Obsolete peripherals: the ghost of the machine?

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Abstract: It is a commonplace that many products we buy bring along with them a range of both material and immaterial 'add-ons', some of which are obligatory, some necessary, some welcome and others unwanted. They are often unexpected, as many of these additional elements do not feature in advertising for products, in their retail display, or on packaging. Such 'add-ons' extend the notion of a product into an extensive series of material, economic, social and often quasi-legal relations. This paper considers these 'peripherals', especially as they relate to computer based consumer products, in relation to excess, obsolescence, and waste.

Introduction

The term 'peripheral' is strongly identified with 'add-on' devices that support computers. One definition offers

> *"…electronic equipment connected by a cable to the Central Processing Unit (CPU) of a computer"* (WordBook, 2014).

This starting point is both useful and limited. For example, power cords, charging docks and cradles, are not defined as peripherals, as they are not connected to the CPU. However, it is surely worth considering their status and contribution to both waste streams and domestic clutter? Conversely, increasing numbers of peripherals connect to a CPU without cables; technologies including Infrared, Wi-Fi and Bluetooth provide the connection. There are other anomalies and I offer these elaborations and observations.

The expanding realm of 'computer' peripherals

Peripherals used to be mainly devices for getting data out of computers—for storing, printing, and sharing. Increasingly, peripherals are also used for getting data in—from CDs and DVDs, the Internet, SD cards. External disc drives, card readers, docking mechanisms for music players, connectors for digital cameras, etc., have increased the number and range of such peripherals.

More peripherals in routine use are 'wireless': no physical cable connects directly to the computer, rather, Wi-Fi, Infrared, and Bluetooth, 'stream' data between devices. However, these peripheral devices are still connected to, and dependent upon, the computer's CPU. Moreover, many of these peripherals connect by cables elsewhere—to wireless routers and Internet modems. They may also connect, wirelessly or otherwise, to other computer-like products that contain computer processors, for example, gaming platforms. Additionally, many peripherals now themselves contain powerful computer processors, such that functions multiply (the printer, copier, scanner) and such that some 'independence', from the central CPU, is evident. However, there has also been an increase in highly dependent peripherals. For example, a DVD/CD drive, whether externally powered, or powered by the computer, has no function when not connected. It becomes an inert object.

A computer connected by cables to functionally dependent devices no longer captures the concept of peripherals. Instead, there is a complex arrangement of physically and wirelessly connected devices, characterised by both functional support and independence. Peripherals have their own peripherals and it becomes increasingly difficult to isolate and clearly define the 'leading' products from peripheral additions.

For example, the laptop, on which I am writing this, has eight ports and, at any one time, could connect as follows:

1. One USB port to a USB stick, either to back up files or to copy them to the computer
2. One USB port to an inkjet printer
3. The Ethernet port to my work telephone system
4. One Thunderbolt port to my mobile phone for charging
5. The second Thunderbolt port to a portable DVD drive as my computer does not have one built in
6. The 3.5 stereo jack port to a pair of headphones
7. The HDMI port, via a cable, to computer monitor so that I can 'mirror' my work on a larger screen
8. The SD card slot to a SD card containing digital photographs ready for importing.

However, there are more connections: my laptop is also connected via Wi-Fi to an extensive network of peripheral devices displaced in space; my workplace shared drives for file storage, the internet and email services; to the *Dropbox* servers through which I 'sync' my work across devices; to the *iCloud* servers through which *Apple* deliver much of their proprietary content; and to the *Backblaze* servers which back up my data.

Many of these additional elements—USB sticks, SD cards, headphones, etc.—are advertised as 'accessories' rather than peripherals. This implies that their consumption is voluntary rather than necessary. This might be strictly the case, however, these products are not marginal gewgaws, rather, they are increasingly necessary and integral—at least to the meaningful experience that the 'core' product is promoted as generating.

Given such complexity, there cannot be an overarching 'theory' of peripherals: there is too much variation between them, and too little in the way of an unambiguous definition. However, we might arrive at a rounded perspective and, through considering one common peripheral, the inkjet printer, we can see how peripherals relate to discussions concerning product durability, obsolescence and waste.[1]

Peripheral commodities

Given their subservient role, it is easy to forget that peripherals spring from the same consumer culture as the products they serve: they are all conceived, designed, developed, manufactured, and are themselves commodities with all the attendant concerns of resource depletion, manufacturing methods, sustainability, and matters relating to packaging, distribution, transport, retail display, marketing, etc. Indeed, there are three 'stages' that deserve attention; first, the conception, design, manufacturing, and retailing of peripherals; second, peripherals in use, including energy consumption, efficiency, pollution, elaboration of functions, and durability; third, what happens to peripherals when they are no longer in use, including obsolescence, methods of disposition, and waste: just as with any commodity.

