"It is Not Because You Have Tools that You Must use Them" - The Difficult Domestication of a Telemedicine Toolkit to Manage Emergencies in Nursing Homes

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ABSTRACT
We conducted a retrospective study on the experimental deployment of a telemedicine toolkit in ten nursing homes. The purpose of the experiment was to see whether the use of these toolkits could allow for better cooperation between nursing homes and the local emergency medical dispatch center to avoid sending costly vehicles and having elderly people unnecessarily discharged at the hospital. We investigated the domestication process of these toolkits by nurses and orderlies from the nursing homes. Our findings show different levels of domestication: for some of the nursing homes, the lack of practical relevance of the toolkit in emergencies and the difficulty to borrow artifacts from doctors prevented complete adoption. For three nursing homes, domestication occurred in an unexpected way in the sense that the objective of the domestication changed. These findings led us to provide recommendations for projects aimed at improving inter-organizational cooperation through artifacts.

Keywords
Telemedicine; domestication; nursing homes; boundary negotiating artifacts

1. INTRODUCTION
A growing number of elderly people end up more or less medicated in nursing homes. These are institutions that regularly deal with complex situations and are faced with deciding whether an emergency requires that a patient should be sent to the hospital - as opposed to situations where people can be treated in the nursing home itself.

Studies have been conducted that showed that people in nursing homes are more likely to be sent to an Emergency Department (ED) than those living in their home [9]. This represents an unfavorable discontinuity of care for frail elderly people [8, 48], and up to 40% of the discharges are considered potentially avoidable [17]. This is an important issue for several reasons. First, this has a negative impact on the short- and mid-term quality of life of the elderly people [36]; second, it has a financial impact on the community [16, 30]. Studies have been conducted to determine how these unnecessary discharges to the ED could be avoided. A recent synthesis of this work can be found in [29]. Among the ten key

factors that have been identified in the literature, the following hold our attention: that the nursing home staff should be trained to address emergency situations, that nursing homes should be equipped with diagnostic devices, that the nursing home staff should be educated on acronyms used in these situations to better communicate with doctors, that ED and nursing home staff should better communicate about the patient data, and finally that the decision-making process should be made more transparent by emergency staff to allow for more cooperation with the nursing home staff.

Indeed, we had the opportunity to be involved in a telemedicine experiment involving ten nursing homes around the city of Troyes (France) and the local emergency response service. In France, the emergency medical dispatch center (EMDC) of a region is responsible for providing an adequate response to urgent medical problems that are submitted via a telephone line exclusively for medical emergencies (15 in France, 112 in Europe). The treatment of these phone calls is called regulation of emergencies. The purpose is to evaluate the criticality of the emergency and to determine if the need is a simple emergency support on the phone, a consignment of heavy mobile equipment (mobile intensive care unit), an ambulance being sent, or a consultation with a general practitioner. Each call is managed first by an assistant of medical regulation, who registers the request of urgent medical aid and evaluates, in a few questions, the degree of urgency to pass the caller to the regulating doctor. The regulating doctor decides whether it is a vital emergency (heart problems, breathing difficulties, comas, serious injury from an accident, etc.). Sending out a vehicle is very costly for the community, and the local emergency service cited in the present case study only has three ambulances at its disposal.

The purpose of the studied experiment was to determine whether offering a telemedicine toolkit to the nursing homes could allow for better cooperation between the nursing homes and the emergency medical dispatch center to avoid sending costly vehicles and having elderly people discharged at the hospital unnecessarily. In fact, in France, there is little medical presence in nursing homes to take care of the residents. Most of them do not employ a doctor, but nurses and orderlies among which the labor is very precisely divided. The work is also tightly scheduled and there is a clear paradox: hospitals are hoping that nursing homes can manage the situations of their residents in an independent way, but it is doubtful that nursing homes actually have the means to achieve this autonomy. This is the reason why the regulating doctors in EMDC are concerned, because this lack of medical presence is a potential dis-organization factor.

The telemedicine toolkit is a suitcase that includes devices with which the nursing home staff can perform an electrocardiograph,

measure blood pressure and determine how much oxygen people have in their blood; it uses a Tablet PC with an integrated webcam to transmit the data gathered using these instruments to the emergency medical dispatch center so that the nursing home staff can discuss the situation with the medical regulators (Figure 1).

Figure 1: The telemedicine toolkit (in the form of a suitcase)

Having observed the deployment of this telemedicine toolkit in ten nursing homes, we interpret this story by conducting a socio-material analysis of the project from its inception using the domestication framework [38]. By so doing, we aim to adopt a perspective in which the success or failure of an instrumentation project is a socio-material accomplishment performed in and by heterogeneous project actors, and this success or failure is inherently indeterminate [6].

The present study is part of a general research endeavor aiming at looking if telemedicine tools are conducive to cooperation between different organizations in situations described as emergencies.

More precisely, our research questions here are:

1) Have nursing homes engaged in processes seeking to ensure the domestication of these telemedicine tools?

2) What implications can we draw for future telemedicine projects?

In the remaining sections of this paper, we first present existing work related to studying the cooperation between different healthcare organizations and potential conceptual frameworks to analyze the case we have observed. Then, we present the origin of the case and the case itself, following the domestication framework. We then analyze the causes of success and failure and conclude with insights for future projects in this domain.

2. RELATED WORK

2.1 Studies of Cooperation in Healthcare Organizations

Several studies have documented the interweaving of the work of different health professionals (doctors, consultants, clerks, nurses,

and orderlies) with the support of numerous tools, documents, charts and processes [2, 5, 20, 43]. These practices distributed on a dense web of artifacts appear to be effortlessly choreographed [33] for the sake of patient care [3].

