

## Creating augmented technicians: The case of Bell Canada

Ana Viseu  
Applied Cognitive Science  
Human Development and Applied Psychology  
OISE / University of Toronto  
<http://fcis.oise.utoronto.ca/~aviseu>  
[ana.viseu@utoronto.ca](mailto:ana.viseu@utoronto.ca)

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### *Abstract*

*In July 2002 Bell Canada's Mobile Communication Center (MCC) conducted a field trial of Panasonic's latest wearable computer, the CF-07. This pilot was part of Bell's larger wearable computing initiative that had as a motto the creation of a 'mobile, wireless and wearable' workforce.*

*From the MCC's perspective this pilot was described as a fairly straightforward procedure. It involved a mere 'technological replacement'—from the old laptop to the new wearable. For Bell, this was a minor change, a change in form not function, since the functionality of the previous laptop computing device had remained the same. Technicians were simply being given a more appropriate tool to perform their jobs.*

*However, as this paper will demonstrate, the process was far more complicated. Entities that the MCC had not considered turned out to play a major role in the development of the pilot, the technological artefact did not have a stable identity and technicians interpreted the shift to wearable computers as an alteration of the character of the job itself, and thus, of their role within it. Technicians resisted this shift that implied a change from being a 'Bell-technician' to becoming a 'Bell-wired-technician'.*

*It is telling that at the time of the writing of this paper most of the actors who were initially involved in the pilot have permutated into something else, or disappeared altogether.*

*This paper analyses the field trial implementation of the Panasonic CF-07 within Bell Canada's Business and Data group using an actor-network theory (ANT) approach. That is, it follows the endeavors of human and nonhuman actors in their attempts to establish a stable sociotechnical network of augmented field technicians. In particular it makes use of Callon's (1986) translation vocabulary to depict and analyse the different stages of the constitution of this network. It concludes by offering some reflections on the implications of the development of this pilot and how this may contribute to further the understanding of human interaction with technology.*

## Introduction

Wearable computers constitute one of the most radical inventions of our *networked society* because they augment individuals transforming their bodies into bodynets—hybrid entities that are integrated information systems, making them a living part of the information network (Viseu in press). Wearable computers also constitute new interfaces between the individual and environment, allowing new interactions with the environment and with others.

The field of wearable computers has been developing steadily for the past 10 years, having achieved academic and commercial respectability (c.f. Baber et al. 1999). Research on wearable computers is being conducted on various areas such as health, work, leisure and security. However, much of the activity around the field is still in the blue-sky or prototype phase. One of the areas where real product development and implementation are flourishing is that of industrial applications.<sup>1</sup>

Wearable computers have long been hailed as a ‘killer application’ for mobile managers and workforces. By providing field workers with fast and reliable access to information while leaving their hands free to perform the tasks at hand, wearable computers are expected to increase productivity and efficiency, hence providing quick returns on investment (Sakurai 2002, Barfield and Caudell 2001).

Bell Canada constituted a perfect fit. As Canada’s largest telecommunications company Bell has a field workforce composed of ten thousand individuals that must be coordinated with resources, clients, managers, salaries, to-do-jobs, and with information about all these items. Bell’s field technicians perform repairs and installations that must be conducted up poles or down in conduits. Access to information and hands free operability are key features of the technology for Bell.

By mid-2002, Bell’s Mobile Communications Centre (MCC) and Panasonic came together to conduct a field-trial implementation of Panasonic’s CF-07 a ruggedized, wearable computer. The pilot attempted to evaluate how this technological artefact contributed to the above mentioned goal of creating a connected/wired workforce, that would in turn contribute to a better work streaming efficiency.

The initial plan was to equip 12 *Business and Data* field technicians with the CF-07 for a period of 3 weeks, survey the results of the pilot, provide feedback to Panasonic—in order to re-adjust any technical requirements—and then proceed to a full deployment. Bell was reported to have in its possession 150 CF-07 units.

However, after being extended for 4 months, the pilot abruptly came to an end, with no end survey ever being conducted. In the ensuing weeks technicians were

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<sup>1</sup> The other is security, with research aiming at increasing or diminishing physical abilities. This is a growing field, and after the events of September 11<sup>th</sup>, 2001 it has received a big financial boost.

given back their old laptops, the MCC was disassembled—its divisions reassembled into other entities—and Panasonic discontinued the production of the CF-07.<sup>2</sup>

My interest in this paper is to offer an in-depth view of processes of adoption and adaptation of wearable computers. This encompasses changes in the work practices, the increasing role played by technology in the workplace, design issues, but it is more than that. It refers to the mutual adaptation of technical and social actors, to the sociotechnical character of the entity that is being created and to the strategies used by different actors in their attempts to stabilize their existence and identity.

