3 Remaking Everyday Objects

When it is not only "us" but also our "things" that can upload, download, disseminate and stream meaningful-making stuff, how does the way in which we occupy the physical world become different?

—Julian Bleecker

When each object has a unique identity, objects begin to seem more like individuals, and individual people become susceptible to being constituted as objects.

—N. Katharine Hayles

So far we have contended, in broad terms, that software makes a difference to everyday life because it possesses technicity. In this chapter, we look at how the nature of material objects and the work they do has been transformed by code. Software, as we detail below, is imbuing everyday objects, such as domestic appliances, handheld tools, sporting equipment, medical devices, recreational gadgets, and children's toys, with capacities that allow them to do additional and new types of work. On the one hand, objects are remade and recast through interconnecting circuits of software that makes them uniquely addressable and consistently machine-readable, and thus exposed to external processes of identification and linkage that embeds them in the emerging "Internet of things" (in much the same way that the location of a web site can be looked up through its unique domain name from anywhere on the Internet, it is envisaged that this infrastructure will facilitate the same for any uniquely tagged object; Schoenberger 2002). On the other hand, software is being embedded in material objects, imbuing them with an awareness of their environment, and the calculative capacities to conduct their own work in the world with only intermittent human oversight, to record their own use, and to take over aspects of decision making from people. In so doing, our approach is one of building a taxonomy that classifies new types of coded objects as a way to start to make sense of how objects are becoming addressable, aware, and active.

Making Objects Addressable

Since the late 1970s and the widespread application of bar codes to mass-produced consumer goods, objects have increasingly become machine-readable through rapid and reliable reading of identification numbers placed on them (see figure 3.1). Such identification technologies include a range of different printed bar codes, the growing use of radio frequency ID (RFID) tags, magnetic strips, embedded chips, and transponder units which, when read and combined with appropriate information infrastructure (for identification number allocation and specifying product classification formats), can be consistently matched to information held in an organization's captabase to reveal the identity of the object and other associated properties (such as batch number, date of manufacture, and shipping history). As a result, while different instances of the same class of product would have previously shared the same bar code identifier (say bottles of whiskey), now each and every instance (bottle) is uniquely indexable and can be tracked through time and space in ways that were previously impossible. What this increased granularity of addressing means is a twofold change in the status of objects. First, the ontological status of each object is uniquely indexed. This information is knowable in new ways in terms of what information is attributable to the object, and can be generated with respect to it—ranging from purchasing information through to a detailed usage trail and eventual disposal (so it is not just *a* bottle of whiskey in a household's trash can but *the* bottle of whiskey purchased for $19.99 on 12/10/2009, at 19:54 p.m., in the Whistlestop convenience store, Downtown Crossing, by A. N. Other). Second, individuated identification transforms the epistemological

Figure 3.1
The physical manifestation of identification systems. (*a, b*) Bar codes that can be read visually. (*c, d*) RFID chips that can be queried remotely by radio signals.