The material side of the support of cooperative practices in healthcare should not hide the dynamic human work required to produce, structure and use these tools [4, 45]. It has been particularly emphasized in investigations of the deployment of EHR (Electronic Health Records) that have shown how professionals work around or adapt Information and Communication Technologies (ICT) to their collaborative work practices [7, 27, 31, 35, 44, 49]. A good example of this adaptation is the one presented by [31] in which the doctors carry personal notes to deal with the lack of availability of patients' EHR at the bedside (contrary to the paper chart solution that existed before). Overlooking the networked and continuous adaptation activity of the nurses to organize the care plan was also presented as an explanation for the failure of a project aimed at deploying a computer-based system in a University Hospital [26].

Moreover, coordinative practices are also attached to the complex network of status and acquaintances in health organizations [43]. These authors highlighted that, even if, in the studied hospital, the process of obtaining radiological examination and data is formally defined and tied to the filling out of a request form, doctors and external medical consultants are found justified by administrative staff and radiologist (being doctors too) in partially following the procedures. Such bypassing and workaround are accepted due to the primary goal, which is caring for patients (against completing administrative processes).

A full understanding of cooperation within and among health organizations is far from being achieved but the previous studies that we listed highlight that: (1) to coordinate themselves, health professionals use and work around a dense web of artifacts; (2) these tools are parts of the professionals' wider coordinative practices, which can evolve to integrate, adapt or reject new artifacts that seem relevant for practical or organizational issues; and (3) statuses and values (such as patients' health) are not neutral in the implementation and use of coordinative artifacts.

Our study of the experimental deployment of a telemedicine toolkit in nursing homes to ease the cooperation between the nursing homes and the local emergency medical dispatch center (EMDC) draws on these on-going research issues but develops them at an inter-organizational level. In fact, to understand the reason why some systems are adopted or not, and the key related factors, it is important to follow deployment processes, to look at them from a user's perspective, and to determine how these users are able, or not, to appropriate the systems.

2.2 Appropriation

Technology use in practice is often quite different than designers anticipate. We often notice unexpected uses and transformations to achieve goals that were never imagined by the designers. Therefore, appropriation, or the way users are integrating technologies into their actions, has been a topic of investigation for researchers in the field, as we can see in the Computer Supported Cooperative Work (CSCW) domain, which has a long tradition of fine-grained observational studies of particular settings in which artifacts are deployed [23].

The appropriation of technologies refers to the installation of new tools and their customization or tailorization, but moreover the organizational learning and the transformation of work practices induced by the introduction of the technology [13]. While tailoring

focuses on the technical customizations of artifacts, appropriation also considers the social-technical process of interpreting artifacts in daily work practice. "Appropriation is the way in which technologies are adopted, adapted and incorporated into working practice" [11, p. 467].

We are particularly interested in this approach in which appropriation simultaneously tackles redesigning some aspects of the technology, reconfiguring organizational relations, and reconfiguring aspects of the physical environment [1]. Therefore, the work that we are presenting in this paper focuses on how people make the technologies work within a particular social and material context. Here, we perform a retrospective analysis of the introduction of a telemedicine toolkit to clarify and elaborate the general lessons learned. For conducting this analysis, we decided to use the domestication framework.

2.3 Domestication

The domestication framework addresses the ways in which people in social situations (homes, communities, and families) adopt and use ICTs [18]. The idea is that, when people take up an ICT, they undergo a process by which these ICTs are appropriated, and this process changes both the situation and the meaning of it. The focus of domestication is on the mechanisms by which an ICT is customized and how routine practices are adapted to accept the new ICT [21, 37]. The assumption is that neither the technology nor the social aspect are determinants to understand ICT use, but both aspects co-determine each other. This theory proposes four steps of domestication: appropriation, objectification, incorporation and conversion. In the appropriation phase, the acquisition of the ICT is the main activity; ICT is beginning its new role as a domestic object. Objectification captures how values are expressed through the display of the new ICT and emphasizes where and how the ICT is arranged and displayed. The incorporation phase focuses on how the ICT is used over time by the user. Finally, the conversion phase mediates relations between the households' internal affairs and the public domain or outside world.

The process of domestication offers an account of the innovation process of a media and information technology in all its uncertainty and indeterminacy. Although it has mainly been used to analyze the use of technologies in domestic settings, it was clear from the beginning that it should not be seen as something that only occurs in the home [37]. For instance, [32] or [19] have illustrated "professional domestication," whereby the potential for new ICTs to be fitted into or to fail to find a place within existing work arrangements is observed.

3. ABOUT THE CASE

The experiment ran from February, 2012 to December, 2014 and funding was received from the Regional Healthcare Agency, a public sector organization operating in all of France's 22 regions since the country enacted its 2009 *Hôpital, Santé et Territoires* law. The agency assembles, at a regional level, state and public-health resources to maximize collective efficiency and sustain the National Health Service in the future. To understand what was expected from this experiment, it is worth discussing the ideas motivating its three drivers.