Explaining the development of this project from a purely social and causal perspective—the MCC miscalculated the importance of the shift to wearables, technicians acted out of a fear for technology—is misleading. Technicians do embrace technology in the practice of their work, and the MCC has successfully implemented other technological artefacts.

Instead, as science and technology studies (STS) suggest, in order to understand how this project developed it is necessary to bring other (f)actors into play. Social actors do not act in isolation, but rather in conjunction with a series of technical actors that play a determinant part in the outcome. The MCC must create a stable actor-network where all entities follow the roles it has assigned to them. In short, the CF-07 must maintain its mobile, wearable status; the field technicians must accept the inclusion in their personal space of a new technology; and, work productivity must be increased so that the managers maintain their support.

What I am proposing here is that the creation of a wearable computing stable network involves the rethinking of the human element within the organization, a rethinking of the technicians personal identity.

This paper traces the movements and strategies of various actors in their attempt to stabilize (or not) wearable computers and the emerging sociotechnical network that will sustain it. It is organized in the following parts: The first part introduces STS's central concepts, with a special emphasis on Actor-Network theory and Michel Callon's (1986) sociology of translation. Callon distinguishes four 'moments' of translation in the stabilization of a network: problematisation, intersement, enrolment, and mobilization. These moments do not reflect temporal or definite stages of the pilot, their function is mainly analytical and exploratory, that is, they provide the conceptual tools for portraying and analyzing a given reality (or network). The second part applies these theoretical concepts to the actual process of creating augmented technicians. Finally, the third part offers some conclusions regarding the implications of the development of this pilot. This concluding section also attempts to highlight the contributions and hindrances that ANT offers to its understanding.

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<sup>2</sup> I do not mean to imply that there is a causal relationship between this pilot and Panasonic's decision. At the time of the writing of this paper interviews have not been conducted with representatives from Panasonic.

## *Sociotechnical Networks*

Much has been written in science and technology studies, in particular by scholars using Actor-Network theorists, about the hybrid character of humans and nonhumans, nature and society. In this view, studying society without looking at its technologies is not only impossible but also fruitless. The contrary, studying technologies without looking at the society that produces them, is equally unavailing. Rather than being bound by causal relationships technology and society complement one another, in a mutually shaping interaction (Castells 1996, Bijker 1995, Law & Callon 1988, Latour 2000, Latour 1993).

From this perspective technological artefacts are hybrid entities, constituted by 'hard' materials and by the social universe in which they will operate and which they help create (c.f. Akrich 1992, Latour 1999, Callon 1987, Law 1987).

The hybrid character of the artefact under study here is quite explicit. A wearable computer needs a body to be worn on, otherwise it is but a computer. Both the body and the computing device are indispensable for a wearable computer to be fully realized.<sup>3</sup> Its identity and existence relies on both entities, making it an intuitive illustration of a sociotechnology.

Central to Actor-Network Theory (ANT) is the notion that in order for an actor to have a stable existence, or identity, a variety of entities—social and technical—must be recruited, mobilized, aligned and locked in given positions within a network.<sup>4</sup> This stabilization process is characterized by the mutual adaptation of all actors involved. When this does not happen the technical artefact changes in character or fades away (Latour 1996, Callon 1986).

From an ANT perspective objects are not passive containers of human designs and desires. They are actors<sup>5</sup> in that they *do* things, i.e., by existing they actively shape and transform the character of that which they are part of (Latour 1991, Latour 1988, Akrich 1992). Technologies are a set of processes, 'environments', that

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<sup>3</sup> Actually the actor-network of wearable computers is composed of many other actors, for instance, pervasive digital backbones, pervasive wireless communication networks, environmental transceivers that communicate with the wearable computer thus facilitating access to information, a variety of "smart" objects that communicate seamlessly with the wearable, and other individuals equipped with compatible technologies.

<sup>4</sup> Michel Callon (1987:93) defines an actor network as being "is simultaneously an actor whose activity is networking heterogenous elements and a network that is able to redefine and transform what it is made of".

<sup>5</sup> The definition of 'actor' used here is well illustrated in Donna Haraway's sentence, "agency is not something you have but something you do" (Haraway & Goodeve 2000). Agency no longer denotes intentionality, instead it follows (inter)actions, displacements and their effects. In a sense, this definition of agency follows a behavioristic psychological tradition and that poses problems of itself.

require and create specific dynamics, social patterns of organization and modes of experience. Technologies are 'active' environments that shape and hold together a set of social dynamics that are both consequences of its existence and necessary for its survival<sup>6</sup> (c.f. McLuhan 1964, McLuhan & McLuhan 1988).