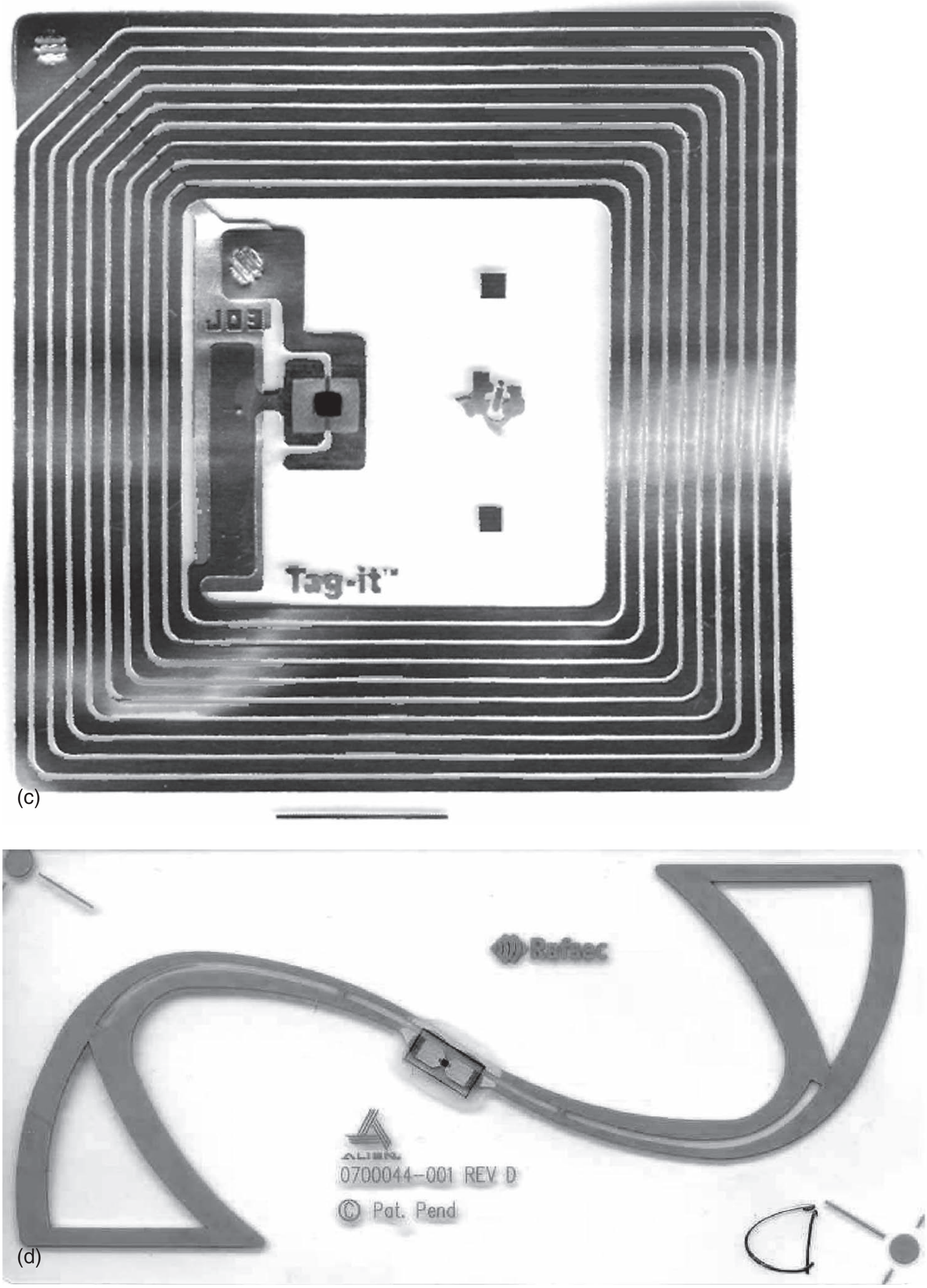

Figure 3.1
(continued)

status of each object, with it being useable in new ways and able to do additional work in the world and to be worked upon by other entities such as information systems.

There are presently two classes of machine-readable objects: passive and active (see figure 3.2), based on the technicity of the tagging technology that holds the unique identification number. Passive machine-readable objects have to be directly queried (for example, by laser scanner) to capture their identification details. In contrast, active ID tags continually broadcast their details. For example, an active RFID tag consists of a simple digital circuit into which data are embedded, an antenna which broadcasts the information, and a battery to power the unit. These tags can be read at a distance by a radio transponder, rather than having to be passed in line of sight to a laser scanner. In both cases, passive and active, the data read or transmitted is one-dimensional and invariant (typically only a unique identification code number). The object itself does not generate and communicate new capta about its status. However, because the captured information is usually transmitted through and queried across distributed networks, machine-readable objects become active constituent parts of circuits of interchange between objects, sensors, captabases, software algorithms, and work.