The first is Dr. Van Petegem[1], formerly Head Doctor at the local EMDC and who was still working both as triage doctor in the EMDC and in the ED of the local hospital. Dr. Van Petegem was concerned about the ever-increasing tide of very old people coming to emergency units, notably after calls made by nursing homes to the EMDC team. He was also very critical of his fellow triage doctors' "conditioned reflex" of systematically sending vehicles out for very old people whom the doctors viewed as "bedridden invalids suffering from dementia". Dr. Van Petegem had the occasion to see the telemedicine "suitcases" presented at a conference: *"I was at a conference when I first heard about suitcases being used to transmit data. The idea was that it mainly helped first responders transmit ECG* [electrocardiograph] *readings from their ambulances. I started wondering whether we could use the same idea to decrease the number of old persons being brought to ED… This ultimately became my main goal, with a second one being to bring the medical and medical-social worlds a little closer together. At this latter level I was in luck after meeting Mrs. Parinello at the Doctors Council where I first spoke about my idea. She was very open to it."*

Mrs. Parinello, who runs two old-age nursing homes and is also a local public figure (having been elected a substitute city councilor), agreed to this experiment based on two observations. First, she found that the ED was an hostile environment for nursing home residents who would sometimes have to wait for hours on trolleys in cold corridors before returning to their nursing homes in worse shape than they had left - undermining the idea that people are always supposed to get better when they are treated in hospital [41]. It was also hard for them returning to the nursing home. As much as possible, residents are supposed to be left in the "cocoon" of their "final home" [24]. Mrs. Parinello also described the rocky cooperation between triage doctors and healthcare staff working in nursing homes, especially orderlies who tended to be women without any nursing diplomas. According to her, *"they* [triage doctors] *don't always react very well to us"; "We get told off a lot"*. In other words, there was good reason to doubt the nursing homes' professionalism and the reasons why they were calling the EMDC. This being the case, the suitcase could be viewed as a way of improving the status quo by avoiding people always sending out ambulances and by helping residents to stay in the nursing homes when appropriate. After all, patients complaining about chest pains would normally be reassured when they saw an electrocardiogram machine. The promise was that if fewer nursing home residents were sent to the ED, savings could be achieved.

The third main player in this equation is Maciste Technologies, the small company that has built and is selling the telemedicine "suitcase". The primary contact here was the company's Sales Director. He was very enthusiastic about an experiment that he expected to bring about €120,000 (€12,000 per suitcase) to his financially struggling company. He also hoped a greater familiarization with the world of nursing homes would facilitate entry into this potentially lucrative new market. It is worth noting here that this suitcase solution was not originally defined for this cooperation context. The idea came in 1996 after a meeting between a doctor working in the merchant marine and the founder of Maciste Technologies. They had the idea of simplifying the equipment to make electrocardiographs, and then equipping French merchant marine ships with electrocardiograms for use in case somebody had a heart attack. This led to the portable electrocardiograph being turned little by little into a "suitcase" containing other instruments. These suitcases first took off in the late 2000s when they were being used by a large French airliner trying to avoid costly unplanned stops for passengers who had fallen ill. This initial market breakthrough fell short, however, after

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[1] Names have been changed

the stewards union argued that its members were not authorized to carry out electrocardiographs (ECGs).

All of which explains why suitcases would ultimately be brought back to another professional environment - nursing homes in contact with the EMDC.

4. METHODOLOGY

The first author of this paper (sociologist) was involved in the field work and collected a variety of empirical materials from January to June, 2014, in line with the precepts of "combinatory ethnography" [10]. This period has been selected because sufficient time has elapsed since the start of the experiment (at the beginning of 2012). Besides, the first author has maintained regular interactions with the main protagonists of the experiment after June 2014, so that we were able to stay informed of the recent developments of the project.

The aim of this 6 months period of field work was to establish "ethnographic jurisprudence", i.e., a series of case studies or relevant situations "revealing forms of activity" that are original or at least noteworthy [10, p. 51]. The methodological approach adopted here was also inspired by multi-sited ethnography that essentially involves "following people, connections, associations, and relationships across space (because they are substantially continuous but spatially non-contiguous) [25]. The research design proceeds by a series of juxtapositions in which the global is collapsed into and made an integral part of parallel, related local situations, rather than something monolithic or external to them. In terms of the method, multi-sited ethnography involves a spatially dispersed field through which the ethnographer moves – actually, via sojourns in two or more places, or conceptually, by means of techniques of juxtaposition of data" [14, p. 3].

The first data category is semi-directive interviews. The purpose of the interviews was to get a variety of opinions regarding the experiment and to garner information from professional circles into which the suitcases had been launched. This was meant to enhance understanding of the kinds of actions required when an emergency occurred, both before and after the parties in question came into possession of this composite technical object. For so doing, it was important to start meeting relevant representatives from all professional groups with some relationship to the suitcases.

This led to interviewing seven nursing home directors (including one operating in a rural setting who did not have the suitcase but wanted one), three head nurses working in these establishments (who did little care work but managed teams), four front-line nurses with no other hierarchical responsibilities, two coordinating doctors who were generally on-site two afternoons a week and operated at the behest of the residents' treatment doctors (working out of their surgeries), Dr. Van Petegem, two orderlies, the sales director of Maciste Technologies, two relevant members of the Regional Healthcare Agency (the public organization funding the experiment) and one IT specialist responsible for several of the nursing homes participating in the experiment. In total, there were 24 interviews, each lasting approximately 90 minutes, with eight men and sixteen women aged between 23 and 65. They were entirely transcribed and analyzed following the content analysis method [28].

To disprove, confirm or complement any information collected during the interviews, in situ observations were carried out in locations where suitcases could be used. These observations also helped to make empirical descriptions of the ecologies of action, noting off-the-cuff quotes and reconstructing interactional sequences. Unfortunately, it was impossible to observe how the object was being used in emergency situations given the dearth thereof. On the other hand, because researchers are supposed to adapt to the impromptu nature characterizing innovation processes, while improvising responses to what they see, what was observed were planned uses of the apparatus (so-called baseline ECG, see below) – uses for which no plans had been made at first. In addition, we attended a training session in which the equipment was being used, and two days and two nights were spent in nursing homes, as well as two nights at the EMDC.