It follows that any entity—human or not—is a relational entity (see Suchman 2002 for more on the relational character of entities). That is, a network of heterogeneous actors that come together to give it shape and existence. As the relationship between these actors changes, and a network is never fully 'closed' and static, so does the identity of the larger entity.

The scope of analysis of an actor network is defined by the actors that constitute it.<sup>7</sup> It is they who decide who and what is important at any given time. It is through their actions that we can analyse the dimensions of a network. The actor-network of an entity provides both its own context and the ways to interpret it. In the case under study here, the actor network was originally composed of three actors: the MCC (spokesentity for Bell Canada), CF-07 (spokesentity for Panasonic), and the first level managers (spokesperson for the field technicians). However, as will be demonstrated in the analysis below, not only did a number of new actors become deeply enmeshed in its existence, but the above mentioned actors increasingly lost the ability speak for the actors they represented, thus fracturing into a number of different actors.

From an analytical perspective this sociotechnical approach requires that distinctions between what is social and technical be made only as a result of an investigation, rather than as a starting point. The researcher must suspend his/her belief in the intrinsic characteristics of humans and nonhumans. In order to ensure this symmetry Actor-Network Theory proposes a set of tools and a vocabulary that facilitate this 'neutral' analysis.

In his seminal article *Some elements of a sociology of translation: domestication of the scallops and the fishermen of St. Brieuc Bay*<sup>8</sup> Michel Callon (1986) proposes one such vocabulary, that of translation. Translation is not an end, a *fait accompli*, but a transformative process that emphasizes "the continuity of the displacements and transformations which occur in th[e] story" (1986:223). The repertoire of translation is not only to give a symmetrical and tolerant description of the complex process which mixes together social and natural entities. It also permits an

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<sup>6</sup> The study of a technology is thus seen as entailing the investigation of an active and dynamic network of heterogeneous elements. It must also make clear the mutual adaptation processes that occurs between these elements, thus freeing us from temporal and causal analytic constraints that often lead to technological or social determinism.

<sup>7</sup> In order to avoid the problem of "infinite regress" when a network acts as a single entity it is considered an actor, i.e., for purposes of analysis one stable entity equals one actor.

<sup>8</sup> The actor-network examined by Michel Callon is a hybrid of scientific knowledge, human and nonhuman actors. In it he describes the efforts of three marine biologists to determine the controversial cause of the decline of the scallop population in St. Brieuc Bay and to develop conservation strategies.

explanation of how a few obtain the right to express and represent the many silent actors of the social and natural worlds they have mobilised (ibid).

Callon distinguishes four main moments in this process. (1) *Problematization, or how to become indispensable*. In this first moment one of the actors within the network establishes itself as an “obligatory point of passage” (OPP) and delineates a programme of action for itself and others. (2) *Interessement, or how the allies are locked into place*. Interessement speaks to the series of devices—e.g., force, seduction, solicitation—by which actors are locked into the roles that were proposed for them in the initial programme. “Interessement is the group of actions by which an entity... attempts to impose and stabilize the identity of the other actors it defines through its problematization” (ibid:207-208). (3) *Enrolment, or how to define and coordinate roles*. If the previous moment is successful it achieves enrolment. Enrolment is constituted by a set of strategies with which the OPP entity seeks to define and connect the various roles it had allocated to others. (4) *Mobilisation, or are the spokesmen representative?* Mobilisation describes the set of methods used by the OPP entity to ensure that supposed spokesmen for various relevant collectivities were properly able to represent all those collectivities and not betrayed by the latter.

If these four moments are successful, that is, if all actors accept the initial programme of action and their role and identity within it, or if they are able to negotiate their differences, then a stable network is formed that constrains the movements of its ‘constituents’. Otherwise the object “disappears” (Latour 1996).

The character of the object under examination present this study with particular challenges. A wearable computer is an intimate technology, one that shares an individual’s personal space and becomes part of his/hers embodied, sensorimotor structures, thus having a potential for changing that individual’s interpretation of the world and of him/herself (c.f. Varela 1999, 2000). One of the issues that this study tackles is the difficulty of being agnostic towards social and technical, while acknowledging their differences.

The creation of augmented technicians, the transformation of their bodies into bodynets, within a larger network of Bell employment relations, personal identities, everyday working conditions and habits and technical support, does not rely on natural and stable sets of relationships. Instead, as the next section will demonstrate, attempts at generating this hybrid entity and the emergent network that will sustain it involve a great deal of work.

#### *A “Mobile, Wireless, Wearable” workforce*

Bell Canada’s wearable computing venture initiated in the late 2000, and had as a motto the creation of a “Mobile, Wireless, Wearable” workforce. The press then reported that Bell Canada, IBM™ and Xybernaut™—the largest player in the wearable computing field—had joined forces to assess the value of implementing wearable computers within Bell’s field workforce.