However, peripheral devices exhibit some differences from many of the mainstream consumer products they support: they tend towards being generic, such that one printer will work with most makes of computer, and operating systems; technological innovations tend to lag behind those of the products they support, their turnover is often less rapid—in terms of both their product cycles and the acquisition-disposal cycles of individuals and institutions (Gabrys, 2011, Grossman, 2014).

Peripherals and obsolescence

Peripherals are subject to the same processes of obsolescence as the products they serve, and there have been several attempts to classify and describe these various types of obsolescence, including the planning of obsolescence as a means to drive repeat consumption and replacement (Burns, 2010; Maycroft, 2009a; Packard, 1963). Peripherals exhibit 'economic' obsolescence (Burns, 2010): many electronic goods, and their peripherals, are simply too expensive to repair, upgrade or engineer consumption (Collinson, 2014; Robinson, 2013).

[1] Inkjet printers, and their own dependent additions, particularly printer cartridges, have also featured as one of only a small number of public scandals concerning forced consumption and waste, such has been the obviousness of attempts to use them to

reuse. The falling use and price of inkjet printers, for example, has made repair far more expensive than replacement. Moreover, peripherals are increasingly marketed as not just being 'disposable' but as disposable and this applies to increasingly complex products. Inkjet cartridges, for example, many of which contain a microchip, are promoted as disposable, and upwards of two billion have so far been dumped in landfills, at a rate of 50 million a year in the UK alone (Collinson, 2014). This further drives the view of the parent printers as disposable: so successful have been industry efforts to build various kinds of obsolescence into inkjet cartridges that it often cheaper to buy a new printer than to replace cartridges (Robinson, 2013).

Stylistic obsolescence also marks peripheral design and promotion. Printers, routers, Wi-Fi stations, disc drives, USB sticks, and so on, all undergo regular aesthetic redesign, often alongside technical changes, but often without: for example *Apple* redesigned the shape of the connectors on their VGA cables from a rounded shape to a square one, as part of the redesign of other computer products and operating systems. Of course, that *Apple* offers its own cables and connectors in white not only make a strong branding statement, it invites consumers to consider the aesthetic coherence of their computers and peripherals. This example also shows how 'deep' into the chain of peripheral and add-on products fashion now extends[2]. Our featured inkjet cartridges, however, provide little scope for fashion-driven obsolescence; hence the efforts of manufacturers to make them drivers of repeat consumption in other ways.

Technological obsolescence dominates the marketing of electronic goods and their peripherals, and we can see both 'natural' technological obsolescence (the consequence of technological innovation) and 'planned' obsolescence which is designed to encourage, foster, and engineer repeat and replacement consumption. So, while many inkjet printer cartridges have been made smaller over the past decade, the corresponding amounts of ink supplied have decreased at a greater rate: some contain only a quarter, or even an eighth, the amount as their previous versions[3]. This pushes consumers towards both repeat purchases and increased disposal. Other technological 'innovations' also help engineer more consumption of cartridges, often as means to recoup revenue lost through falling printer sales (which continue to fall despite tumbling prices). These 'fixes' include bundling colour ink cartridges so that, when one colour runs out, all cartridges need replacing; the use of encryption technology (using yet more computer chips) such that non-branded cartridges will not work; elaborate designs which make the refilling of cartridges very messy at best and impossible at worst. Many cartridges are also incompatible across both brands and ranges within brands, despite them often being made by the same parent company. These 'innovations' have taken place against a background marked by the functional development of the printer—into scanner, film scanner, photocopier, and even fax[4]. Such elaboration, while offering many advantages to consumers, increases the number of associated peripherals and consumables—paper feeds and trays, film negative holders, etc.

Peripherals and e-waste

Peripheral products, components, cables, and connectors contribute significantly to various waste streams. Many small components—cables, chargers, plugs, storage media—tend to be disposed of in domestic waste streams (even though the disposal of some may be prohibited), often after a period of domestic 'storage' which lags behind disposal of the product they supported (Cwerner & Metcalfe, 2003; Maycroft, 2009b). Larger peripherals, especially in the context of the huge numbers associated with much institutional consumption,

[2] There is a further aspect of stylistic obsolescence that marks electronic goods and their peripherals significantly: their promotion and reception as objects that do not exhibit the marks of wear and tear favourably. There is no valued patina that belongs to electronic products (Burns, 2010).

