we will attempt to show how boundary objects are themselves constructed in practice.

We report on a study of the role of objects in a particular case of organizing medical treatment. We will show how objects helped to stabilize such processes. However, during the study we observed that objects must not be treated as stable entities; they too are constructed and enacted in the process. Our contribution is threefold. First, we demonstrate that the action net perspective allows the study of all kinds of connections without making any analytical distinctions in advance. The action net approach means taking a performative perspective on organizing and, we claim, a performative perspective on objects as well. If organization is conceptualized as an "on-going accomplishment" (Feldman, 2000), the role of the things in this process should be conceptualized as *objects in use*; not as stable entities, but as enacted

ones. Second, we claim that it is only when the objects are "enacted" that they become part of the ongoing process of organizing. Thus, *objects-in-use* and actions are recursively connected and enacted during the process of organizing. There are no objects that are boundary "by nature", just objects which, in a particular time and place, function as boundary objects. Third, we would like to point out to managers that the various objects they use in organizing practice can fulfill differing roles, not only because people interpret them differently but also because they become different things in different situations. The study also shows how problems arising during day-to-day work are solved and established as new practices before being inscribed into formal organizations.

Our point of departure was a critical incident at a Swedish hospital[1]: the failure of a drop infusion pump. The pump was about to inject air into a patient's bloodstream, and this failure could have resulted in a life-threatening situation. Immediately, actions were taken to replace the pump. The pump is in constant use on this ward and, as we discovered, was the pivot around which the actions of various actors revolved; including actions undertaken at different times and in different places. We followed the chain of actions initiated in order to investigate this incident and to prevent any further ones. These collective actions were not necessarily performed within the bounds of a specific organization, but involved different organizations, units and groups of people.

The study showed that, as triggered by the accident, the pump had changed from an ordinary operational tool into an object of inquiry. As an operational tool, the pump was 'silent' and taken for granted as long as it worked as expected (Latour, 1999); it functioned as a boundary object among practices. After the accident, the pump lost its invisibility and became an object of inquiry: its own boundaries were under scrutiny. During this inquiry, the

[1] As Annemarie Mol (2002) convincingly showed, hospitals in Western countries are constructed upon and operate along the same principles.

pump was divided into several parts: its boundary became fluid (see de Laet & Mol, 2000) and mutable (Law & Singleton, 2005); thus it could not function any longer as a boundary object. Further, we demonstrate how different groups of people acted upon the malfunctioning pump, and how their collective actions led to changes in various practices. Moreover, the changes in practice were elevated to national importance by changes in national regulations, an act that stabilized and institutionalized the reconstructed action net.

The paper is organized as follows: First, we present our points of departure in the study: boundaries and action nets, and the role of objects in the process of organizing. Next, we describe the process of collecting and analyzing the field material. In the section that follows, we depict the chain of actions taken during the investigation of the incident, the role of the pump during the process, and how responsibility was defined and distributed along the way. Finally, we show how the pump was constructed and enacted as a boundary object, how it was used in the reconstruction and stabilization of boundaries, and how the action net was transformed as a consequence.

Boundaries and Boundary Objects

Studying organizations and processes of organizing always involves the issue of boundaries, either implicitly or explicitly. In everyday organizing, boundaries tend to be taken for granted; however, in times of change, boundaries often become visible and questioned. Lamont and Molnár (2002, p.167) denoted boundaries as "… part of the classical conceptual tool-kit of social sciences"; indeed, this is a concept that played a significant role in organization theory. Santos and Eisenhardt (2005) claimed that boundaries reflect the essence of organization as they constitute the demarcation between an organization and its environment. "As such, they speak both to why organizations are unique and advantaged, and why they fail. At the same time boundaries necessarily address what is outside the organization, not just what is inside." (p. 505). This view can be traced back to earlier organization theories emphasizing the

inside/outside divide, e.g. the contingency theory (Lawrence & Lorsch, 1967), the open systems theory (Katz & Kahn, 1966/1978), or the resource dependence perspective (Pfeffer & Salancik, 1978). There has been a strong tendency within this tradition to focus on internal structures and processes, even when taking the environment into consideration. Thus, organization theory has had - and still has - a tendency to emphasize the organization as an entity demarcated by a stable and unambiguous boundary, yet still influenced by the environment.[2]

However, the issue of boundaries and their role in organizing as well as other aspects of social life has gained renewed interest following an increased focus on processes and a decreased focus on structures (Hernes & Maitlis, 2010). These organization scholars emphasize the social structuring processes instead of seeing boundaries simply as things (e.g. Sturdy, Clark, Finchman, & Handley, 2009). Hernes and Paulsen (2004) proposed several explanations for this: i.e. the increased use of information technologies, the globalization of world markets, and trends in the arts, literature and politics, entailing an increased focus on crossing and bridging boundaries. Thus organization scholars have been studying how knowledge is managed across organization boundaries (Carlile, 2002; 2004), boundary-spanning coordination in postbureaucratic organizations (Kellogg, Orlikowski, & Yates, 2006), or even boundary organizations (O'Mahoney & Bechky, 2008). After studying boundary organizations enabling collaboration between open-source communities, O'Mahoney and Bechky (2008) concluded that these organizations sustain their ability to represent different parties solely by preserving the boundaries that separate them.

Others scholars have focused their attention on the actors taking part in work across organizational or professional boundaries. Boundary-work is described by Nippert-Eng (2004,

[2] For an extensive overview of the issue of organizational boundaries, see Hernes (2004).

p. 263) as "…the never-ending, hands-on, largely visible process through which boundaries are negotiated, placed, maintained and transformed by individuals over time". Abbott (1988) suggested that professionals are constantly participating in boundary-work, whereby authority and domains of jurisdiction are always called into question. Also, Bechky (2003, p. 721) claimed that "Jurisdiction is contested through public, legal, and workplace claims, for control over task areas . . . These jurisdictional claims act to shift both relations between professional groups and the boundaries of their core work domains".

One concept that has been used in relation to cross-boundary coordination and knowledge sharing is *boundary objects*. Boundary objects are often described as knowledge-integration mechanisms, or mediation mechanisms, instrumental in the process of coordination between different communities of practice (Trompette & Vinck, 2009). A variety of objects have been shown to function as boundary objects: i.e. repositories and standardized forms (Star & Griesemer, 1989), engineering artifacts and prototypes (Carlile, 2002; Henderson, 1991), patient records (Berg & Bowker, 1997), project management tools (Sapsed & Salter, 2004), and software specifications (Barrett & Oborn, 2010).