This initiative was the recipient of much media attention (see for instance, Mark 2001, Wrolstad 2001) and was widely praised as a success story by all partners. For its part Bell's representative was quoted as saying, "[w]e had to literally beg trial participants to return the units" (Sakurai 2002). Likewise, Xybernaut reported, on its website that Bell's xybernaut-fitted field technicians saved up to 50 minutes per day thus "[i]mproving [technicians'] productivity and effectiveness with customers everyday [and providing] a tangible value for the company" (Xybernaut n.d.).

Bell Canada's spokesentity for the overall wearable project was the Mobile Communications Centre.<sup>9</sup> The MCC is both part of Bell Canada and independent from it. It has its own budget and its own set of revenue expectations. In its capability of spokesentity the MCC possessed both the decision power and the negotiation space to enroll and make new deals with different partners, its legitimacy having been granted by Bell's upper management.

During the course of its joint venture with Xybernaut™ and IBM™ Bell Canada was consistently portrayed—in the media and information technology sectors—as an innovative company willing to experiment with cutting-edge technologies to provide better service to its customers. This attracted the attention of several technology vendors who wanted an opportunity to show their products (interview). Panasonic was one of these technology vendors. The product it was displaying was an alpha-version of the CF-07, a mobile, wearable personal computer that is part of its "toughbook" division that is especially suitable for field work since it is able to withstand drops, rain, cold, dust and other types of harsh treatment.

By mid-2002, the Mobile Communications Centre and Panasonic came together to conduct a field-trial implementation of Panasonic's CF-07. This field pilot would determine how this technological artefact contributed to the above mentioned goal of creating a connected/mobile workforce, that would in turn contribute to a better work streaming efficiency.

The CF-07 is a distributed computer composed of three parts: the CPU (called the 'brick' for its size and shape), a docking station (which offers added functionality to the CPU, but remains chained to the technicians desk), and the touch-screen display. The features of the display are central to the CF-07's identity. It is transreflective, i.e., it can be used in bright sunlight (a problem that had previously been reported by technicians piloting Xybernaut's products), it offers the possibility taking pictures of doing screen-saves that can be accessed at a later time, even when the CPU is disconnected or inaccessible, it can be handheld and, most

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<sup>9</sup> The MCC is composed of three divisions, each with its own mandate: management of Bell's wireless internal consumption; system's integration (both internal and external to Bell); and, management of the technology for the Ontario Field Services teams—hardware and software, maintenance and repair.

importantly, it is wirelessly connected to the brick using a Wi-Fi or 802.11b protocol.<sup>10</sup>

A third actor needed to be recruited, the users. The MCC recruited the field technicians through their 'bosses' (first level management). This recruitment method had several advantages, the MCC had to deal with less actors—individual field technicians were effectively 'silenced'—but it also meant that the technicians involved would have a similar job demands and thus could provide a good test bed.

There are divergent versions of how and why the field managers from Business & Data groups and the MCC decided to collaborate.<sup>11</sup> Some field managers say they saw a product demonstration, another that he heard about it from friends. Their reasons for participating in the pilot are also not uniform, although the overall expectation was that it would ease the technicians daily work practice—either because there had been technicians' complaints that needed to be solved, or because managers wanted to obtain a better oversight over their technicians performance (interview).

The four field managers involved then selected the end users. Twelve technicians were involved in the pilot. These technicians came from the Business stream of Bell's operations.<sup>12</sup>

The technicians<sup>13</sup> involved in this pilot have two types of job description, they either repair or install Bell equipment. The technicians who focus on repairs are called "repair technicians", and the ones doing installations "due date install technicians". However, the boundaries between both are not clear-cut and many technicians perform both types of jobs.

Another difference, and qualifier, pertains to the physical location of the technicians, to their "headquarters". Some of the technicians dispatch from a Bell building. Others, however, use a private, commercial building as their base and/or as their site of operations. The latter are "main site technicians" (MST). MSTs either work either in one building or a small number of buildings, or assigned to a small geographical area. MSTs are, with a few exceptions, less mobile than the other technicians involved in this pilot.

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<sup>10</sup> 802.11b or 'wi-fi' is currently the most widely used wireless standard. It offers data transmission rates of up to 11 megabits/second.

<sup>11</sup> Four field managers were involved.

<sup>12</sup> Of these 11 work in the Toronto core and specialize in voice operations. One technician came from Esna Park and works in the data stream.

<sup>13</sup> All Bell technicians participating in this pilot were unionized. This is important because it increased their openness while speaking to me. In fact, as one technician said, "once you are unionized you have to kill someone to be fired". Being unionized also means that job benefits are good, which in turn is reflected in the number of years the technicians tend to be, and stay, with it. For this pilot the average was 10 years of work with Bell Canada.