Let us consider RFID tags in more detail. The industry aim of RFID tags is to provide a means to automatically identify any object, anywhere. They are presently most widely used in vehicle dashboard tags for automatic toll payment (a widespread system in the United States being E-ZPass) and in livestock to facilitate "farm-to-fork" traceability given growing concerns over food safety (Popper 2007). The main application of RFID tags is likely to be in retail, where they are seen as a major advance in inventory management, the fight against shoplifting, staff pilfering, and in enhancing

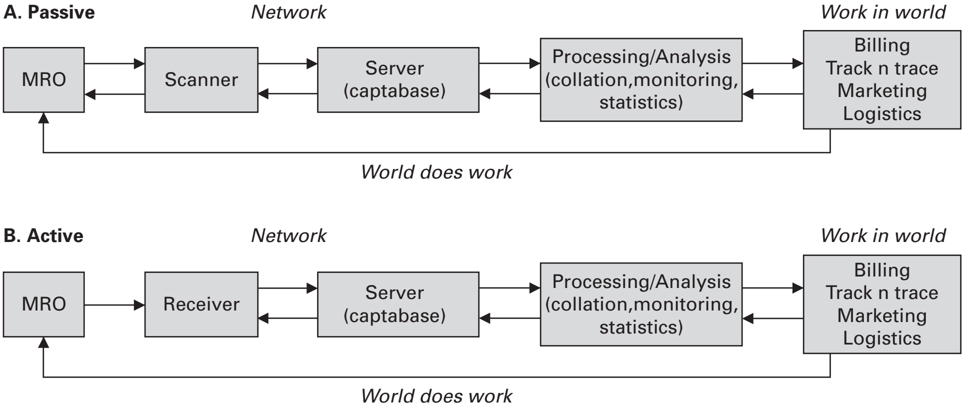

Figure 3.2
Classes of machine-readable objects.

customer profiling (Ferguson 2002) and in surveillance and security (for example, RFID tags are embedded into new passports; see chapter 5).

The leading standard with regard to uniquely coding objects with RFID tags is known as the Electronic Product Code (EPC), developed by the Auto-ID Center, an industry-sponsored R&D lab at MIT, and commercially implemented by EPCglobal Inc. (a joint venture of the Uniform Code Council and EAN International, the main players in UPC bar code management). Through EPCs, RFID tags can be linked together into a global information network—an Internet of things—which provides the means to automatically look up details on any tagged object from any location across distributed networks. Borrowing the domain name schema used on the Internet, the EPC network uses a distributed Object Naming Service (ONS) to link each EPC number to an appropriate naming authority database that provides detailed information. Importantly, the querying of the ONS as RFID tagged products move through supply chains will automatically create richly-detailed audit trails of capta. The result will be a much greater degree of routine machine-to-machine generated knowledge on the status and positioning of many millions of physical objects in time and space.

Evangelists for RFID tagging and the EPC network envision a wide range of innovations in the handling of physical objects arising from these networked capta trails (see Ferguson 2002, for typical speculation). Inside retail stores, a key aim is so-called smart shelving (units that are aware of their own stock levels and the activities of individual customers). In the home, pundits are predicting microwave ovens that check and set the best cooking settings for frozen dinners, washing machines that read the tags of clothing to automatically select the most appropriate wash cycle, and medicine cabinets able to spot out-of-date or recalled pharmaceuticals. There could also be potential for tracking goods at the end of the life cycle, alerting waste disposal collectors to items containing toxic substances, for example. Yet bound up with the promises of greater convenience and more orderly domestic routines, is the capacity to make formally hidden and unrecorded actions newly visible to external organizations and to eliminate anonymity from mass consumption because every time an RFID tag is queried it leaves behind a log. As such, RFID smart tagging raises the specter of a new frontier of potentially invasive surveillance (Albrecht and McIntyre 2005; van Kranenburg 2008; see chapter 5). It also opens up a significant debate about property rights (Hayles 2009) in that a person may legally own a material object but not possess the capta that is generated with respect to it. And such "virtualized [cap]ta about the object has market values that amount to considerable percentages of the value of the material commodities to which the [cap]ta correspond" (Hayles 2009, 54).

Regardless of their wider uses, it is likely that over the next few years RFIDs will replace bar codes on retail packaging and be embedded in all manner of manufactured goods to facilitate asset management and logistics. It is already fair to say, as we explore in chapter 9, that as part of larger infrastructures of identification and addressing, RFID


Vaillant
Th. 30.08.07
15.0 °C Outside
10:15
Auto
21.0 °C
VRC 430
+
−
(a)
37.0 °C
PHILIPS
AVENT
(b)

Figure 3.3

Figure 3.3
A range of coded objects used to solve domestic tasks of heating, health and well-being, capturing photograph memory card data, and cleaning of clothes. The presence of digital display screens is an indicator of the executive presence of software. (*a*) Thermostat (*Source*: www.vaillant.co.uk). (*b*) Pacifier with a built-in thermometer (*Source*: www.p4c.philips.com/files/s/sch540_00/sch540_00_pss_eng.pdf). (*c*) Digital camera interface. (*d*) Washing machine interface.

tagging systems have already started to reshape modes of production and the processes of capital accumulation on a variety of scales. They also pose a significant intellectual and political challenge (see chapter 5).