In management and organization studies, it has been shown that boundary objects provide the means for crossing boundaries, being used to inscribe and share meaning across different local contexts (e.g. Beckhy, 2003; Carlile, 2002). Carlile (2002) showed how different communities of practice use boundary objects to share knowledge across different local contexts. The names of such objects provide the rudiments of a shared language, allowing idiosyncratic knowledge to be represented in a structure that is recognizable to many, including those who act on the other side of the boundary. The objects themselves can also help people to learn about differences across boundaries and to understand the dependencies between them (Carlile, 2002; Kellogg et al., 2006 Sapsed & Salter, 2004). However, Bechky (2003) has shown that boundary objects also constrain knowledge-sharing

if used to legitimize or impose occupational interests, while Levina (2005) has stressed the possible consequences of silencing and fragmentation. It has also been shown that boundary objects may function as a means of delimitation and exclusion, in the sense that the object defines why people gather round, and which people it would be (Lindberg & Czarniawska, 2006).

However, as pointed out by several authors (Trompette & Vinck, 2009; Zeiss & Groenewegen, 2009), it is commonplace to treat boundary objects as stable entities rather than enacted into being; as a consequence, the concept has lost its original analytical momentum. For example, Nicolini, et al. (2011, p. 3) have pointed out that boundary objects have increasingly been used as "a one-size-fits-all explanation", thus precluding deeper analytical inquiry. Reviewing management and organization literature, Zeiss and Groenewegen found the following image prevalent: "... a boundary object can be used to manage boundaries through facilitating the transformation of knowledge, some boundary objects are more effective in this than others, and boundary objects can be purposefully created." (2009, p. 91).

In the original study (Star & Griesemer, 1989), boundary objects were shown to function as boundaries and crossing points between different social worlds. Star (2010, p. 604) has said that her "…initial framing of the concept was motivated by a desire to analyze the nature of cooperative work in the absence of consensus." Studying the construction of a scientific museum, Star and Griesemer noticed that the actors involved worked around certain objects (rather than verbal agreements), allowing them to maintain a plurality of viewpoints while maintaining their separate identities and a good deal of autonomy in their own workplaces. In contrast to the normative use of boundary objects prevalent in management and organization studies, science and technology scholars "... want to resist specifying whether or not boundary objects are effective and how they can be purposefully created" (Zeiss & Groenewegen, 2009, p. 93). As pointed out by Fujimura (1992, p. 173), the objects

in Star and Griesemer's study acquired the boundary aspect when the work of multiple groups coincided; that is, they were not designed as boundary objects by some individuals or groups. Rather, boundary objects are a sort of arrangement that has arisen from information and work requirements as perceived locally by groups that wish or need to cooperate, argued Star (2010).

Boundary objects are plastic enough to adapt to the local needs and constraints of the numerous parties employing them, and robust enough to maintain a common identity across sites (Star & Griesemer, 1989, p. 393). They are "weakly structured" in shared use and "strongly structured" in individual (or single community) use. Their flexible character allows them to be differently interpreted by different groups and in different situations; consequently, Law and Singleton (2005) called them "epistemological objects". The epistemological approach treats the boundary object as a single reality that makes it possible to negotiate and secure transactions between different cultures or professional groups. However, as Law and Singleton (2005, p. 342) pointed out, such a perspective disregards the fact that the accounts of realities and the realities that they describe are produced together. In her reflection on the use of the concept, Star (2010) pointed out that studies of boundary objects have often confused or conflated this interpretive flexibility with the process of tacking back and forth between the weakly-structured and the strongly-structured aspects of this arrangement.

Boundary objects are those endowed with the capacity to play a part in organizing that occurs across sites and practices without being moved to other sites. In other situations, connections between different sites and practices may be forged by moving objects in time and space. Such objects are referred to as immutable mobile (see Latour, 1987); as they are part of a network of rather stable character, they hold their shape even when moved between different times and places. While this seems only too obvious in the case of solid objects, such as those described by Latour in his science study, Law and Singleton (2005) have pointed out

that the work of making the objects relationally stable is often invisible. This was also brilliantly documented by Annemarie Mol (2002) in her book *The Body Multiple*, where she showed how different practices (or sets of relations) each produced their own object, in this case the atherosclerosis. Continuing this line of thought, Law and Singleton (2005) have suggested that objects exist which are themselves multiple, calling them "ontological objects". They want us to move from multiple interpretations of objects to thinking about multiple objects themselves; to think about what *counts* as an object (p. 334). Drawing on Mol (2002), they argue "This means that difference is no longer a matter of different perspectives on a single object but the enactment of different objects in the different sets of relations and contexts of practice."(Law & Singleton, 2005, p. 342). These (ontological) objects are "mutable mobiles" or, in de Laet and Mol's formulation (2000), they have a fluid character. The boundary of such objects is neither solid nor sharply delineated, and whether or not its activity is successful is not a binary matter (de Laet & Mol, 2000, p. 252). Over time, and when moved to other sites, such objects may change their shape bit by bit; in addition, they may or may not function as boundary objects. Moreover, as we will show in our study, the practices and relations related to the object also change.

This is why we chose to study organizing as the construction and maintenance of action nets – in this perspective, space and time do not exist *a priori* (see Jones, McLean, & Quattrone, 2004, for an elaborated discussion on spacing and timing). For example boundaries, and boundary objects, are not defined in advance, but negotiated and set as the process of organizing continues. This perspective deflects the division between human and nonhuman by focusing on actions and connections, no matter who or what performs them. However, actions can hardly be connected to each other as such; *objects* play a crucial part in the ongoing construction of action nets. As Latour (1992) has pointed out, objects are necessary if *durable* social connections are to be achieved. "Objects allow us both to act at a

distance and to make our interaction endure beyond the present" argued Nicolini, Mengis, and Swan (2011, p. 2). In the following, we describe the concept of the action net as a way of studying how objects and actions are connected and enacted during the process of organizing.

Action Nets

The concept of the *action net* was introduced by Czarniawska (1997; 2004) as a way of studying the practice of management and organizing as an ongoing process. It originated in a combination of new institutional theory and the sociology of translation, but it is tailored specifically to organization studies. "It is founded on the idea that in each time and place it is possible to speak of an 'institutional order', a set (not a system) of institutions (not necessarily coherent) prevalent right then and there," argues Czarniawska (2004, p. 780). Thus, it suggests that a fruitful way of studying organizing is seeing it in terms of consisting of the connecting of various collective actions with one another; usually according to a pattern that is legitimate at a given time and in a given place, although innovations and deviations happen. Such collective actions are not necessarily performed within the bounds of a specific organization; an action net may involve a great variety of organizations, or people organized into groups of a loose or temporary character.

