

# Debris

## The detritus of digital media technologies

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### ABSTRACT

This paper describes the artwork *Debris* (2021) and examines the impact of consumer electronics and digital media as electronic waste (e-waste) in environmental pollution. E-waste is in part motivated by planned obsolescence, a model for designing consumer electronics and digital media technologies to shorten their functional time period. The materiality of digital media as e-waste is explored in the installation *Debris* by repurposing found e-waste in an assemblage of broken hardware together with sound and a browser-based game. The assemblage becomes an autonomous device that reacts to the environment's light intensity to generate noise. As part of the assemblage, the game visualises the exponential growth of e-waste where the player has to survive planned obsolescence. *Debris* aims to raise awareness of the aggravating effects of e-waste on the environment.

### CCS CONCEPTS

• **Applied computing** → Arts and humanities; Media arts; Arts and humanities; Fine arts; Arts and humanities; Sound and music computing.

### KEYWORDS

Electronic Waste, Environment, Digital Culture, Materiality, Sound Art, Planned Obsolescence, Game, Media Archaeology

### ACM Reference Format:

Pedro Ferreira. 2021. Debris: The detritus of digital media technologies. In *10th International Conference on Digital and Interactive Arts (ARTECH 2021), October 13–15, 2021, Aveiro, Portugal, Portugal*. ACM, New York, NY, USA, 4 pages. <https://doi.org/10.1145/3483529.3483737>

## 1 INTRODUCTION

The proliferation of consumer electronics and the consumption of digital media devices in the last decades has caused electronic waste (e-waste) to grow exponentially. The majority of e-waste is not properly disposed of or recycled which has several environmental implications. E-waste contaminates the soil and groundwater with chemicals such as lead, lithium or mercury, it pollutes the air through incineration and the sea through garbage dumping; in all, it damages ecosystems, animal and human health. The growth

of e-waste is in part motivated by planned obsolescence, a model for designing consumer electronics and digital media gadgets to shorten their functional time period. The devices are manufactured to break easily, are difficult or impossible to repair, and become outdated in a short period of time. This unsustainability of current digital media technologies is addressed in the installation *Debris* (2021).

This article starts by examining the shift in computation to computational media allowed by the development of object-oriented programming. It then focuses on the materialities of consumer electronics and digital media manifested as e-waste. Subsequently, it presents the artwork *Debris*, an installation inspired by the aesthetics of discarded electronics and digital media waste mixed with the environment. The artwork repurposes e-waste through an assemblage of discarded media with sound and a browser-based game. The article concludes by making a plea for alternatives to the current state of consumer digital media, for a future with sustainable technologies.

### 1.1 Computation and computational media

In cities like Berlin, e-waste often lays on the streets, sometimes still functional, as part of the urban landscape. Within natural landscapes e-waste is less common. However, to my surprise, I found a dump of e-waste as I rode my bike in the mountains of the small town where I grew up in Portugal. Among floppy disks, cassette tapes, and computer monitors, I found a media artefact that I had never seen before but immediately recognized its decaying label: “Smalltalk” one of the first object-oriented programming (OOP) languages developed in 1972 by the pioneer computer scientist Alan Kay and his Learning Research Group at Xerox's Palo Alto Research Center.

Throughout World War II, before OOP, computers were programmed mainly by “young women with some background in mathematics” [1] using machine code and assembly language. Then, in the late 1950s and early 1960s with the development of higher-level programming languages such as FORTRAN, ALGOL or BASIC, and, in the early 1970s, such as Pascal, C, SQL and Smalltalk enabled “automatic programming” or what is known as “programming” nowadays:

Automatic programming is an abstraction that allows the production of computer-enabled human-readable code—key to the commodification and materialization of software and to the emergence of higher-level programming languages. This automation of programming—in particular, programming languages—makes programming problem- rather than numerically oriented. Higher-level programming languages, unlike assembly language, explode one's

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ARTECH 2021, October 13–15, 2021, Aveiro, Portugal, Portugal

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ACM ISBN 978-1-4503-8420-9/21/10...\$15.00

<https://doi.org/10.1145/3483529.3483737>

instructions and enable one to forget the machine. They enable one to run a program on more than one machine—a property now assumed to be a “natural” property of software. [1]