Coded Objects

In contrast to machine-readable goods and products which simply participate externally in the Internet of things, some objects have code physically embedded into their material form, altering endogenously their ongoing relations with the world. In such objects, software is used on the one hand to enhance the functional capacity of what were previously dumb objects, enabling them to sense something of their environments and to perform different tasks, or the same tasks more efficiently (figure 3.3), or to be plugged into new distributed networks that afford some value-added dimension such as data exchange on how they are used. On the other hand, code is used to underpin the design and deployment of new classes of objects, particularly mobile devices (such as PDAs, MP3 players, and GPS), that in some cases replace analog equivalents (diaries and date books, portable cassette tape and CD players, paper maps and guide books) or undertake entirely new tasks. In either case, the embedding of software significantly increases an object's technicity.

In thinking through the relationship between code and its embedding into objects, we have used the decision-making process detailed in figure 3.4 to subdivide coded objects into two general types based on the level of significance of software to an object's primary function(s). *Peripherally coded objects* are objects in which software has been embedded, but such code is not essential to their use (that is, if the software fails, they still work as intended, but not as efficiently, cost-effectively, or productively). *Codejects* on the other hand are dependent upon code to function—the object and its code are thoroughly interdependent and inseparable (hence our conjoining of the terms code and object to denote this mutual interdependence). Codejects can be further subdivided into three main classes on the basis of the following characteristics: their programmability, interactivity, capacity for remembering, their ability for anticipatory action in the future based on previous use, and relational capacities. In summary, these classes are hard codejects, unitary codejects, and logjects.

Hard codejects rely on code to function but are not programmable and therefore have low levels of interactivity.

Unitary codejects are programmable, exhibit some level of interactivity (although this is typically limited and highly scripted), and do not record their work in the world. They can be subdivided into two groups: (a) *closed codejects* and (b) *sensory objects* depending on whether they sense and react to the world around them.

Logjects are objects that have an awareness of themselves and their relations with the world and which, by default, automatically record aspects of those relations in logs

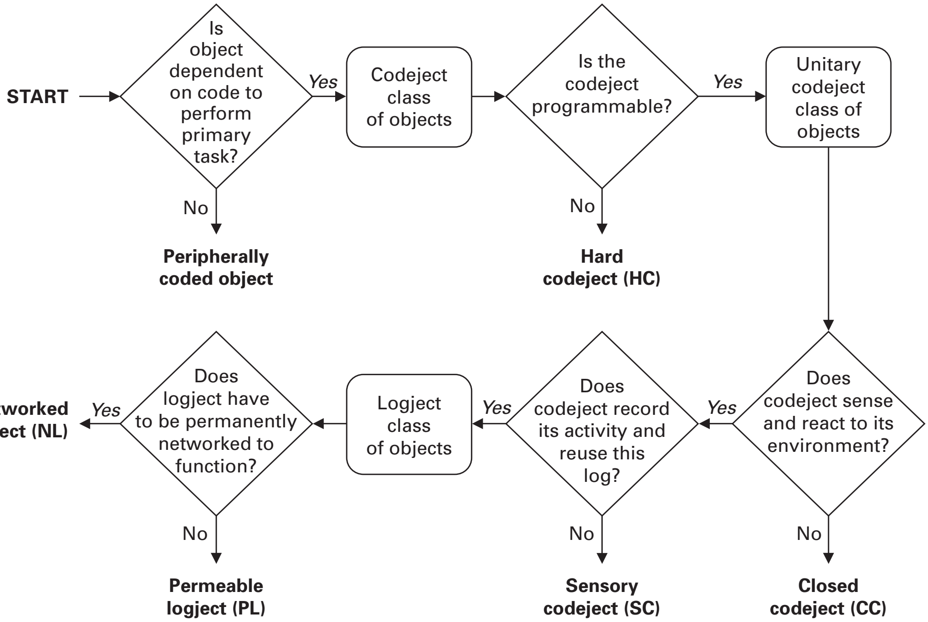

Figure 3.4

A decision tree of the characteristics of different classes of coded objects.

that are stored and reused in the future. Logjects often have high levels of interactivity and multifunctionality. Logjects can also be subdivided into two groups based on their capacity to work independently of wider networks: (a) *permeable logjects* and (b) *networked logjects*.