Action nets differ somewhat from close concepts such as organization fields, networks or actor-networks when it comes to their time and space coordinates. The concept of the organization field, describing the frame of reference through which organizations deal with the same types of activity, does not necessarily capture the interactions actually occurring in time and space: organizations in the same field may have virtual contacts or even no direct contact at all. An action net, on the other hand, implies actual connections among actions.

An action net is not the same as a network. A network, as it is generally understood, is a set of connections *among actors*, be they people or organizations. The difference between an action net and a network is time: before networks can come into being, there must first be

actors. In an action net perspective, actions come first and actors second, with networks possibly, but not necessarily, coming third (see Korneliussen & Panozzo, 2005). Actors come second in the sense that they are exchangeable and acquire an "actorial" identity from actions, not the other way round (Czarniawska, 1997). A doctor becomes a doctor not simply by becoming known as a doctor, but by diagnosing diseases and curing illness. Thus, past actions build up actors' reputations and stabilize their identities. This means that ‘actors’ or ‘organizations’ are the products rather than the sources of the organizing (Czarniawska, 2004, p. 780). This also means abandoning the dominant belief that the subject is the source of meaning and knowledge in favor of the idea that knowledge and meaning reside in practices (Nicolini, 2010). Moreover, changes in actors or the loss of an individual actor will decisively alter the character of the network, whereas a similar event in an action net, however important it may be, may only change the net slightly, if at all (Czarniawska, 1997). If one nurse quits her job, caring for the patient will not cease; someone else will take over. Patient care is what the field of practice of healthcare is all about. Action nets of this kind are shaped by institutions more durable than individual actors.

Actor-network theory (ANT), too, assumes that actions create actors and like action net suggests a reversal in *the time under study* (Czarniawska, 2004, p. 782). However, whereas ANT focuses upon the production of solidified entities, action nets has a more open-ended perspective. Action nets may coalesce into a network, or a macro-actor, but may also disintegrate after fulfilling their function. The latter tends to often be the case of action nets constructed in emergencies (see e.g. Renemark, 2009; Walter, 2009, on temporary action nets resulting from such cases). The concept of action net is thus close to actor-network theory but avoids the critique sometimes directed toward ANT, for instance by Gherardi and Nicolini

(2005) for its focus on macro-actors, rather than on "ecology"[3], or by Law and Singleton (2005) for its focus on how networks are sustained rather than how they are enacted. ANT's focus on macro-actors stems originally for an interest in technology (Czarniawska & Hernes, 2005); action net approach stems from interest in actual organizing, with its varying results.

Thus, the purpose of adopting the action net concept is to free the researcher from the limitations of the traditional focus of organization studies on places, people, or issues (Czarniawska, 2004) and to capture the connections between actions actually occurring in time and space (Korneliussen & Panozzo, 2005). Action nets are "'empty concepts', to be filled with contents until it is clear what label might be put on them. […] Studying action nets means answering a dual question: what is being done, and how does this connect to other things that are being done in the same context?" (Czarniawska, 2004, p. 783-784). This equals a shift from ostensive to performative definitions of organization; highlighting the role of technology and objects in organization and acknowledging the importance of a symmetrical approach (all kinds of connections may be of interest, there is no need to make any analytical distinctions in advance). As Czarniawska (2002) has pointed out, performative definitions of organization (analogous to Latour's, 1986, use of the term in his discussion of the definition of society) are attempts to explore practice:

> Thus, with performative definitions, organizations are ascribed neither a nature nor an essence in any absolute sense; rather, organizations are considered to be what the people producing them made them at the time when those who were the observers conducted their observations. (p. 316)

[3] It can be said that the action net perspective belongs to the version of actor network theory which Gherardi and Nicolini (2005) called ecological; an approach that privileges the actions over the actors "… ecological in the sense of putting emphasis on the context, on the reciprocal change of actors and situations, and on the negotiated nature of social order (even when negotiations are not apparent)" (p. 304).

Assuming that connecting (or *assembling*, as Latour, 2005, would have it) is a key activity in all organizing, the main aim of such observations is to show how certain actions become connected and how these connections become stabilized. However, as pointed out above, objects are also part of this process; Star (2010) reminds us of the fact that objects are a set of work arrangements which are at once material and processual. "An object is something people (or in computer science, other objects and programs) act toward and with. Its materiality derives from action, not from the sense of prefabricated stuff or 'thing'-ness," argued Star (2010, p. 603). Thus, objects are, as pointed out by Suchman (2005), constituted within specific sites and associated practices. This means that performative definitions of organization also entail performative definitions of objects; objects, too, are enacted into being. It is only when they are enacted that they become part of the ongoing process of organizing, not when they are resting on the shelves of a storage room. We will thus call them *objects-in-use*.

Method: how to study organizing

The concept of the action net is a way of studying processes rather than an analytical tool. Therefore, recognition of the existence of an action net is not a desired result of a study of organizing; it is the *point of departure*. One methodological implication of such a point of departure is the focus on the ways in which actions are related to each other in a particular time and place. The action net perspective also makes it possible to study *objects-in-use*, revealing how objects are enacted, acted upon, negotiated and transformed in the on-going practice of organising treatment and care.

The study reported on here provided us with an excellent opportunity to follow the actions unfolding around an object. Fieldwork began back in 2000 and ended in 2007, and was carried out by one of the authors. Most of the field material presented and analyzed in

this paper, however, was collected during 2006 and 2007. One of the authors spent two days a week for four months observing day-to-day work, shadowing some of the staff, and interviewing 16 people. We have also collected written reports and documents. The incident involving the infusion pump occurred during fieldwork focusing on other matters. We took it as our point of departure and started following the actions undertaken in order to deal with the incident. We have also traced actions taken in the past in order to better understand what was happening in the present. Many different fieldwork techniques were used: interviews, observations, shadowing, and document analysis.

The fieldwork was organized as follows: the initial phase consisted of a few introductory interviews and a number of presentations of the study and its goals; the second phase consisted of direct observation, shadowing activities, and (follow-up) interviews. Shadowing consisted of following, monitoring, and reporting on the everyday activities, interactions, and structure of a working day of a staff member. Direct observations mainly focused on the group of nurses working on the ward, but some assistant nurses, physicians, and the ward manager were also subjected to shadowing. Direct observations were conducted in situations judged to be potentially relevant to the study, e.g. staff meetings, ward rounds, and consultations etc. The interviews included both permanent and temporary nurses, student nurses on work training, assistant nurses, ward managers, an assistant ward manager, and physicians. All in all, sixteen semi-structured interviews were conducted, which were thematically organized around each respondent's function, role, and duties. Structuring the interviews was informed by the experience and understanding that developed during the phase of participating observation and shadowing which preceded the follow-up interview phase.