Third, a series of documents were gathered, with a number of photos also being taking during the observation phases. Written texts involved, for instance, nursing homes' internal memos trying to reassure employees of what would occur if suitcases were used; an angry mail exchange between a care team in a nursing home and the ED unit accusing the former of sending residents "for the tiniest little problem"; and a descriptive questionnaire meant to inform calls to the EMDC from orderlies (called "Esperanto" and described in section 5). Photos were taken whenever deemed necessary; however, not all of the photos were kept. The goal of taking pictures was to communicate the atmosphere on-site, the ecologies of action, the look of objects, etc.

The sum total of these efforts contributed to an indicative logic based on an administration of proof; photos could serve as markers of processes at work, attesting to a greater or lesser attempt at appropriation; an exchange of letters or internal retirement memos could sometimes signal an attempt to solve an argument, etc. All of these methodological processes supplemented an inductive logic as it is usually applied in grounded theory [15], the latter also being relevant to the present exercise.

5. THE DOMESTICATION OF THE TELEMEDICINE TOOLKIT

To present how suitcases were received in the nursing homes (irrespective of the EMDC), the previously mentioned domestication theoretical framework [38] was applied. This framework had originally been conceived for private sphere activities. In this sense, the particularity of a nursing home is that it is both a place where people live and one where they receive care. It is worth stating that the use of suitcases was relatively rare and only occurred in three out of the ten nursing homes involved in the experiment. Nevertheless, a respectable number of 25 remote transmissions of ECG to the EMDC were stated. This total means relatively little, however, given how long the experiment lasted (about three years) and above all given the total number of nursing homes that took part (ten).

5.1 Appropriation

Regarding the acquisition of the technology – something that the domestication model refers to as "appropriation" [38] - what the investigation demonstrated is that the suitcases suffered from an original setback. For instance, two nursing homes were given free suitcases by Maciste Technologies in early 2012 after meeting the sales director, Dr. Van Petegem and Mrs. Parinello. One young nursing home director in Troyes also tried to acquire the equipment when Mrs. Parinello told her that Maciste Technologies was ready to hand out free samples to two establishments (hers and another). Toward the end of 2012, Mrs. Parinello arm-wrestled a Regional Healthcare Agency subsidy for other nursing home members. This is how, in early 2013, suitcases were "suddenly… parachuted" - in one skeptical nurse's words - to establishments where nobody was particularly looking forward to getting them. Mrs. Parinello thought she was doing something good but encountered a great deal of

hostility. Despite all her dynamism and experience, most nursing home managers saw things differently. They felt that staff members did not need technically superior equipment because they could simply manage emergency situations by calling the EMDC. This initial differentiation in people's outlook may or may not constitute an example of organizational sensemaking [47].

5.2 Objectification

Across the ten nursing homes participating in the experiment, there was less adoption than might otherwise have been expected. One way of understanding this is by noting that suitcases encountered technical difficulties that appeared over the course of the experiment. Some of the challenges here played out at a spatial level and/or in terms of the fit between material and physical environments - all of which are indicative of the domestication model's "objectification" phase [38]. The main hurdle was related to the Internet connections enabling the remote transmission of data (ECG readings, blood pressure, and saturation) using electronic messaging on the suitcase's Tablet PC. The nursing homes needed to cover as much of their premises as possible so they would be prepared wherever a medical incident occurred. In merchant marine ships, where suitcases had first been used, they were simply equipped with SIM cards, GSM and low bandwidth GPRS connections. This technical solution was not enough for nursing homes because some of their rooms were not covered by the GSM network. Tests undertaken at the beginning of the experiment showed that Tablet PC messages to the EMDC would only arrive if sent from certain locations within the buildings.

Depending on the configuration (number of floors, buildings, area, age, etc.) and other factors such as the thickness of the walls or the number of sockets, two solutions were possible. First, RJ45 sockets could be used to connect the Tablet PC to a wall socket.

Second, participants had the option to use wireless connections, but nursing homes that were already equipped with RJ45 sockets in all resident rooms tended to prefer this solution over Wi-Fi because it did not require spending any more money.

Mrs. Parinello opted for Wi-Fi because her institution lacked a network of RJ45 sockets. Other nursing homes postponed this investment or were happy to use whatever RJ45 socket they already had in their nurses' office. The key here was that suitcases were not products that could be used off-the-shelf. This means that they had to be "objectified" [38] and that they imposed certain "technical requirements", in the words of a technical expert met at the Regional Healthcare Agency.

Another series of obstacles related to legal arguments about liability were raised. A technical expert at the Regional Healthcare Agency, who was opposed to funding the experiment, was quick to suggest that, because medical data is strictly confidential in France, it should not be communicated via unencrypted emails. This explains why the new version of the suitcase (expected for September, 2016) is supposed to use a secure cloud. Note that this is a type of equipment that uses its own weaknesses (and detractors' criticisms) as a means of evolving. In the present case, the suitcase actually transformed over the course of the experiment, as if it were simultaneously ready to be used but also open to redesign, something at odds with the diffusionist schema [34].

5.3 Incorporation

Looking at the incorporation of the suitcase in the work practices of the employees of the nursing homes, the domestication process did, however, follow a number of trajectories that the nursing homes had not predicted, especially the three that were using it at first.