[3] This is because the size of the sponges and ink tanks inside, which hold the ink, have been progressively reduced over the years—at a greater rate than the overall size reduction of the cartridge. This leaves a significant amount of empty space.

[4] The fax machine, and its associated paraphernalia, provides a good example of 'social' obsolescence that occurs when society as a whole moves away from a particular habit or behaviour, leaving a tide of associated material detritus (Burns, 2010).

may be disposed of through more formal, regulated processes.[5] Even here, however, they tend not to have featured strongly in recent research, for example in relation to the problems associated with the disposal of bulky items (Defra, 2011). Moreover, their 'value' for recyclers is low as they do not contain the valuable circuit boards and precious metals found in computers. In the US, for example, only five of twenty-three states include printers in mandatory recycling programs (Grossman, 2014).

The problems of pollution, dangers to health, global dumping, and so on all apply to peripherals as to their parent products. These have been well documented (Maxwell & Miller, 2012). Peripherals present some additional challenges; some being too small to effectively disassemble are just dumped, others are dumped because they lack valuable materials (Preton Ltd, 2010). Many peripherals have also escaped the scrutiny associated with the production of regulatory frameworks. Yet, the volume of such peripherals that has been disposed of, or is due to enter waste streams, is enormous (US EPA, 2009). Huge quantities of materials are spread across an immeasurable number of discrete but 'valueless' objects: unlike computers themselves, for example, in which discrete and valuable materials are contained within measurable and distinct units.

Conclusions

While compatibility with host devices has improved, we continue to consume ever more peripherals due to the need to 'service' more products and new categories of products. New categories of electronic goods, with their attendant peripherals, are intensively developed and heavily promoted. Currently, various Global Positioning System (GPS) devices and 'smart' watches are prominent. These represent increasingly energy intensive manufacture of ever smaller devices, the scale and specificity of which, let alone that of their peripherals, often rules out design for disassembly, repurposing, effective recycling, 'upcycling', and the like.
Cooper argues,

> *"there is a distinct lack of firm evidence that product improvement alone will be sufficient to steer the economy onto an environmentally sustainable course"* (2013, p. 143).

Indeed, we have no real criteria for guiding the designing of 'improvement' into such products and their peripherals. Nonetheless, design approaches promoting repair, reuse, recycling, compatibility, and standards would help alleviate many of the problems discussed above. A conscious move from Life Cycle Analysis to Life Cycle Design, with its focus on the materials of design, is advocated as an approach that can accommodate these principles (Vezzoli, 2014).
Solutions aimed at unused and waste peripherals might include 'take back' programmes: here, stronger regulatory control and coverage might provide the framework, for example, by expanding producer responsibility legislation to cover peripheral.[6] More protective consumer legislation might also be provided via warranties and guarantees (see Moles, 1985, for the most 'comprehensive' treatment) Apart from professional recycling, some small peripherals might lend themselves to vernacular reuse or recycling (Bramston & Maycroft, 2014). We might also envisage more novel approaches, product 'amnesties' or appeals, for example.[7]

There is, however, a large amount of e-waste, including peripherals and components that end up in landfill. Even those who live by scavenging on the world's dumps have no interest in recovering all waste materials. For example, when reclaiming copper from cables, usually by open burning, whatever is on the end of the cable (connectors, 'mice', plugs) is simply cut off and dumped. These bits and pieces, to quote Gabrys, "…accumulate into a sort of sedimentary record" (2011, p. vi). Esoteric solutions include dump mining, and bacterial

[5] Institutional disposal accounts for around 75% of all electronic waste sent for recycling and refurbishment (Grossman, 2014).
[6] The extension of legislation would, however, have to rest on a definition of peripheral; drawing attention to this lack of certitude might in itself be a useful exercise.
[7] As a child, I well remember the annual appeals launched by the BBC children's television programme 'Blue Peter'. These appeals, for small, unwanted items, for example unused keys, buckle, and in recent years mobile phones and CDs/DVDs, would be used to fund charity projects.

breakdown, but, as yet, this sediment of electronic and plastic defies our ability to reclaim it (or to stop it becoming such sediment). This left over peripheral matter; in the ground, in storage, and in domestic clutter, we might regard as 'the ghost **of** the machine'.

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