The resulting field material has been analyzed in different stages. First, we mapped the actions taken when the infusion pump failed, as shown in a chronological description of the chain of actions. This first-order description (Van Maanen, 1988) was an attempt to answer

our initial query: What happened when the pump failed? Our description documented what happened, who was involved, and the different outcomes as we saw them. It was presented to the staff of the medical ward in order for them to check whether or not our description was accurate (in their opinion, it was). From this first-order description, new queries emerged, which required following connections spanning organizational and professional boundaries: What did the pharmaceutical company that provided the pump do? What did the purchasing unit that buys all hospital equipment do or what did it plan to do? We extended our fieldwork accordingly.

The next stage consisted of coding and categorizing the field material in a process similar to that recommended by grounded theory (Glaser & Strauss, 1967), especially as described by Martin and Turner (1986). Based on our mapping of the chain of actions and the interrelated activities, we proceeded to explore the status of the pump in this process. Sometimes, it was treated as a single object or entity, at other times as a configuration of different parts. In some situations, the infusion pump was contested and negotiated, in others it was taken for granted and became almost invisible. This confirmed our image of the infusion pump as enacted as a part of the ongoing organizing of care and treatment, in line with Law and Singleton's suggestion that "… we need to think of more carefully about the nature of the objects in the world – about what counts as an object" (2005, p. 334). Finally, we considered how our case could provide additional input for the conceptualization of organization as an "on-going accomplishment" (Feldman, 2000). As we will argue, it will help if the role of the things in this process is conceptualized as *objects in use*; not as stable entities, but as enacted ones.

Before presenting the field material and our analysis, however, we need to briefly characterize the setting of the study.

The setting

The incident described and analysed in this paper occurred on a ward at a regional hospital owned and managed by the local county council, the Region of West Sweden, which is the highest decision-making body that bears the political responsibility for the region's healthcare. The hospital where the incident occurred is a full-scale acute hospital, offering specialist services in all major areas and shouldering some educational and research responsibilities. The site of this study was one of the wards at the medical clinic. This ward specializes in various types of blood diseases, e.g. leukaemia. The responsibility for the ward is shared between a physician, who is responsible for medical decisions and general treatment, and a ward manager. The ward manager is a nurse who is responsible for the day-to-day nursing care, but also for administrative tasks and staffing. The ward has a staff of 28 which consists of 16 registered nurses and 12 assistant nurses, including those who work nights. There are 18 beds. The ward includes a surgery providing treatment to outpatients with haematology diagnosis during office hours. Typical treatments provided by the ward include blood infusion and chemotherapy, during which patients use beds belonging to the surgery for a few hours.

The Infusion Pump

At the heart of this paper lies a piece of medical equipment, as well as the actions that followed when this equipment, during the ongoing treatment of a patient, malfunctioned. The particular piece of medical equipment in focus is used for a type of cancer treatment that involves chemotherapy. Chemotherapy is potentially dangerous for both patients and staff, and is always performed by highly-skilled and experienced nurses. Thus, all use of chemotherapy is taken very seriously; it is a highly regulated and controlled type of treatment. A treatment which in many ways, however, is a routine procedure for the nurses and physicians working and treating leukaemia patients at the surgery. The prescribed procedure

when treating patients with cytostatics is to infuse the substance into the patient using an infusion pump that regulates the time and volume of liquid administered to him or her.

The infusion pump (see figure 1) used at the ward, and provided by a company called *Medone*, was a generic type of pump, designed for infusing various fluids into the patient's bloodstream: drugs, nutritive and hydrating liquids, and blood. This is in contrast to more specialist types infusions pumps available in the market that are designed to the specific use of treatment of cytostatics. The choice of infusion pump was not made by staff at the ward. Instead the choice was made, as is the case with most of the medical equipment used at the ward, by a designated purchasing committee at the regional level. The committee responsible for certain types of drugs or equipment consists of people who have specific knowledge of these areas. They evaluate the alternatives by using criteria such as "effectiveness in treatment and price", deciding which products the central purchasing organization *Westma* should purchase. Thus, the supply of drugs and medical equipment is standardized throughout the Region. Based on the committee's recommendation the conditions for purchasing the infusion pumps of choice were negotiated by *Westma*. This is how the Ward Manager described the purchasing process:

> There's a central purchasing committee that decides what types of pumps we'll be using at the hospital. Within this group of people there's no one to represent us, though the ward administers treatment with Cytostatica on a daily basis. In the group there are people from anaesthesia and intensive care units, they're really skilled and competent, but in their work they need very different pumps to the ones we need. We need a pump that allows us to infuse 200 ml an hour – nothing else. However, I can only use the kinds of pumps they have decided to buy. We

> often complain about the fact that the equipment we're supposed to use doesn't function as well as we would like it to.

The purchasing committee decided what pumps should be used when treating cancer patients, but it was the hospital pharmacy that provided the medical equipment to the ward. When the pump first was introduced at the ward, the procedure for using it was to connect the infusion pump directly to the bottle containing the cytostatics. However, after the intervention of the hospital pharmacy, the routines had to be changed – for two reasons. Firstly, as cytostatics are toxic, handling this substance entails a risk for those involved in treatment, e.g. rashes or foetal damage**.** Secondly, it is of great importance that the drug be properly mixed and diluted in order to avoid serious side effects. Therefore an adjustment was made to the infusion pump. A piece of equipment, a shunt provided by a company called *Medtwo*, was added to the infusion system to allow the more controlled blending and regulation of the flow of liquid into the patient. This adjustment made it possible to handle the substance without compromising the safety of both the staff and the patients.

----------Insert Figure 1 about here----------

This combination of two parts, a pump and a shunt, worked as an infusion system. This particular configuration had been in use on the ward for more than two years without problems. The infusion system was part of everyday work at the ward and assembling it became a procedure taken for granted by the people involved, i.e. the hospital technicians and the nurses. However, such treatment procedures were never seen as trivial. One nurse described it thus:

> There is always a risk of leakage, as when you do your plumbing yourself at home – you always know that a water leak is a possibility. It's the same when you put this system together. However, there's an even a bigger problem, potentially, with this type of system. Since air is much lighter than fluid, the air and not the medicine might be injected into the patient if there's any leakage.

The importance and seriousness of the activities of the surgery were also reflected in the physical design of the premises. The surgery consists of one large room with windows facing the outside at the back, with three beds on each side of the room and a smaller room in the middle with glass walls, facing the other beds. The smaller room is used by hospital staff and is full of medical equipment. It was designed as a panopticum that allows the monitoring of all the beds from a single point. The surgery is open between 07.00 and 16.00 five days a week, and is staffed at all times by two registered nurses and one assistant nurse. Across the corridor, four haematologists have their treatment rooms. At least one of them is always on duty during opening hours, and prepared to take on emergency cases.