First, - and much like the previously mentioned airline stewards - orderlies in the different participating nursing homes felt a sense of foreboding. This fell into the domain of (professional) values, which is consistent with what is emphasized at this step of the domestication model [38]. It exemplifies doubt (or rather the expression of certainty) that these professionals - often women – were not authorized to carry out ECGs on residents, even in emergency situations. Registered nurses had been trained to do this kind of testing and were experienced in analyzing electrocardiograph results at a basic level. Even more importantly, they had often been given the responsibility of administering ECGs in hospitals, working under a doctor's supervision. Orderlies, on the other hand, had never had any formal ECG training. The argument that broke out at this level went much further, however, than a question of legalities and the interpretation thereof. There was a real fear of being given responsibility for acts that had not been specified in the regulations describing the orderlies' duties, despite this being a professional milieu where tasks were often undertaken by parties other than the ones for whom they had originally been conceived. For instance, orderlies were not authorized to take people's blood pressure but often did this with permission from nurses, their hierarchical superiors. In the present case, however, with suitcases having just arrived in the nursing homes, the orderlies began anticipating a number of risks, even if this was not fully verbalized. All of which created more than a little confusion during the investigation, with discussions sometimes relating to the act itself and, on other occasions, to the validity of the measurements, patients' condition or how ECGs should be interpreted. The way in which this can be analyzed across all of the participating nursing homes is that these various fears caused many orderlies "not to do anything", i.e., not to engage in a process of technological domestication.

The second issue faced when trying to incorporate the suitcase into the existing work practices was the lack of proper definition of "emergencies". In fact, the emergency situations faced by healthcare professionals in these nursing homes did not involve using the suitcases, or certainly not all of the items contained therein. This led to a differentiation between situations that were considered by the professionals to be "real" emergencies that they called: "pure emergencies", "life-threatening emergencies", "distress", or "the resident is dying". Here, the nurses would refer to respiratory distress accompanied by a pulmonary edema, malaises where people lost consciousness, heart attacks, acute vomiting with fever, falls where there was concern that the person had broken their leg, sudden (and violent) dementia, or hemorrhaging. These situations were compared with less critical ones such as a cut after somebody fell or chest pain unaccompanied by any worrisome clinical signs. Actors' reflexivity, which translated in this case by their asking practical questions - such as "Should I use the suitcase?" - drastically reduced the prospect of the suitcase being used in the way that had been expected for an "emergency". The domestication model [38] teaches that elimination is one of the key (mainly temporal) challenges faced during an incorporation phase. The head nurse in the nursing home managed by Mrs. Parinello expressed this as follows:

"*At first it is true that managers presented it to us like… Well at first it was supposed to be used more for problems that happen at night since we don't have as many nurses on the night shift. This was the real aim at first. Management used to say, in fact it still says, that it's "for an emergency". And I always thought "No, I*

won't use it in an emergency". If somebody is having problems breathing and then they say to us ... Well no, I wouldn't think of using the suitcase because it takes so long to get it ready... I mean just turning on a computer takes so long... So as a nurse I don't think so ... [...] I mean, a 70-year-old resident who can't breathe, I'm going to call EMDC because he has to go to the hospital right away ... So you know, a real emergency ... Maybe later on, it's never happened here, but somebody who has a nasty fall and is bleeding badly, am I going to take out my telemedicine equipment or first stop the bleeding? After all, I'm a nurse working in an emergency situation, trying to help residents. And this may mean starting by giving them oxygen because that provides some relief ... You know when you're choking it's not very nice ... You really expect me to take the time to get out my telemedicine equipment? While the person is choking? You see what I mean?"

The point here is that in these "real emergency" situations, the health professionals felt the need to act and help people, for instance by immediately ringing the EMDC. Suitcases were extraneous to their expected behavior or actions during these incidents. It takes quite a while to get a suitcase started up and ready to administer an ECG (around eight minutes). This also competed with other medical or care acts (as indicated above) - with several nurses or orderlies insisting on the need to be close to the person in distress, reassuring them by taking their hand, etc. The idea here is that spending time on the suitcase "adds to patients' stress", in the words of a coordinating doctor working in one nursing home.

Therefore, the need to invent other uses for the suitcase, outside of the emergency situations that nursing home professionals described, arose.

Here, "incorporation" [38] took a positive form. The uses created in this way might be called "residential" because they were primarily geared toward nursing home residents and less so toward the idea of saving money by not sending patients to the ED. These uses then became appropriate for a particular site, the "residence", in this case a nursing home. In short, the new uses started being merged into daily work routines and realities of the nursing homes, much in the same way that the staffs were always on the lookout for patients suffering from bedsores. The end result was that the uses observed in the three institutions that had purchased the equipment can be categorized in two ways. The first is surveillance (and in opposition to the "life-threatening emergencies" discussed above), and this is apparent in the following discussion with one of the nurses:

I think that the first time [I was doing an ECG] was a morning when I was all alone. There was an old lady who was complaining about chest pains and the feeling she couldn't breathe. I wasn't sure what to do - it was about 8:30 or 9 AM and I was all alone with some orderly colleagues. I did an ECG and sent it [via email] to EMDC right away [...] After that I rang them to say "I've just sent you an ECG for an old lady" and told them about her symptoms and why I did it. They responded immediately, "It could be serious, she needs to come in right away, we're sending you an ambulance".

The other "residential" use consisted of administering an ECG when things were "normal" in order to provide a baseline for comparison. The idea here was to be able to compare the ECG of an older person when this person is not feeling well to the ECG of the older person when the situation was normal. Dr. Van Petegem had initiated this procedure, ostensibly in response to the confusion and difficulties witnessed when suitcases were used during emergency situations. He visited the nursing homes to talk about the initiative. Several expressed interest in his idea, but only three carried it out systematically.