Field technicians can either be 'walkers' or have a van. MSTs are usually walkers, and 'due-date install' technicians usually have a van. However, again here the boundaries are not clear-cut. Having a van or being a walker determines how much equipment and weight a field technician carries with him at all times.

### *Translating bodies, computers and identities*

At the start of this pilot the following actors can be identified: the Mobile Communications Centre as a spokesentity for Bell, the CF-07 as spokesentity for Panasonic, the managers and their technicians.

The MCC's objective is to demonstrate that wearable computers increase the productivity and efficiency of field technicians, thus producing quick return on investment. This ensures its position within Bell at large. At first sight the managers goals are similar: to increase (or maintain) technicians' productivity by making their jobs easier. The CF-07's objectives also seem to be fulfilled, to establish itself as the wearable computer of choice within Bell Canada and the IT industry. Field technicians are both seduced (with promises of increased productivity and thus larger salary) and compelled to participate (the managers' recruitment was only somewhat voluntary).

In order for the pilot to be successful, and its goals to be accomplished, all actors must be kept firmly aligned and locked into their positions. All actors must support the general effort, but as seen above, this involves different engagements. The managers must be assured that their technicians' productivity is increasing, or at least not dropping; the CF-07 must prove its workability, wearability and efficiency and reinforce its identity as a work-computer; the field technicians must be convinced that wearing the CF-07 helps them perform their jobs and they must also be willing to change their identities to become wired technicians; furthermore, the MCC must itself be able to maintain its status of spokesentity for Bell Canada, it must guarantee that it does not lose its legitimacy, that is power and negotiation space. To do that the MCC has to be able to demonstrate that augmented technicians are "the way of the future," the only real option that will put Bell at the industry's cutting-edge (interview).

In keeping with the methodological principle of "letting the actors speak" an forced itself upon this project (and research), proving vital to its development: the software application. Federated WorkForce Management (FWFM) is Bell's new workforce management system. It is a centralized information/communication system that runs in Bell's virtual private network (intranet) and automates the workflow. FWFM is what has been described by Akrich (1992) as a technology whose goal is to create "non-users", that is, docile users with very little maneuvering space in their interactions with it. Its role within the development of this project will be further described below, for now suffice to say that FWFM's standing within Bell, as an organization, is non-negotiable.

The appearance of this 'new' actor signifies that the MCC must "impose a polite behavior" (Latour 1996) between the CF-07 and FWF, that is, they must be compatible so that that FWF runs smoothly on the CF-07. It must also ensure that utilizing it is not a hurdle for users.

In order to keep the field technicians "interested" and "enrolled", the MCC asked, at the start of this pilot, that all field technicians return their laptops. However, in the first act of dissent in this story, that shows the (still) unstable state of the actor-network, the managers, whose main goal is to guarantee that the technicians productivity does not drop, warned some of their technicians to keep the laptops *and* get a new wearable.

The MCC also insisted that this pilot was a rather straightforward procedure for the users, since it required only a change in tools—from laptop to wearable. The form function would change but the function would not.

As the MCC engages in its efforts to keep all actors aligned with its initial programme of action, it becomes clear that they are resisting the role that was assigned to them in the initial problematisation. The decision of using the CF-07 is understood by them as an imposition from an abstract entity, rather than a measure to make their jobs easier. Technicians feel that their needs are always on the bottom of the ladder of decisions and that the CF-07 will only make their lives more complex.

Technicians are also uncertain as to what their role within the project is. They believe that using the CF-07 means that they will be forever stuck with it. This is an important decision especially as there were rumors<sup>14</sup> that other groups within Bell were receiving new laptops equipped with DVD players. The pilot participants did not want to see themselves locked out of this possibility.

The CF-07 also proves recalcitrant with its identity being under negotiation. It was introduced as a wearable computer but its wearability is not seamless or evident. Technicians don't wear it, and most don't even carry it with them on most of their tasks, but rather leave it at the office or inside the van. Furthermore, the CF-07 had been introduced as a substitute for the laptop, a general purpose computer. However, its functionality as a general purpose computer was reduced. The data input process relies on a software keyboard and is thus rather tedious. Its wearability having been disputed, in the comparison of laptop vs. CF-07 technicians clearly prefer the first. If, however, the CF-07 is supposed to be something else, like a PDA, then it is not a very good one, because it is too large.

The breakdown of its wearable identity led to a renegotiation of its relationship to technicians, and in an effort to keep the field technicians enrolled, the MCC brought new actors are brought into play. The MCC provided some of the technicians

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<sup>14</sup> One of the things that I have learned from working with Bell Canada for over a year is that rumors within Bell are usually good sources of information for they are accurate and up-to-date.

peripheral keyboards and screens. The identity of the CF-07 is now even more contested. The CF-07 is transformed into an expensive desktop, providing even less mobility than the previous laptop.