Peripherally Coded Objects

Peripherally coded objects are objects in which software has been embedded, but where the software is incidental to the primary function of the object. There are relatively few such objects and, in most cases, the code merely augments use, but is by no means essential to its functioning. Often, the presence of code is merely an adornment that serves the purpose of product marketing, to differentiate it from predecessors or acts as a token of added value. For example, an oven might have a digital timer embedded in it, but if this ceases to function, then the appliance will continue to cook food. Similarly, an exercise bike might have a device that digitally displays the speed at which the cyclist is pedaling, but if this ceases to work, the equipment still enables exercise to take place. In both cases, the code does little more than augment the object's use by enabling the chef to know how long a dish has been cooking and the cyclist to know the traveling speed. Both are simply digital replacements for analog technology.

Hard Codejects

Hard codejects have a special kind of software, known as firmware, embedded into them that is essential for their functioning. Firmware consists of a defined set of routines being stored permanently in read-only memory on a device, rather than being enacted through an executable program that can be accessed and interfaced with. Examples include a USB memory stick and basic SCADA (supervisory control and data acquisition) systems wherein code monitors and controls an element of infrastructure, such as a valve. Both rely on code, but its functionality is predetermined and fixed.

Unitary Codejects

Unlike hard codejects, unitary codejects are programmable to some degree and therefore exhibit some degree of interactivity; users are able to control some aspects of the object's functionality, instructing it as and when required. They, along with logjects, exhibit *liveness*—a feeling that there are infinite possibilities to explore; *plasticity*—the person interacting with the codeject feels that they can push its limits without breaking the system; *accretion*—the computation improves and evolves with use; and *interruption*—computation is open to unpredictable input and can react to it without breakdown (Murtaugh 2008).

We term them *unitary* because they are self-contained, having everything they need to function within their material form. In broad terms, unitary codejects can be divided into those that function independent of their surroundings (closed codejects), and those that are equipped with some sensors that enable the object to react meaningfully to particular variables in their immediate environment (sensory codejects).

Closed codejects can include digital clocks, and some audiovisual equipment such as radios, CD players, and DVD players. Code is vital to the functioning and performance of each of these items, but the object executes its task independent of the world around it. Each is programmable to some degree—the time can be adjusted, stopwatch operated, alarm and record times set, the order of tracks selected—but generally they have circumscribed functions and limited latitude to operate automatically.

Sensory codejects have some awareness of their environment and react automatically to defined external stimulus: common domestic examples include a heating/air conditioner control unit; a washing machine that is monitored and controlled by software; and a digital camera and storage card. The heating/air conditioning unit is equipped with a digital thermostat and timer that is aware of the time/date and senses the surrounding temperature. Simple software algorithms react accordingly to temperature measurements in relation to preset requirements. Similarly, software embedded in the washing machine will monitor multiple contextual parameters such as door lock, load weight, and water temperature, necessary for safe and effective operation without human oversight (see table 3.1). The digital camera captures an image of the

Table 3.1
Hotpoint washer-dryer error codes that are displayed by software to the user

Fault codes for LCD EVO1 Washing Machines and Washer Dryers
* F01—Short circuit motor triac—Book a washing machine repair.
* F02—Motor jammed tacho detached—Book a washing machine repair.
* F03—Wash thermistor open/short circuit—Book a washing machine repair.
* F04—Pressure switch jammed on empty—Book a washing machine repair.
* F05—Pressure switch jammed on full—Book a washing machine repair.
* F06—Program selector error—Book a washing machine repair.
* F07—Heater relay stuck—Book a washing machine repair.
* F08—Heater relay cannot be activated—Book a washing machine repair.
* F09—Incompatible eeprom—Book a washing machine repair.
* F10—Pressure switch not sensing correctly—Book a washing machine repair.
* F11—Pump cannot be activated—Book a washing machine repair.
* F12—Communication error—Book a washing machine repair.
* F13—Dryer fan or dryer thermistor faulty—Book a washing machine repair.
* F14—Dryer element faulty—Book a washing machine repair.
* F15—Dryer element relay faulty—Book a washing machine repair.
* H20—Not fillings. Check tap, hose and inlet valves.
* LOCKED—Check interlock—Book a washing machine repair.