Finally, during the first year that the experiment ran, the project tended to intensify cooperation between the different nursing homes and the EMDC, but in a way that had little to do with the suitcase. This was a response to the technical difficulties encountered when using the suitcase and to the rare emergency situations that the use of the suitcase helped to tackle. The starting point of this new way of cooperation was a knock against orderlies: doctors from the EMDC were annoyed that orderlies do not use the same language as them:

"When you have orderlies who call medical emergency, the question of the doctor is "could you describe how is Mrs So-and-so?" They often answer,"Not fine". For the doctor receiving the call, "Not fine" doesn't mean anything to him. Conversely, orderlies could say "she is an old woman, but usually she's fine". But for us, in the nursing home, it means that she still has her head even if we have to help with toileting, even if she is incontinent. They don't have the same references in the hospital sector "(interview with Mrs. Collibrini, nursing home director).

As a result, an informal workgroup was created, formed by Dr. Van Petegem, the coordinating doctor working in the nursing home run by Mrs. Parinello, and the head of the sector hospital's geriatrics department. This group put together a descriptive questionnaire, that they named "esperanto" (Figure 2), to help orderlies from nursing homes use a more medically oriented language when interacting with the EMDC. The goal was to support these orderlies and serve as a guide for them. In reality, the document paved the way for a kind of categorization. It included elements pertaining to parties' "initial observations" and taking of life-threatening readings. It then went on to cover typical events (neurologic disorders, chest pain, falls, breathing problems, etc.), providing both precisions and asking questions.
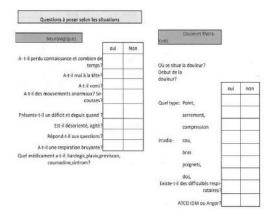

Figure 2: an excerpt of the "esperanto" questionnaire (in French)

In practical terms, the status of these questions was fairly uncertain, and it was unclear whether orderlies were supposed to ask them before calling the EMDC; ask the patient/resident; respond in writing; or prepare for the moment when they would have a triage doctor on the phone. In all probability, each of these options were possible.

5.4 Conversion
The "esperanto" questionnaire approach was highly appreciated by the promoters of the experiment, who must have felt that the

suitcases were less important than the prospects they created. This was a bridge to the "conversion" phase of the domestication model [38] in which the use and the incorporation into work practices lead to an evolution of the relationships between the nursing homes and its wider public and organizational context. Since this questionnaire was designed, public communications around the experiment focused on the suitcase's secondary benefits. This attested to an organizational reflexivity driven by managers in the nursing homes pioneering the experiment and by certain other parties. Maciste Technologies also got involved with an approach based on turning the questionnaire into a "prerequisite" for using their equipment. In some nursing homes, the "esperanto" and the suitcase were even seen as an indivisible whole (Figure 3).

This irritated Mrs. Parinello, who stated that, "They [Maciste Technologies] are exploiting us". After all, the questionnaire did have some value. Notably, it drew the fund provider's attention toward the overall ambition of enhancing the extent to which nursing homes might take responsibility for emergencies without any further financial commitments having to be made. In this case, suitcases could no longer be considered central to a network that was itself declining. The questionnaire revealed a growing cooperation between the medical-social sector and hospitals (the "healthcare" sphere). It also revealed an ongoing bridging process (promoters of the suitcase talked about breaking down silos) as well as different parties' attempts to understand one another better, to familiarize themselves with each other, and thereby to improve their mutual effectiveness.

Figure 3: the suitcase and the esperanto as an indivisible whole

Above and beyond the aim of avoiding the unnecessary hospitalization of nursing home residents, the suitcase experiment ended up being part of an attempt to design greater cooperation between social worlds experiencing de facto interaction but whose level of cooperation could, in the eyes of relevant actors, be improved. This explains why the experiment's initiators began talking about "esperanto" and "shared language" when describing what they considered an undeniable success (the questionnaire).

Any discussion here about secondary benefits and "conversion" [38] should also mention the Wi-Fi infrastructure that coincided with the suitcase's arrival. Such connections could then be used for other purposes and would often lead to organizations reflecting upon the link between their residents and the outside world - and specifically whether they should wire up each room over time so that residents could all communicate with the outside world.

A final element is that the three nursing homes where the domestication occurred went even further than expected with their baseline ECGs by systematically doing an ECG for each new resident. Families would be made aware of this when they first came to speak with the nursing home director about moving in their elderly parent. The suitcase, or more specifically the ECG data contained therein, would be used, to some extent, by the nursing home as a way of presenting itself, i.e., communicating a serious image of itself to families.

6. DISCUSSION

As we have just shown, of the ten nursing homes included for the experimental deployment of the suitcase, only three have gone through the four stages of domestication, while the others are locked at one or another step shorter after acquisition. In what follows, we highlight the barriers that we think have hampered domestication as well as disqualified the use of the suitcase for cooperation during emergency situations. Then, we discuss the unexpected impact the suitcase integration had on the three nursing homes that have adopted it.

6.1 Different Levels of Domestication

How can we explain the contrasting situations among the ten nursing homes?

It turns out that two of the three nursing homes that have domesticated the suitcase were pioneers in the project. They were followed by a nursing home led by the daughter of Mrs. Parinello. This nursing home was a pioneer in the unexpected use of the suitcase that we described above for baseline ECG. Therefore, we suggest that the involvement of the top management of the nursing homes is a key factor to achieving all of the steps of the domestication of the toolkit. In fact, introducing the suitcase is a process that has to be managed and organized; the suitcase does not work by itself.