The incident

The morning the incident occurred, a patient diagnosed with leukaemia, who had previously been hospitalised and was well known to the staff, was scheduled to receive chemotherapy. This patient was given a bed in the surgery. One of the nurses hung up a bag of cytostatics, connected it to an infusion pump, and then to a device that regulates the flow. Finally, the nurse connected the infusion pump to a needle that had already been inserted into one of the patient's main arteries. Before commencing the treatment, the nurse checked the prescription, and adjusted the equipment to make sure that the correct dosage and flow of cytostatics was being injected into the patient's bloodstream. The patient was supposed to remain in bed for an hour or more, waiting for the anti-cancer drugs to slowly infuse. A couple of minutes later, however, the nurse discovered that that the infusion pump had malfunctioned.

> I just entered the room by chance and noticed that the pump was seconds away from injecting air into the patients' bloodstream, something that might have caused severe injury.

Treatment was stopped immediately. The nurse told the patient that something seemed to be wrong with the pump and thus it was necessary to use another pump to complete the treatment. After exchanging pumps, the nurse reported the incident to the Ward Manager. One nurse was assigned the task of monitoring the further treatment. What happened was immediately recognized as a serious incident and the staff were very concerned; "How could this happen?".

Discussion: The silent and blackboxed boundary object in a stabilized action net

Before the incident, the infusion pump had not been called into question or challenged; it was part of the established practice of treating cancer patients. In this respect, the equipment was used in a way that made it function as a boundary object as the daily activities of people from different social worlds were organized around, and connected through, this object. Thus, the object was not intentionally constructed to manage boundaries; however, when it was used, it made the actions of the different groups of people connect. Without it, the connections between them might cease.

At first glance, the pump was not a complex or messy object, such as the alcoholic liver disease Law and Singleton (2005) described, but neither was it a static entity. Rather, it was perceived as an object with stable boundaries as long as it worked as it was expected to, and it was taken for granted. The perceived solidity (robustness in Star and Griesemer's account) made it possible to stabilize the work unfolding around the pump. At the same time, it was also flexible enough to allow multiple interpretations among the people using it. For the nurse, it was an operational tool that was taken for granted until it malfunctioned. For the ward manager, it was a piece of equipment representing a budgetary cost. For the

representatives of the medical equipment companies, it was just another product. For the patient, it was a means of obtaining treatment. Thus, the users of the equipment possessed what Carlile (2004) called domain-specific knowledge of the infusion equipment and they were expected to act according to this knowledge.

Its existence also meant that those involved did not have to meet in the same time and space, as connections between their actions could be maintained by sending products or written documents, e.g. purchasing orders or invoices, from one place to another, thus permitting *coordination at a distance* (see further Lindberg & Czarniawska, 2006; Nicolini et al., 2011). For example, committees deciding which medical equipment to use could make their decisions without being present on the ward. *Westma* bought the different parts and the pharmacy assembled them without being in direct contact with each other. They could perform their activities - being a part of the action net - and could control these activities at a distance. The object thus depends on the relational work of other groups of actors (even if it is at a distance) to be enacted in day-to-day work on the ward.

The established practices of the different groups were thus connected in a loose but stable way that can be described as an action net (Czarniawska, 2004); an action net in which the pump was the connector/mediator between the different groups of people which was silent and blackboxed as long as it worked as expected, helping to stabilize the connections of actions between people in different social worlds. Moreover, the actions unfolding around the object were kept within the boundaries of different social worlds and the practices that they represent: medical treatment, the selling and buying of medical equipment and so on. But this life-threatening incident became a turning point.

Initiating an investigation

When the Ward Manager was informed of the malfunctioning pump, she promptly initiated an investigation of the causes of the incident. She was trained in conducting investigations of

deviations and incidents and had the formal responsibility of dealing with all deviation reports originating from the ward. This responsibility includes investigating the circumstances of the incident and taking the actions necessary to prevent similar incidents in the future. It also includes an obligation to monitor the effects of the actions taken. The purpose of the investigation was twofold: Firstly, to establish what had happened; what actually occurred during the incident; secondly, to establish the causes – why did the error and/or malfunction occur?

What happened?

When the pump malfunctioned the staff immediately tried to find out what happened. The seriousness of the incident left no room for discussion; the people involved wanted to prevent it from happening again. The first hypothesis was that the incident occurred because the equipment had not been handled in the prescribed way. In order to use the pump in a proper manner, connecting up the different parts needs to be done in a specific sequence. The same afternoon that the incident occurred, the nurses working in the surgery were called as eyewitnesses to describe what had happened, step-by-step and in great detail. No one could remember any deviations from the normal routines, and there were no indications that there were any problems with the equipment. However, the malfunctioning occurred again when the Ward Manager, together with an experienced nurse, repeated the procedures in the prescribed manner and checked that each piece of equipment was in the right place and that everything was tightly fastened together.

The use of the infusion system was authorized by the hospital pharmacy, thus the next step in the investigation was to involve the hospital pharmacy. The pharmacy is located in the hospital building and staff from the ward visits the pharmacy on a daily basis, and vice versa. The Ward Manager contacted the pharmacy technician specialising in chemotherapy and related equipment who visited the ward a few hours after the incident. Once again, the Ward

Manager and one of the nurses working in the surgery, together with the pharmacy technician, examined the equipment without finding any clear explanation as to why the incident had occurred. Yet again, they concluded that there were no indications of malpractice or errors in the way the staff had handled and maintained the equipment. So far, the investigation was inconclusive as regards causes. It was clear that air had been drawn into the system, but there were still no answers as to why this had happened.

This caused mixed feeling among the involved staff. They were relieved, because this made it clear that they had not done anything wrong. But they were also puzzled by the fact that there was no obvious explanation. The lack of explanation raised new questions: "What if this will happen again?"; "Is it this particular pump that failed or is it a more general problem?" Because of the seriousness of the incident, and their concern for the safety of the patient, they were worried about it happening again.

Thus the situation became more complex as many more actors and interests were to be involved in order to try to find out what happened. The pump was placed in storage awaiting further and more detailed investigations.

Expanding the investigation

The next hypothesis was that this particular pump was faulty. The next day, the Ward Manager contacted the two pharmaceutical companies that supplied the equipment. *Medtwo*, supplying the shunt, is a company specialising in drugs and medical equipment for the treatment of leukaemia patients. The Ward Manager had a long-term professional relationship with the representative working at *Medtwo*. He visited the ward on a regular basis regularly informing and training the staff or just checking on the products:

> We understand each other rather well as we both have a background as trained intensive care nurses. I just called him and said: We have a problem. Could you

pay us a visit and check whether it‘s your equipment or the pump that created the problem?