This property transformed the computer from a universal calculator machine of lower-level programming into a universal computer medium of higher-level programming that allowed the emergence of computational media. Alan Kay became “the first computer scientist to vocally promote computation as a medium.” [2] Kay used the metaphor of “human-computer symbiosis” [3] envisioning computational media as a “metamedium” capable of simulating previous media and able to create “not-yet invented media.” [4] Kay proposed a personal computer that could be used by anyone, the *Dynabook* (1972), which remained a concept, but its software was fully developed using Smalltalk. It included tools for painting and drawing, music composition, word processing and font editor, just to name a few. However, its hardware was never built. Computers were not yet the portable small machines that fit in one’s pocket—like the devices we have today. Nonetheless, computational media were already envisioned as devices that would not be limited to computer engineers and scientists but accessible to anyone, including children. This influenced not only the development of the personal computer and graphical user interface but entirely restructured programming. Consequently, OOP became the norm for digital computing which allowed “computation to become such a rich and engaging medium” [2] enabling the emergence of consumer digital media technologies.

## 1.2 Digital media (im)materiality

Digital media technologies, such as laptops, smartphones or tablets, draw on many of Kay’s innovations for computational media. However, the main difference is that the majority of the present digital media devices do not pursue the concept of a personal computer as a meta-medium that allows users to creatively develop “not-yet invented media,” enables children to learn easily computer programming or lets users modify and build new software from “already-written general tools.” [4] Instead, today’s digital media gadgets seem to trap users in proprietary exclusive software or apps that cannot be modified, let alone grasp their infrastructures.

The media fossil of Smalltalk that I found in the mountains serves as a reminder that even software relies on material components. The scholar and media theorist Friedrich Kittler writes that there is no software, “because software does not exist as a machine-independent faculty.” [5] The material effects and consequences of digital media can then be traced not as software, an immaterial component that enables “one to forget the machine,” [1] but as software embodied in hardware, that becomes noticeable and materialized in “electronic waste, chemical contamination, failure, breakdown, obsolescence, and information overload.” [6]

## 2 THE CONSTELLATION OF DIGITAL MEDIA MATERIALITY

Discarded electronic devices, or e-waste, contribute to the contemporary ecological crisis by generating environmental pollution that is hazardous for ecosystems, animals and human health. E-waste is in part a by-product of planned obsolescence, which by

design limits the longevity of consumer electronics and digital media gadgets. Garnet Hertz and Jussi Parikka describe contemporary planned obsolescence as the state of technological objects that “are designed as a “black box”—not engineered to be fixable and with no user-serviceable parts inside.” [7] Recent research is paying closer attention to the environmental impacts of consumer digital media. Books such as *Electronic Rubbish* (2013) written by Jennifer Gabrys, Jussi Parikka’s *A Geology of Media* (2015) and *Finite Media* (2016) by Sean Cubitt analyse extensively the many environmental effects of producing, manufacturing and maintaining consumer electronics and digital media technologies as well as their disposability.

In *A Geology of Media*, Parikka addresses media materiality and the deep time of media in relation to the mining of finite raw materials that allow the manufacturing of digital media technologies, such as “rare earth minerals essential to computers and in general advanced technology industries from entertainment to the military.” [8] In addition to the mining of rare earth minerals, Parikka writes that the manufacturing of consumer gadgets such as the iPhone is only possible because of “dubious labor practices, including child labor in the mines of Congo; the appalling working conditions, which lead to a number of suicides, in the Foxconn factories in China; and the planned obsolescence designed into the product.” [8] After the short iPhone’s functional time span,

“the device becomes part of the materiality of e-waste, leaking environmental hazards into nature through river dumping or incineration. In the latter, the burning produces toxic vapors that attach to the nervous system of underpaid laborers in China, India, and Ghana.” [8]

The scholar Sean Cubitt points out that “digital media are responsible globally for seven kilos of waste per person per year, totalling 50 million tons in 2012.” [9] More recently, in 2019 a new record of e-waste was achieved—53.6 million metric tons (Mt), of which only 17.4% was officially documented, properly collected and recycled. [10] According to the Global E-waste Monitor 2020 report,

approximately 53.6 million metric tons (Mt) of e-waste (excluding PV panels) was generated, or 7.3 kg per capita. It is estimated that the amount of e-waste generated will exceed 74Mt in 2030. Thus, the global quantity of e-waste is increasing at an alarming rate of almost 2 Mt per year. [10]