Another important factor that we noticed is the establishment of a common observation as the starting point of rolling-out the suitcases: "we have a problem with the EMDC". This common observation was clearly a motivation to try to improve the cooperation between nursing homes and the EMDC, and the suitcase (or even the "esperanto") was a good candidate to support this improvement. In most of the nursing homes that tried out the suitcase, this starting point (acknowledging the cooperation and communication issues with the EMDC) was not entirely clear, so the need to use a new tool was not obvious; therefore, they did not make the effort to include the suitcase in their work practices.

Finally, the existing technical infrastructure (Wi-Fi, RJ45) and/or the timing of the arrival of the suitcase affected its trajectory. This was particularly the case when the suitcase arrived at the same time as a new integrated information system that deeply impacts professional practices, as we have seen in three of the participating nursing homes. In this context, the suitcase was never prioritized by the management or the care team.

6.2 The Lack of Practical Relevance of the Toolkit in Emergencies

The weak success of the experiment and domestication of the suitcase can also be explained by the weak relevance of the use of ECG in response to "real" emergencies as reported by several of the interviewees from both sides (nursing homes and EMDC members). The informants have detailed practical constraints on their situated action [42] in case of emergency; as we illustrated earlier, if a resident is encountering heart distress, is hardly breathing and is requiring urgent care, nurses and orderlies have no

time to perform an ECG, especially if they are not used to it. They are also dependent on doctors to interpret and make sense of the results.

Moreover, from the EMDC triage doctors' point of view, an ECG is only one piece of evidence among others in identifying a critical situation that requires carrying the resident to the hospital. Other measures more easily performed by orderlies (like blood pressure, pulse, and screening patient's eyes) as well as a description of symptoms can support triage doctors in their decision to send an emergency vehicle. Precisely diagnosing heart problems from an ECG for an elderly person is particularly challenging for doctors because most elderly people tend to have non pathological but irregular cardiac measures. The medical interpretation of an ECG takes time and implies a good knowledge of the patient's history that is far from being the case in an emergency situation.

Therefore, in fact, on the occasion of a "real" emergency situation that requires a timely response, ECGs appeared to be of limited use for making the decision to send the patient to the hospital.

6.3 The Difficulty to Borrow Artifacts
As we described in the origin of the case study, the two project leaders (the head of the EMDC and the head of two nursing homes) shared the aim of improving cooperation between the EMDC and the employees of the nursing homes. Their initial idea was to provide suitcases in nursing homes so that orderlies could perform ECGs. As we also described above, they decided later on to offer the orderlies a questionnaire and associated vocabulary (the "esperanto") to help them communicate information about patients to EMDC staff. Using this approach, artifacts (the ECG and the esperanto) were then borrowed from the EMDC with the expectation that this will help orderlies to ensure better cooperation with the EMDC by providing more accurate data to decide whether the resident is in an emergency situation and should be sent to the ED.

Our observation of the deployment of the suitcase and the esperanto (illustrated in the domestication of the toolkit, section 5), as well as the study of existing research on cooperation in healthcare settings, show how much this schematic borrowing strategy needs amendments.

The strategy of borrowing an artifact from one community of practice has been described in the Boundary Negotiating Artefact (BNA) analysis framework [22]. BNA is a useful concept to understand a not well used or controversial artifact that does not succeed as a boundary object [40] at the border of several groups. Regarding the difference of the consensual view of flexibly reusable boundary objects serving coordination and cooperation, BNA shows a more complex and conflicting landscape where groups are pushing their interests and views through artifacts.

In the case we studied, the EMDC cuts down early the attempt from nursing homes to borrow ECG and emergency care language by opposing a strict protocol for using the suitcase: the ECG should be performed only in response to EMDC request during the emergency call, as clearly mentioned by Maciste Technologies during a training session in a nursing home:

*You, in any case, you do not decide if you should use the suitcase. OK? Because, this is also the big issue: This is thinking, I have a telemedicine toolkit, I do everything, I send to EMDC, I tell them, now, help yourself. No, this is not how things are going on. There is an existing procedure, that you already know, which is: you call EMDC, this is what you do. It does not change anything; **this is not because you have tools that you must use them**. The goal is that these tools should be used on the orders of EMDC. Ok?*

The asymmetry of positions and valued expertise between triage doctors in the EMDC and nursing home employees (mainly orderlies and nurses) appear to be at stake, as seen in other medical contexts [43]. For nurses and orderlies, performing an ECG without the explicit order from a doctor would have no organizational rationale or even could be seen as malpractice. Indeed, this has clearly discouraged the use of the suitcase and the initiative of practicing ECG by nursing home employees.

The failure to position the suitcase and the Esperanto as a support for improving cooperation between the EMDC and nursing homes is consistent with existing cooperative work analyses on a "could have been" boundary object [22, 26]. As Star reminds us [39], boundary objects should be thought of both in their material dimension, the artifact, and their process dimension, the practices associated with their production and use. In the case we have presented here, the process dimension was clearly neglected. In other words, a negotiation on how (practically) the suitcase could be used to ensure better cooperation between the EMDC and nursing homes did not occur and was missing. We join Munkvold, Ellingsen, and Monteiro [26] in their analysis that work practices, such as planning or defining an emergency situation in our case, have to be addressed before even specifying the artifact that would allow for better cooperation. This learning appears to us as still neglected in many projects aimed at supporting an evolution of inter-organizational cooperation, or at least cooperation.

6.4 A Domestication in an Unexpected Way
As we described above, facing the rebuttal from the EMDC to change their cooperation practices, three nursing homes have incorporated the suitcases in their work practices in unexpected ways.