Transforming the CF-07 into a desktop created dissent among managers, who now see their technicians becoming less and less mobile, the opposite of the what they expected to achieve. It also created more uncertainty on the part of field technicians who now had a very expensive desktop,<sup>15</sup> rather than a laptop they could take home.<sup>16</sup>

A further variable was introduced into this already complex network of identities, alliances and negotiations, when the FWFM imposed itself as a major actor. Technicians knew that my interest was in observing their interactions and adaptation strategies regarding the hardware but were adamant in their conviction that it is not possible to distinguish between software and hardware, between CF-07 and FWFM. For them, the CF-07 did not have an existence of its own, but was dependent on FWFM. If this software application did not exist, then neither would the computing device.

FWFM is Bell's new workforce management system, running on its virtual private network. It is the application that is used to keep track of the workload, assign different jobs to different individuals, keep records of time, get stats on each technician's performance, and other work streaming management tasks. FWFM is a critical piece of technicians' workday because it constitutes the only interface between technicians and the workload and, to a great extent, between them and management. Technicians use it to dispatch themselves on a job, release that job once it is completed, create 'tickets' for new jobs that had not been anticipated, get information regarding the job to be performed, and indicate any problems that arise during the course of the day.

FWFM had recently been introduced to the Business and Data group (1 to 2 months) before the Panasonic field trial took place. This meant that the MCC's initial assertion (or expectation) that changing from a laptop to a wearable was merely change in tools, a form issue that did not involve content, was severely undermined by the simultaneous adaptation to a new mediation system.<sup>17</sup>

Using FWFM entailed a radical change in the nature of the job being performed by field technicians. Until the moment of its introduction technicians would receive printouts describing their tasks in the morning. New jobs would then be added throughout the day and technicians would be warned through their pagers. They

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<sup>15</sup> Since the start of the pilot technicians speculated about the price of the CF-07. They often asked if I knew. By the end of the pilot a consensus had emerged, among technicians that the CF-07 costed \$6000 CAD. I have no way of confirming this figure.

<sup>16</sup> It is Bell's policy to encourage field technicians to take their laptops home. This is part of an effort to make technicians comfortable with computers.

<sup>17</sup> FWFM is still being fully deployed within Bell Canada and field technicians have continued adapting it to their needs and adapting themselves to it. Several strategies have already been developed, by the users, to adapt it to their needs, and to work around it.

could then call the dispatch and control centers to find out details about the job. With FWFM, technicians were no longer given the printouts, but were expected to take the laptop with them, and scribble down the information in a piece of paper. After finishing each job technicians were expected to call 'dispatch', clear that job and dispatch themselves on another job. (Rather than going back to the 'base' office and clearing it there).

For the MCC there is a clear distinction between FWFM and the CF-07. FWFM is an application, while the CF-07 is a piece of hardware that optimizes the software but has an independent existence. The project manager for this project claimed that FWFM is a great application, very helpful for technicians, if they only used it in the right way.

FWFM is built for a "non-user" (Akrich 1992), i.e., it leaves very little space for negotiation on the part of the user. It is a centralized application that intends to place more control in the hands of the organization, and that makes some technicians refer to it as a "chokehold".<sup>18</sup>

For the MCC the field trial implementation of the CF-07 was a straightforward procedure: Field technicians would have their laptops replaced with wearable technology. For the MCC, this was a minor change, a change in form not in function. The wearable's form seems to the MCC more appropriate to the type of mobile work that Bell's field workforce performs. The job would remain the same, the content of the screen would still be the same, technicians were only being given a more appropriate tool with which to perform their jobs.

For the technicians involved, this process was far more complicated. Technicians interpreted it as an alteration of the character of the job itself, and of their role within it. Technicians to differentiate between technologies as tools (those that they use to do their job, such as the machine that measures the length of the telephone signal) and technologies that *are* the job itself (such as the wearable computer or FWFM). For them using a wearable computer is not merely using a different tool, but doing a different job, being a different technician. Technicians resisted the change from being a 'Bell-technician' to becoming a 'Bell-wired-technician'.

### *Mobile Enterprise Technology*

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<sup>18</sup> Even if FWFM leaves little space for user improvisation technicians have already found ways to circumvent it. It is not clear who is the original creator of these adaptation strategies is, but they circulate quickly among field technicians. Thus, technicians have learned when they want to get more information about a job that they do not want to perform straightaway, they can dispatch themselves on it and then cancel it and re-route it to themselves. It takes from a couple of hours to one day to get that ticket (or job) back on their load. Creative time accounts is another way in which the technicians fool the system. If before this was hard to do, because times were negotiated with the controllers and dispatchers, with a mediated system it is effortless.