Note: These codes give a partial indicator of the range of conditions that the appliance's software monitors.
Source: Hotpoint Service web site "Error Messages and Error Codes," www.hotpointservice.co.uk/hs/pages/content.do?keys=FAQ:ERROR_CODES

world using a CCD sensor and measures light levels to adjust the aperture setting and the lens movement for auto-focusing, as well as monitoring the remaining battery life and available storage space.

Logjects

Logjects differ from unitary objects in that they also record their status and usage, and, importantly, can retain these logs even when deactivated and utilize them when reactivated. In key ways, these logs can have a bearing on the ongoing operation of the object and its relations with people or wider processes. Furthermore, part of their functionality is externalized, lying beyond the immediate material form of the object.

We derive the term *logjects* from Bleecker's (2006) notion of a blogject (where for us a blogject is one type of logject). Bleecker defines a *blogject* as an emerging class of software-enabled objects that generates a kind of blog of its own use and has the capability to automatically initiate exchanges of socially meaningful information—"it is an artifact that can disseminate a record of experience to the web" (Nova and

Bleecker 2006, no pagination). Bleecker (2006, 6, original emphasis) characterizes blogjects as objects that: (1) can "track and trace where they are and where they've been," (2) "have self-contained (embedded) histories of their encounters and experiences" (rather than indexed histories), and (3) "have some form of agency—they can foment action and participate; they have an assertive voice within *the social web*." Blogjects are things that can do meaningful social acts where their actions shape how people think about and act in the world; they "participat[e] within the Internet of social networks" (Bleecker 2006, 2). Here, Bleecker is very much interested in only a certain kind of software-enabled object, those that produce streams of information very much like a blog written by a person, thus contributing to the "ecology of networked publics—streams, feeds, trackbacks, permalinks, wiki inscriptions and blog posts" (Bleecker 2006, 9). He is very careful to delineate blogjects as political actants that contribute to debates by providing socially meaningful information, rather than being coded objects that log their use and communicate and/or analyze that data across distributed networks.

While Bleecker's notion of a blogject has conceptual utility, for us, it is one form of a logging object in a much larger sociotechnical ecology of logjects. We broadly define a logject as an object with embedded software able to monitor and record, in some fashion, its own operation. More specifically, and expanding on Bleecker, a logject has the following qualities:

- It is uniquely indexable.
- It has awareness of its environment and is able to respond meaningfully to changes in that environment within its functional context.
- It traces and tracks its own usage in time and/or space records that history, and can communicate that history across a network for analysis and use by other agents (objects and people).
- The logject can use the capta it produces to undertake what we have previously termed automated management (Dodge and Kitchin 2007a)—automated, automatic, and autonomous decisions and actions in the world without human oversight and to effect change through the "consequences of their assertions" (Bleecker 2006, 9).
- A logject is programmable and thus mutable to some degree (that is, it is possible to adjust settings, update parameters, and download new firmware).

Logjects then enable the kinds of unobtrusive machine-to-machine, machine-to-person, and person-to-machine exchanges that are a fundamental trait of pervasive computing and are diverse in nature.

Permeable Logjects Permeable logjects consist of relatively self-contained units such as an MP3 player, a PDA, and a GPS, all of which have the potential to be connected to wider networks. Such devices trace and track their usage by default, recording this capta as an embedded history; are programmable in terms of configurable settings and creating lists (for example, they play lists of songs, keep calendar entries, and provide route itineraries); perform operations in automated, automatic and autonomous ways; and engender socially meaningful acts such as entertaining, remembering an important meeting, and helping an individual to travel between locations. These devices work to relieve the cognitive burden of routine tasks on people who use them, and help to reduce the risks and consequence of unexpected events. Unlike a networked logject, all essential capacities are held locally, and primary functionality does not require a network connection to operate. That said, appropriate capta (such as music, calendar entries, or map files) and software must be downloaded onto the machine at some point; hence they are permeable. These devices can be connected to wider networks in order for information to be uploaded and exchanged with other devices (via Bluetooth wireless transmission, for example) and updates in firmware can be downloaded, though typically this is not automatic and sometimes requires considerable human intervention (what might be classed as digital housework, for example, syncing a PDA or MP3 player). The uploaded information can be processed and analyzed in relation to other usage, thus providing added value. The aggregate social significance of such objects is impossible to estimate, but they are used to solve all manner of domestic problems billions of times a day, often without the active awareness or involvement of people.