The *Medtwo* representative scheduled a meeting with the Ward Manager, the staff involved in the incident, and the pharmacy technician from the hospital pharmacy. Together, they went through what had happened but were still unable to figure out what had gone wrong. For *Medtwo*, this was of great importance as their reputation as a specialist in this area was at stake. As they could not find an explanation on the spot the representative decided to take the shunt, that is, the part of the equipment that had been supplied by *Medtwo*, back to the company's R&D unit for more elaborate investigations and tests.

Similar arrangements were made with *Medone*, the supplier of the infusion pump. The representative of Medone also visited the ward, picking up the pump involved in the incident and taking it back to the company to conduct extensive tests on it.

After concluding their own investigation, *Medone* issued a written statement declaring that, despite the search for problems or errors in the design or production of the infusion pump, no signs or indications of malfunctioning had been found. Consequently, no causes had been established. Furthermore, the company also issued instructions regarding how to use the infusion pump, as well as a refusal to accept responsibility if the pump is used with equipment from any other company than *Medone* (in this case *Medtwo*). However, as decided by the hospital pharmacy the *Medone* infusion pump, which was a generic pump, had to be combined with extra equipment in order to be used with anti-cancer drugs. *Medone* could not provide this extra equipment. Nevertheless, the responsibility had been refused, even though it was likely to prevent further use of *Medone's* infusion pump in the treatment of leukaemia patients. The Ward Manager explained this saying that *"Medone* focuses on supplying pumps

and equipment for intensive care, anesthesia and surgery. Supplying materials for chemotherapy is of secondary importance to them, and a small part of their business."

Following extensive tests, *Medtwo* acted in a similar way. They also initiated an internal investigation of the shunt that they provided, and stated that no cause of the incident could be established. As no problems had been found in the equipment they had provided, in order for the company to assume any responsibility for the use of its regulating equipment, it would have to be used solely with infusion pumps produced by *Medtwo*. According to the *Medtwo* representative this was the only way to ensure that the system was safe to use on the patients. The suppliers were thus protecting themselves by not assuming any responsibility for the particular incident, and by restricting the further use of their products. This was also the end of the inquiry.

Discussion: Initiating an investigation and deconstructing an action net

Being plastic and capable of containing the meanings of different social worlds was a necessary condition for the equipment to be used in day-to-day work on the ward, and as such it worked as a silent, or blackboxed, object. However, as this example shows and as emphasized previously by Star and Griesemer (1989), maintaining coherence across intersecting social worlds does not mean that one single definition of the object needs to be accepted. Rather, a boundary object works as a means of translating, thus allowing multiple interpretations. In this case, the object was made up of two different parts, i.e. a shunt and a pump. As long as it worked as expected, it allowed people to act upon the infusion pump even if they did not use or fully understand the different parts of the configuration. Furthermore, as long as actors were freely able to act using the equipment (as long as it remained silent and blackboxed), they did not have to bother about possible multiple viewpoints on the object.

However, this changed in a heartbeat when the infusion pump malfunctioned and the mandatory investigation was initiated. Just as Trompette and Vinck (2009) have shown, a

boundary object which is silent and invisible can be made visible in situations where there are shortcomings, changes, or tests. In this case, the incident made the equipment visible in the sense that it came under scrutiny and its boundaries were contested. In the process, it lost its invisibility; no longer was it taken-for-granted. The object became visible (the blackbox was opened), as did the connections and the origins of the actions. The equipment was thus translated from an ordinary tool, used in day-to-day work on the ward, into *object(s) of inquiry*.

The investigation gave rise to questions such as "Who is responsible for what?", which introduced new, or previously hidden, perspectives on the equipment, caused multiple viewpoints to surface, and mobilized new groups into action regarding the infusion pump. Examples of this include the supplier's shift of focus toward responsibility rather than sales activities, by representing its specific parts rather than the full infusion system and introducing technical expertise as a complement to the company's client relations representative.

With the investigation, old connections were disintegrated and new actions were required, actions that to some extent needed to be performed by new or reconfigured actors as positions and roles were contested, renegotiated and changed. In sum, the investigation caused a deconstruction of the established action net. Moreover, the infusion pump also became deconstructed as a (boundary) object. As a consequence, the infusion pump was seen as a configuration of parts, all visible and possible to act upon. Thus, it was no longer immutable and did not necessarily allow competing and differing interpretations. Over time, and with the continuing investigation, its physical shape also changed as parts of the configuration were exchanged for others. Just what counted as a proper "infusion pump" shifted between the various groups of people who were part of the network of relations keeping the pump going. The inquiry also made it clear that those involved not only had different areas of knowledge,

and meanings attached to the object, but also different domains of responsibility and jurisdiction.

Just as prior to the incident, the infusion pump was the pivot around which the actions of various people revolved, even if the actions were actually undertaken at different times and in different places. However, this was a different set of actions, performed by slightly different people and, ultimately, concerning another infusion pump. The action net was deconstructed, as were the objects being acted on. This in turn made it possible to contest and challenge established practices and procedures for organizing the care and treatment of patients suffering from leukemia, as well as any object forming a part of such practices. Some actions that previously formed part of day-to-day work on the ward were prohibited while other actions, e.g. providing treatment under strict manual supervision, were only allowed as part of the investigation. However, any challenging and contesting of the established practices was limited and, in order to be legitimate, needed to be directed at the provision of safe and ongoing treatment.

Continued work on the ward

While the investigation lasted, the Ward Manager decided to keep using the infusion pumps from *Medone* on a daily basis. It was also decided that the use of these infusion pumps had to be constantly monitored, until a clear conclusion had been reached regarding what had caused the malfunctioning. Monitoring was carried out by the nurses, which required them to be present the whole time when using the pump. A number of similar, but less serious, incidents occurred over the next few weeks. It was therefore no longer an isolated phenomenon.

The problem thus grew from potentially being restricted to a specific pump and piece of equipment into a more general one related to the equipment for treating patients in need of chemotherapy. This, together with the restriction of use stipulated by the suppliers, resulted in the decision to replace the *Medone* pumps with *Medtwo* infusion pumps.

The decision was made by the Ward Manager and the Senior Physician jointly. This was an extraordinary decision and a departure from normal routines, which excluded the purchase of other products than those approved by the regional purchasing committee. The purchases of new pumps also exceeded the ward's stipulated budget, as *Medtwo's* pumps for infusing anti-cancer drugs were more expensive than generic pumps.