The rebellion of the constituent actors was evident. In December 2002, as I was conducting a second round of interviews with field technicians, the pilot was abruptly called to an end. Technicians returned the CF-07 and received their laptops back. Shortly afterwards, they were upgraded to a new laptop. The MCC was dismantled, its different divisions were incorporated in other departments or became new entities. Most of team heading this project formed the “Mobile Enterprise Team” (MET) specializing in consulting for external clients. FWFM continued being used, but there are calls within Bell to make it more flexible. The CF-07 is being discontinued by Panasonic, for lack of industry interest.

As the actor-network collapsed, the reality it sustained and composed, its ‘environment’, shifted. Bell’s strategy changed, and so did that of the former MCC. The new MET no longer emphasizes wearability but mobility and connectivity. Access to information no longer relies on the creation of ubiquitous augmented individuals, but rather ubiquitous wireless infra-structures. The new slogan being “Mobile Enterprise Technology”.

From an off-body computing paradigm, Bell moved to an on-body paradigm and back to off-body. It is not clear, yet, what the implications of this shift are, or if they are indicative of a larger trend, however, the implications for the fields of (wearable) computing design are obvious.

Still, this pilot was not without successes. There were examples of mutual shaping strategies both at the level of hardware and software. Some technicians found new ways of carrying the equipment—e.g., putting CPU in their backpack while keeping the screen at hand, or connecting screen pen to the body with a phone wire. On a more significant level, a few technicians were observed changing their work routines to adapt to the new ones, for instance, some stopped writing down the information on paper and took screen captures instead.

### *Technologies and Identities*

The adoption of new technologies in the workplace forces individuals to change some of their work routines, some deeply ingrained habits and, to a great extent, their identity. Individuals are always reluctant to accept this. This pilot, that is, the implementation of a combined usage of FWFM with CF-07 is a good example of this. It had a tremendous impact on the way technicians work at Bell Canada. It forced them to adopt new strategies, new routines, new reporting methods, new identities.

The MCC saw the transformation of technicians into ‘virtual nodes’ as a positive thing. Technicians rebelled against being made more invisible and ‘unsituated’, against being transformed into bodynets, with their identities and practices being processed into information (c.f. Baudrillard 2002) and their bodies becoming “data-spaces” (Manovich 2002).

It would be wrong to conclude that technicians are against technology. They resist being forced to change identities whenever management decides to, perhaps they

don't want to become even more invisible to the system than they already are. They don't want to become more of a 'productivity statistic'.

At the bottom of this, I think, lie different conceptions of what technology is. For the MCC and Bell in general technologies are tools that the technicians use to do a certain job. Thus, when deciding to go implement wearable computers they are simply choosing a certain type of tool. Technicians seem to make a differentiation between technologies as tools (those that they use to do their job, such as the machine that measures the length of the connection signal) and technologies that are the job itself (such as the wearable computer). Thus, for technicians using a wearable computer (and FWF) is not merely using a different tool, but doing a different job, being a different technician.

Producing an ANT informed analysis of the development, implementation and adoption of wearables within Bell's workforce highlights the actions of technical and social actors, emphasizing their simultaneous, mutually adaptive character rather than establishing a causal relationship between them. The ambiguities of the pilot's problematization, and ensuing translation difficulties, that involved both technicians and technological actors contributed to the pilot's outcome.

However, it is important to note the limitations of ANT. If what we are observing here is a resistance to a shift in identity, as well as an assessment of the mutual adaptation of technical and social actors, then it is necessary to find a vocabulary that allows to acknowledge their differences while maintaining their similarities.

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#### *Notes:*

This paper is not properly referenced. I am currently struggling to find the appropriate ways of identifying the subjects that participated in my case study. This involves a series of ethical considerations and I have not yet defined a course of action.

#### *References:*

- Akrich, M. (1992) [2000]. The De-Description of Technical Objects. In Bijker, W., Law, J.(Eds.), *Shaping technology/Building society studies in sociotechnical change* (pp. 205-224). Cambridge, MA: MIT Press.
- Baber, C., Haniff, D.J., Woolley, S. I. (1999). Contrasting paradigms for the development of wearable computers. *IBM Systems Journal*. Issue on Pervasive Computing, 38 (4): 551-565.