Networked Logjects Networked logjects do not function without continuous access to other technologies and networks. In particular, because they need constant two-way data exchanges, they are reliant on access to a distributed communication network to perform their primary function. Such logjects track, trace, and record their usage locally, but because of memory issues, the necessity of service monitoring/billing, and in some cases a user's ability to erase or reprogram such objects, their full histories are also recorded externally to an immediate material form. Some networked logjects are relatively fixed in the environment (satellite/cable television control boxes, home security monitoring systems) and others are inherently mobile (cell phones, vehicles with remote monitoring) that use a range of communication technologies such as GSM, Wi-Fi, and Bluetooth to maintain a network connection. Mobile networked logjects continuously search for connectivity and can respond automatically and autonomously to the network conditions. For example, a cell phone reacts automatically to incoming calls by sounding the ringtone, switches to the answer service if the call is unanswered, and alerts the owner that a call was missed and/or a message is waiting.

Objects Become and Do Other Things

Reflecting on this taxonomy, and the ways in which objects are becoming either externally machine-readable or endogenously coded, it seems to us that the nature of many objects and the material processes that constitute everyday life are being remade in quite radical ways—objects are being alternatively reconfigured and defined, they are gaining additional capacities to do additional work in the world, and the world can do more work on and through them. Individual objects are now knowable in new ways—they are uniquely identifiable and their use and movement is trackable across space and time. They are becoming part of the emerging Internet of things. Objects thus gain capta shadows that can be analyzed for emergent properties, with new knowledge of the life of an object used to refine the system through which it is made, distributed, sold, and potentially used. And importantly, such capta can be processed to anticipate potential future activities.

Let's explore the example of the archetypal machine-readable object: a credit card. A credit card has a machine-readable unique identifier embedded in its chip and/or magnetic strip. Functionally, it is a conveniently-sized material token used to authenticate access to transaction records in financial captabases. The card can be enrolled by software into a secure communications process with the financial captabase through an intranet, which also tracks spending across time and space and is increasingly subjected to real-time analysis for fraud detection. The capta gathered from the card can also be aggregated to provide an individualized spatial history of consumption. In turn, a plethora of other material objects and sociotechnical infrastructures have been built around it (from the design of ATMs and card readers, online baskets, and SSL encryption, through to the mundane shape of wallets). Through its membership of the Internet of things, the credit card does work in the world—enabling the purchasing of goods and services more securely and efficiently than in previous incarnations, and it is also worked upon, with the information concerning usage employed to evaluate credit levels and anticipate future risk; to monitor purchases in real time for potential fraud and regulate the amount of spending for accurate billing; as well as feeding some of the capta into wider marketing profiles and geodemographics models (Burrows and Gane 2006; Leyshon and Thrift 1999; see chapter 9). Importantly, it can legally, and through social convention, now hold a measure of trust that allow actions at a distance that are replacing embodied transactions (Lyon 2002).

Now let us examine the example of a codeject: a cell phone. A cell phone is wholly dependent on software to function; without the ongoing updates of code it cannot work; it is an inert piece of plastic and other materials. Software enables the phone to act as a traditional phone, but to also undertake a range of additional functions such as the sending and receiving of texts, music, and other information; connecting to the Internet; to take and send photos; act as an alarm clock or calendar or a radio or a recorder or a calculator; to play games; to store phone numbers, images, and other files; and so on. It enables the phone to be customizable, selecting ring tones, wallpaper, profiles, and connectivity type. In other words, a cell phone enables its user to do a range of different activities. And fundamentally it allows the user to do all of these things on the move, rather than being tethered by a cable. It has become so ubiquitous and embedded into everyday life for so many people that it is easy to overlook the power of such a spatial reconfiguring in a very short span of time (Rheingold 2002; Townsend 2000; Schwanen and Kwan 2008).