However, as the incident was generally perceived as very serious, this decision was never challenged, not even when the Senior Physician presented the decision to the Hospital Board that the old pumps should be replaced by new, more expensive ones. The Board, without questioning the decision, approved the decision to purchase pumps from *Medtwo*. This decision had a major impact on practice, as it prevented further incidents and insured the safe use of infusion pumps. The text of the formal decision emphasized the fact that the safety of the patient comes first. *Westma*, the purchasing authority, was notified of the changes and simply added the new pumps to their list of products. It is worth mentioning that the Ward Manager never contacted the regional committee, questioning their routines even though she had earlier expressed doubts about the decision to purchase pumps from *Medone*.

Discussion: Action precedence

The pump was not a fluid object in the sense used by de Laet and Mol (2000) as it had not gently changed shape. The incident was abrupt and the pump was replaced by another configuration of parts. However, this was also a process that had a bearing on organizing day-to-day work on the ward. The Bush pump, described by de Laet and Mol (2000), was successful because of its fluid adaptability, following a political commitment (made by the supplier) to allow all kinds of translations and use. In the case of the infusion pump, any political commitmentthat was in place before the incident ended with the investigation. For example, as a result of the inquiry, the medical equipment companies decided to restrict their responsibility solely for their own parts. In doing so, they stopped any further use of the pump

and forced the replacement of specific parts. The possibility of different translations and uses was limited. In this situation, the actors' different claims never became problems for negotiation in the sense described by Star and Griesemer (1989, p. 412): "Each social world has partial jurisdiction over the resources represented by the object, and mismatches caused by the overlap become problems for negotiation." Instead of claiming partial jurisdiction over the equipment, the pump and the shunt, the companies only investigated their own parts, claiming responsibility and full jurisdiction solely for these. As a consequence, their different worlds were kept apart.

Moreover, in this particular situation, the equipment ceased to be fluid and could not function as a boundary object. On the contrary, when parts became separated, the boundaries between them became sharper and more solid. Even though the investigation failed to establish what caused the incident, further incidents were prevented by the purchasing of different pumps. This decision was not based on technical aspects, or on any regulations concerning the equipment, but on the fact that the medical equipment companies accepted responsibility solely for their own parts. On the one hand, this was a pragmatic decision, but on the other, it was a political statement: the safety of the patient overruled both economic concerns and established procedures for purchasing medical equipment.

The decision challenged the position of the regional purchasing committee, *Westma*, the Region's formal purchaser, and the Hospital's Board budget restrictions– all of them representing institutionalized and legitimized ways of acting. Thus, the companies' reconstruction of their responsibility also affected the way this responsibility was re-allocated between the ward, *Westma,* and hospital management. In his study of the rebuilding of a collapsed bridge, Walter (2009) also observed how a catastrophic event led to a type of *action precedence;* actions were seen as more legitimate than formal and legal structures. In the case of the bridge, speed of action was superior to any other factor, and a self-evident premise for

selecting actions (ibid, p.141). In the case of the pump, preventing further incidents - and the overall aim of patient safety - overruled all other factors and legitimized the actions deviating from an institutional order; this, in turn, led to problems arising from day-to-day work being solved and new connections between actions and objects-in-use being established.

A Parallel Story: From local incident to national recommendation

When a critical incident occurs, a strict procedure has to be followed as the medical profession is subject to control. In parallel with the investigation conducted in the ward, the Ward Manager also filed a deviation report using a system called *MediControl*. These two actions were interrelated, but loosely coupled as the investigation formed the basis for the deviation report.

MediControl is a standardized system containing preformatted forms that are used at all the hospitals in the Region of West Sweden. When an incident involving medical equipment occurs, specific routines regarding analysis and documentation are prescribed. The equipment must be preserved pending a possible investigation, along with instructions, additional equipment, spare parts, and wrappers. None of these things can be used until a full investigation of the incident has been completed.

In *MediControl* incidents are categorised in terms of their “degree of seriousness”. This categorization is based on the potential consequences for the patient and on the estimated risk of the repetition of the same sort of incident. Thus the way the Ward Manager decided to describe the incident had a major impact on the actions that ensued. The incident involving the infusion pump was judged to be life-threatening and was therefore categorised as "serious", a label second only to "catastrophic". Because of the severity of the incident, the Ward Manager reported it to the Senior Physician at the hospital, who has the overall responsibility for systematically identifying and assessing the causes of incidents and taking

further steps to prevent them from happening again. The Senior Physician informed the Hospital Board about the incident and the investigation that was in progress.

Using a special form for serious incidents in the *Medicontrol* deviation reporting system, the report provided an account of when and where the incident occurred, the type of medical equipment involved, and the name of the supplier. A detailed description of the incident, including its causes and consequences, was also to be included in the report, as was an account of the actions to be taken in order to prevent further incidents. The following types of actions were to be accounted for:

- whether or not the equipment was handled or used incorrectly,
- whether or not the staff were lacking in training and/or experience of using the equipment,
- whether or not there have been organisational and/or coordination errors,
- whether or not there were any design or manufacturing faults or defects in the equipment,
- whether or not maintenance of the equipment had been neglected or performed incorrectly.

Based on the investigation conducted by the staff of the ward, the pharmacy technician, and the two medical companies, the answer to all of the questions was "not". Still, given that the incident was categorised as “serious”, the Senior Physician was obliged by the Act on Professional Activity in Health and Medical Services to send the deviation report to the Medical Products Agency (MPA), the national agency for regulating medicines and drugs, and to the National Board of Health and Welfare. The two agencies are the regulatory bodies responsible for monitoring the adherence to the codes of conduct. The Senior Physician sent the report electronically to the government agencies and was then notified that they had received it.

When the deviation report reached the MPA, it became clear that similar incidents had been reported by other healthcare organizations in various parts of Sweden. What is more, none of the investigations of these incidents had provided a clear explanation as to why they had occurred. In spite of the fact that no explanation had been found, the MPA issued national recommendations, which warned against the particular configuration of equipment that had been used on the ward. These national recommendations, however, were put in place long after the system had been taken out of use in practice.

Discussion: The transformation of the action net

The previous action net consisted of various collective actions connected with one another according to a pattern that was legitimate before the accident, and kept in place by the pump. As long as the pump worked as expected, the actions of those involved continued as per usual. During the investigation, other kinds of actions were needed in order to proceed; both according to the steps prescribed in *MediControl* and in order to solve problems arising from day-to-day work. Therefore, other people with the relevant knowledge of the object, but also with the authority to act, were involved in the process, while others were excluded, even if the formal structure would suggest that they ought to have been involved. For example, the work and knowledge of the regional purchasing committee and *Westma*, including their previously conducted negotiations, agreements, financial restrictions etc., was never involved in the investigation. Westma's role as head of purchasing was overruled by the ward manager, as head of investigation, and the focus on the functionality of the pump and the safety of patients which the investigation entailed.