- Barfield, W., Caudell, T. (2001). Basic Concepts in Wearable Computers and Augmented Reality. In Barfield, W., Caudell, T. (Eds.), *Fundamentals of Wearable Computers and Augmented Reality* (pp. 3-26). Mahwan, NJ: Lawrence Erlbaum Associates.
- Baudrillard, J. (2002). The violence of the virtual and integral reality. Paper presented to the Living Literacies conference. York University, Canada, November 14-16, 2002.
- Bijker, W. (1995) [1999]. *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change*. Cambridge, MA: MIT Press
- Callon, M. (1986). Some elements of a sociology of translation: domestication of the scallops and the fishermen of St. Brieuc Bay. In Law, J. (Ed.), *Power, Action and Belief: A New Sociology of Knowledge?* Sociological Review Monograph, 32, 196-233. London, UK: Routledge & Kegan Paul.
- Callon, Michel. (1987) [1999]. Society in the Making: The Study of Technology as a Tool for Sociological Analysis. In Bijker, W., Hughes, T. & Pinch, T. (Eds.), *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (pp. 83-103). Cambridge, Massachusetts: MIT Press.
- Callon, M. & Law, J. (1997). After the individual in society: Lessons on collectivity from science, technology and society. *Canadian Journal of Sociology*, 22 (2): 165-182.
- Castells, M. (1996). *The rise of the network society*. Massachusetts, USA: Blackwell.
- Haraway, D. J. (2000). *How Like a Leaf: An interview with Thyrza Nichols Goodeve*. New York, NY: Routledge.
- Latour, B. (pseudonymously Jim Johnson). (1988 June). Mixing Humans and Nonhumans Together: The Sociology of a Door-Closer. *Social Problems*, 35 (3): 298-310.
- Latour, B. (1991). Technology is society made durable. In Law, J. (Ed.), *A sociology of monsters: Essays on power, technology and domination* (pp. 103-131). London and New York: Routledge.
- Latour, B. (1993). *We have never been modern* (translated by Catherine Porter). Cambridge, MA: Harvard University Press.
- Latour, B. (1996). *Aramis or the Love of Technology* (translated by Catherine Porter). Harvard University Press: Cambridge, MA.
- Latour, B. (1999). *Pandora's hope: Essays on the reality of science studies*. Cambridge, MA: Harvard University Press.
- Latour, B. (2000 January/March). When things strike back: a possible contribution of 'science studies' to the social sciences. *British Journal of Sociology*, 51 (1): 107-123.
- Law, J. (1987) [1999]. Technology and Heterogeneous Engineering: The Case of Portuguese Expansion. In Bijker, W., Hughes, T. & Pinch, T. (Eds.), *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (pp. 111-134). Cambridge, Massachusetts: MIT Press.
- Mark, Roy. (2001, August 03). Wearable Computers Replace Laptops. [Online]. Available:

- [http://allnetdevices.com/wireless/news/2001/08/03/wearable\\_computers.html](http://allnetdevices.com/wireless/news/2001/08/03/wearable_computers.html) [2001, August 03]
- McLuhan, M. (1964) [1994]. *Understanding media: the extensions of man*. Cambridge, Massachusetts: MIT Press.
- McLuhan, M. & McLuhan, E. (1988). *Laws of media: The new science*. Toronto: University of Toronto Press.
- Sakurai, J. M. (2002, January 4). Ready to Wear. [Online]. Available: [http://www.destinationffa.com/APCM/templates/solution\\_set\\_template.asp?Articleid=647&Zoneid=17](http://www.destinationffa.com/APCM/templates/solution_set_template.asp?Articleid=647&Zoneid=17) [2002, January 4].
- Suchman, L. (2002). Replicants and Irreductions: Affective encounters at the interface. Paper presented to the European Association for the Study of Science and Technology (EASST), York, UK, 2 August.
- Varela, F. J. (1999). *Ethical Know-How: Action, Wisdom, and Cognition*. Writing Science Series. Stanford, CA: Stanford University Press.
- Varela, F. & Mulder, Arjen. (2000). The Deep Now: An Interview with Francisco Varela. In *Machine Times* (pp. 6-27). Rotterdam, Netherlands: NAI Publishers, V2\_Organisation.
- Viseu, A. (in press). Simulation and Augmentation: Issues of Wearable Computers. *Journal of Ethics and Information Technology*.
- Xybernaut - case studies press release. (n.d). Xybernaut® Mobile Assistant®: Productivity Gains in the Telecommunications Field Bell Canada: Time Savings of 50 Minutes per Day per Technician. [Online]. Available: [http://www.xybernaut.com/newxybernaut/case\\_studies/PDFs/Telecommunication\\_CS.pdf](http://www.xybernaut.com/newxybernaut/case_studies/PDFs/Telecommunication_CS.pdf) [2002, July 15].
- Wrolstad, Jay. (2001, August 2). Bell Canada Spurs Wearable Computer Trend. *Wireless NewsFactor*. [Online]. Available: <http://www.wirelessnewsfactor.com/perl/story/12477.html> [2001, August 03].