Just as the phone performs work in the world, it is performed upon. Calls, texts, and other information are received, logged, and stored, and capta about usage by the customer is used to monitor service uptake and generate bills and customer profiles. The radio signal also pinpoints the location of phone, which generates spatial capta that can enable all manner of interesting analysis of activity patterns (Ratti et al. 2006) as well as continuous tracking and spatial surveillance (Dobson and Fisher 2003). And like the credit card, a plethora of other physical objects (phone holders, hands-free kits) and infrastructure (such as the tens of thousands of new antennas erected in the last decade) have been built around it, as well as other cultural products and practices such as ringtones, gaming, and web sites for downloads and payments.

Significantly, both the credit card and the cell phone work across a distributed network. If an object is connected into a distributed network, it can be worked on from a distance or it can conduct additional work across the network both in relation to other objects and people. Table 3.2 provides other examples of the changing ways in which objects and people interact and work together at a distance. In all cases, the status and function of an object and the system it resides in has been reconfigured in new ways through the enrollment of software.

Conclusion

In this chapter we have started to document various kinds of coded objects, their emerging characteristics, the work that they do in the world, and how their changing state alters their nature. Machine-readable and coded objects are having a profound effect on sociospatial contours of lives, although often in subtle and banal ways. They augment, supplement, and facilitate people in their daily tasks and routines. They constitute the means by which most people come directly into contact with software. Almost stealthlike, they have seeped into the fabric of social environments and workplaces forming what Thrift (2004b) has termed a "technological unconsciousness." For example, as chapter 8 details, the typical Western household has a growing constellation of coded objects on which it relies for entertainment, communication, and domestic tasks. And yet there has been very little serious academic appraisal of what the creation of the machine-readable and coded object means, both philosophically and practically, for everyday life. As such, we feel that coded objects demand further attention as key, future actants.

Over time, as we become more and more reliant on such objects, there will be a need to more fully examine their nature from an ontological and epistemological

Table 3.2

Coded objects working across distributed networks

Machine to machine	
Cargo monitoring	A telemetric GPS unit on a high-value cargo vehicle communicating its location at regular intervals to a monitoring station
Vending machine	A vending machine communicating its stock levels to a central computer at the end of a day
Health care	Health care monitoring equipment, such as a cardiac monitor or dialysis machine, communicating a patient's status to a medical database
Vehicle services	Automated updating of a vehicle's navigational system to incorporate up-to-date information, such as road construction and weather forecasts
Machine to person	
Remote patient monitoring	A cardiac monitor alerting a physician if the patient's condition suddenly deteriorates, enabling an emergency response
Vending machines	A cellular-enabled vending machine requesting attention from a technician in the case of a technical fault
Driver services	A traffic information system alerting a GPS system that alerts a driver in the event of an accident on the driver's known route
Car rental	A telemetric GPS unit in a rental car alerting the rental company if it was driven outside of its permitted boundary
Person to machine	
Traffic management	Remotely reconfiguring the timing for a traffic signal, allowing traffic patterns to be quickly altered
Vending machines	Changing prices on a vending machine without requiring a site visit
Vehicle services	A key fob remotely unlocking a car door; or turning on the air conditioning in a car before the owner arrives
Maintenance	Conducting remote diagnostics and maintenance on an object, saving the technician a visit to the site

Source: Adapted from Deloitte Research 2002, 7–8 point of view and to tease out the difference they make across a number of domains such as home, work, and public space, and to fundamental spatial processes such as communication and travel. For us, this will need to entail the construction of detailed ethnographies of the development, use and networking of different kinds of coded objects; how they are placed into and become key actants in complex actor-networks; and how they work in diverse conjunctions with people to realize a multiplicity of social processes and spatialities. In the following chapters, we argue that the coding of objects makes a difference in the world because they have additional capacities to modulate the transduction of space and also enable new forms of governance, as well as enabling creativity and empowerment. We provide examples of the difference such objects make in part III, and in chapter 10 we discuss the possibility that a proliferation of such objects will constitute a state of everyware.