On the other hand, new actions were required in the re-forming action net. For example, the positions of the suppliers changed and expanded since answering the questions in *MediControl* required the knowledge and action of other people, e.g. the suppliers' R&D units and the pharmacy technician; thus, their actions were included in the action net.

Furthermore, the investigation required the ward manager to extend her repertoire of actions. During the investigation, she was continually informing managers at the hospital and the Hospital Board about what actions were being taken. Even though the managers and Board members belonged to the same organization, they were not, under normal circumstances, included in the everyday activities concerning the pump. Thus, they were not part of her usual action net. Consequently, what needed to be done and which actions needed to be taken, both during the investigation and in order to continue the day-to-day work of treating cancer patients, determined the shape of the action net.

As a part of conducting the investigation, the ward manager also filed a deviation report in *MediControl*, describing what actions were taken during the investigation, and thus also describing parts of the action net. Not all the actions taken during the investigation were included in the description filed with the deviation report, however. Following the pre-determined steps of *MediControl* does not make it possible to take all actions into account as it is impossible to foresee what might happen. But the *MediControl* system permitted the connection of actions taken at the local hospital with actions taken by people at government agencies which were responsible for monitoring healthcare providers, and also with actions taken during the investigation of other incidents at other places. Thus, even actions separated by time and space were connected via *MediControl*; another boundary object.

The formal investigation documented in *MediControl*, and the actions taken to establish safe practice for treating cancer patients, were loosely coupled. The ward manager assumed the role of mediator, and thus translator, between the day-to-day practice and standardized procedures prescribed by the government agencies. Taken together, the actions unfolding around the malfunctioning pump transformed the previously existing action net. When the new configuration of parts, the new object-in-use, became a part of established practice, it also became blackboxed and could function as a boundary object within the transformed

action net. The formal investigation, documented in *MediControl*, legitimized and stabilized what had happened in practice.

Conclusions

At first glance, this is a straightforward story about the actions of a group of people who set out to identify the causes of, and to solve the problems related to, an incident involving a particular piece of medical equipment. This chain of actions resulted in the creation of nationally-applicable recommendations, but even this is not very original. The story is also an account, however, of processes that usually remain hidden. It is a story of a certain piece of equipment that worked initially as a boundary object, silent and blackboxed, dutifully connecting different social worlds, and in this way assembling an action net and stabilizing it. However, the incident and the following investigation made the hidden boundaries visible. When the pump became an object of inquiry, it was separated into different parts, which acquired different meanings. In this process, responsibility was reallocated among the different groups of people and the equipment ceased to work as a boundary object as it could not maintain coherence across intersecting worlds.

In consequence, the previously existing action net became contested and re-constructed; some actions were no longer appropriate and were excluded, while some other actions were included. The action net that was reconstructed around the pump also included and excluded actors with interests different than before, whose actions then became coordinated and connected to each other. In this sense, actions came first, with the actors in second place in the construction of the action net. The malfunctioning equipment was replaced by a new configuration of parts, which became a new (silenced and blackboxed) boundary object.

Both the investigation and the collective actions taken led to changes in practice; in this process, even the boundaries between different social worlds were reconstructed. Once practices had changed, changes to national regulations followed suit; in this way, the

reconstructed action net was stabilized and institutionalized. Inscribed into national recommendations and disseminated to all hospitals in Sweden, the new practices became valid in different times and spaces. The national recommendation can thus be seen as an institutional inscription of what actually happened.

It is worth mentioning that the formal organizations involved in the network surrounding this pump did not change. Some of their procedures changed, but their organizational boundaries did not. Had we focused on changes to formal structures, we would not have been able to notice anything in particular. Had we focused on actors and their identities, the results would similarly have been non-existent. An action net perspective enabled us to observe the efforts undertaken in order to continue day-to-day work on the ward, as well as the role played by the objects in day-to-day practice on the ward. Mapping the actions unfolding around the object was one way of throwing light on the complexity of organizational practices.

One implicit premise of this story is the necessity to continue providing the cancer patient with care and treatment at the clinic, regardless of any interruptions or incidents. In this respect, the incident not only triggered the organizing of an investigation, it also initiated the further organizing of the work and treatment carried out at the clinic. Furthermore, this process of organizing was not restricted to the organisational boundaries of the hospital ward, but also involved a number of different organizations (e.g. Medone and Medtwo), units (e.g. the ward, the hospital pharmacy and *Westma*), and groups of people e.g. (nurses, ward managers, and physicians), due to their actions being interconnected within an action net. The picture of organizing that emerges from this study reveals a process by means of which collective actions – and consequentially the objects, organizational units, and people necessary to perform them – are constantly being connected and reconnected with one another. Furthermore, our study also illustrates how this process of organizing, in line with

Latour (2005), Law (1994), Orlikowski (2007), is dependent on and conditioned by material arrangements and objects such as the infusion pump. Far from being stable entities, however, such objects are being constructed, deconstructed and reconstructed as part of the ongoing organizing of the care and treatment of patients.

In the case of the infusion pump, the equipment was a stabilizing entity within an institutionalized action net. The continuing existence of an action net was dependent on, and conditioned by, the possibility of maintaining cooperation across different, but intersecting, social worlds; this possibility was enhanced by the boundary object. This worked as long as the object was taken for granted and blackboxed, without the need for continuing negotiation and the coordination of actions. As long as it worked, further organizing was redundant. However, the contextualized and temporary nature of the construct was quickly revealed when it became an object of inquiry. Not only did it cease to work as a boundary object, it also ceased to be treated as one *object*, becoming deconstructed and reconstructed as something else. Thus, it is correct to say that there are no boundary objects, just objects which, in a particular time and place, function as boundary objects, and that objects are fluid (in the sense that de Laet and Mol, 2000, gave fluidity) only as long as their fluidity is allowed and recognized within context. Such recognition is based on a logic of appropriateness (March & Olsen, 1989) – what works in a particular time and place – rather than on formal structures. However, the national recommendations issued, and the pre-established structure embedded within them, which was based on a logic of consequentiality (March & Olsen, 1989), played a part by taking *organizing* activities into structured organizations, by formalizing and restricting what sets of *further* actions are legitimate to take and pursue when providing patients with care and treatment.

This is why actions have been the focal point of this study; by observing actions and their connections with one another, it has been possible to trace the dynamics and

complexities of organizing across organizational boundaries. These boundaries were not merely crossed, they were also constructed and reproduced. In this sense, constructing formal organizations becomes part of the ongoing practice of organizing. Thus, rather than viewing organizing and organizations as epistemologically different, formal organizations are an effect of organizing; an effect which, in the case of the infusion pump, helped in stabilizing a reconstructed action net.

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Figure 1. Source: The Medical Products Agency, www.lakemedelsverket.se