Among these three nursing homes, two are headed by Mrs. Parinello and the other by a well-known colleague of hers. They were thus especially involved and interested in trying out the potential of using the suitcase. Then, based on the rationale that orderlies have to be familiar with the suitcase and the ECG exam to be able to perform one in an emergency situation, they started asking the orderlies to perform ECGs for residents outside of emergency situations. This led to these three nursing homes incorporating the suitcase in their work practices and overcoming the restrictive protocol imposed by the EMDC on its use, straying from its initial cooperation purpose.

As we have seen, two unexpected uses were then developed in nursing homes. The first one is the idea of performing an ECG for each resident when the situation is "normal" to get a baseline ECG. This use offers the doctors the opportunity to compare the ECG of a resident in abnormal conditions with a previous measure at a time she or he felt ok. The other unexpected use is to perform surveillance ECGs when residents start complaining about breathing or heart problems, before the situation worsens and eventually becomes an emergency situation.

Thus, the suitcases are no longer presented and used as a support for inter-organizational cooperation in emergency situations. The transformational power of tools when incorporated into work practices is well established in social sciences and CSCW [12]. For the three nursing homes that developed these unexpected uses, the domestication of the suitcase eventually appeared to be an opportunity for organizational learning [46] through the development of practicing baseline and surveillance ECGs.

The incorporation of the suitcase in the existing work practices of the nursing homes has led to reflexivity and redefinition of the very notion of an emergency from the nursing homes point of view. As

the suitcases were lacking their initial cooperation purpose, they have been repurposed by nursing home management and staff to fit the particular issues at stake in their context [13], and especially to provide quality care to the residents. In fact, the conversion phase of the domestication of the suitcase, which led to performing baseline ECGs, has contributed to the development of a message from the top-management of the nursing homes to patients and their family. When requesting their consent for ECG, they are also promoting this new practice as a benefit for the good care of the residents. This new practice and its benefit are also emphasized when communicating with the general public and funding agencies. For nursing homes that are early adopters of telemedicine solutions, it shows a clear impact on their identity.

6.5 Limitations and Implications for Future Projects

This case study of course has some limitations. First, we did not have the opportunity to cover the entire experimentation process that lasted two years. We only had the chance to investigate the case during six months. Another limit is that the only emergency situations that we observed did not involve the use of the toolkit. Furthermore, in the three nursing homes that have domesticated the telemedicine toolkit, the new work practices that were implemented are just starting. Indeed, the introduction of the new practices that we described above (baseline and surveillance ECGs) in the nursing homes is far from being unproblematic.

In fact, these "baseline" ECGs were not unanimously welcomed by the head nurses in the nursing homes. They wondered whether an ECG that had been carried out but not read by a doctor could make the institution liable if a resident died from a problem that no one had noticed but could have been detected on the ECG. The worry here was that families might sue the nursing homes, or indeed sue the nurses or orderlies who had carried out an ECG without any medical demand for this. Otherwise, although Maciste Technologies' sales director did not contest the legitimacy of this line of questioning, they did argue that, based on current law, an ECG becomes a medical act once it has been interpreted, but not before. Here, the legal question was whether entering the results of an ECG in an in-house database transformed it into a medical act. Lacking any real clarity, one of the coordinating doctors of a nursing home said that he had refused to interpret ECGs when his manager asked him to do so. A number of doctors treating nursing home residents had also refused, apparently because they had not been trained recently in reading these examinations. This reveals a controversy inside of the experiment that impeded the appropriation of the technology in all of the different nursing homes that were supposed to take part in the project.

It is also important to notice that the regional health authorities did not decide yet about the legality of this particular point. Moreover, we have to mention that, because this experiment is one of the first in France, we were not able to refer to any defined policy on the use of telemedicine in nursing homes.

Despite these limitations, our analysis of the domestication successes and failures in the different nursing homes allows us to provide recommendations for projects aimed at improving inter-organizational cooperation by the use of a toolkit:

- A prerequisite is that all of the concerned organizations acknowledge that they have an issue in terms of cooperation.

- The important and often neglected step is to define the different concrete situations in which this cooperation should occur and how. These descriptions should lead to the choice of the most appropriate socio-material intervention (device, application, protocol, training …).

- A key factor is the involvement of the top-management of the organizations that plan to improve their cooperation with a socio-material intervention.

- The socio-technical infrastructure should be ready before the system is rolled-out: network availability, form and timing of the training sessions, and integration into the existing information system.

7. CONCLUSION

In this paper, we investigated the experimental deployment of a telemedicine toolkit. The aim of this experiment was to try out the pertinence of using this kind of artifact to improve the cooperation between the triage doctors of the EMDC and the nurses and orderlies of nursing homes in a city in France. The goal was to avoid unnecessary discharge of the nursing home residents to the Emergency Department of the local hospital both for quality of life and economic reasons.

We specifically focused on the domestication process that occurred in the ten nursing homes that took part in the experiment. Our study reveals that only three nursing homes fully domesticated the telemedicine toolkit, but in an unexpected way: by finally incorporating their use in their internal work practices and, in this way, making them evolve instead of using the toolkit to cooperate with the EMDC.

Our contribution can be seen at different levels. First, we provide a detailed description of one of the first telemedicine experiments intended to improve cooperation in emergency settings in France, which is part of a large-scale project aimed at developing telemedicine practices to face the shortage of medical resources. Our description and analysis uncover the potential pitfalls and suggest recommendations for future projects. Then, our study adds a new case to the literature on domestication in which this framework was successfully used in a professional setting. It also further develops the BNA framework by providing an instance of the idea of borrowing artifacts.

8. ACKNOWLEDGMENT

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