In addition to the increase of e-waste, Cubitt claims that the production of a digital culture and the logistics of “digital equipment now uses at least as much energy as the air-line industry.” [9] According to Greenpeace, IT companies rely heavily on non-renewable energy sources, such as coal, to power cloud computing. [11] Therefore, the impact of digital media technologies on environmental pollution is part of a wider constellation of digital media materialities, which includes carbon footprint, electricity, mining, unfair labour, planned obsolescence, e-waste and other residues such as dust from “polished iPads as well as attached to workers’ lungs from coal mines to contemporary factories of information technology.” [8]

### 3 DEBRIS

The urgency to deal with the environmental impact of increasing e-waste, in part due to planned obsolescence, is the main subject for the artwork *Debris*. The on-going project *Debris* repurposes e-waste found on the streets of Berlin, Germany, and broken smartphones donated by individuals. It creates an assemblage of sound and broken hardware together with a browser-based game which visualises the exponential growth of e-waste. The game can be played on a repurposed smartphone as part of the installation or by scanning a QR-code. [12]

#### 3.1 Repurposing discarded media

*Debris* aims to provoke awareness of media materiality by following a “critical making” methodology for its production which gives “emphasis on critique and expression rather than technical sophistication and function.” [13] The installation repurposes found e-waste, such as broken hardware components from TVs and smartphones, as raw material to create an assemblage. The assemblage (Figure 1) is an autonomous device and reacts to the environment’s light intensity in order to produce sound. This is done by four oscillators that generate noise to give expression to broken media, highlighting the components of black boxes and their materiality. The sound can also be manipulated by the audience’s interaction through gestures as they discover the photocells and interact with the assemblage.

#### 3.2 Can you defeat planned obsolescence?

Through a playful and fast-paced gameplay, the browser-based game (Figure 2) intends to visualise the exponential growth of electronic waste and the aggravating impacts of planned obsolescence. The game was developed in Processing with the p5.js JavaScript library for creative coding and exposes the frame-by-frame nature of Processing together with sound manipulation that embraces a glitch aesthetics. The game presents an environment in which the player embodies a smartphone that scrolls social media on a loop and has to survive planned obsolescence. Planned obsolescence is represented as a broken smartphone that chases the player. In the game, the player is stuck to minimal gestures of touch or mouse movements, forever doomed to lose. The score adds up chronologically and starts from 2007, the year of the first iPhone release (or the year the iPod mutated into another media gadget). Akin to the state of affairs, the player cannot defeat planned obsolescence but solely endure it while trying to escape it.

#### 3.3 The detritus of digital media technologies

The media materiality of a digital culture is often obscured by optimistic discourses around digital media as tools. This rhetoric not only masks the consequences of digital media and their impact on environmental pollution but also that software is indivisible from hardware as well as economy, corporate interests, politics, ideology, ethics, cultures, labour exploitation and finite resources. *Debris* conflates the material infrastructure of digital media in an assemblage that reflects on the impacts of e-waste and its agency to affect, transform and interact. The installation relies on hybridisation as a tactic that attempts to debunk digital media concepts of innovation, immateriality and transparency as signifier of superiority, control and empowerment.



Figure 1: *Debris* (2021) installation at Sonic Curiosities VI, Villa Kuriosum, Berlin, Germany. ©Pedro Ferreira.

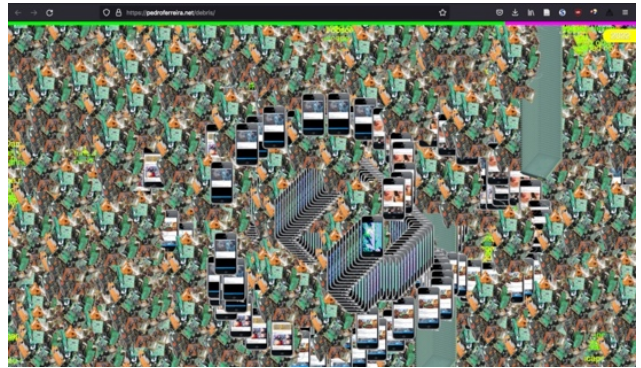


Figure 2: *Debris* (2021) browser-based game screenshot. ©Pedro Ferreira.

While many scholars and gadget lovers celebrate iDevices as innovative new media products, the installation *Debris* takes these gadgets as drawbacks. These devices are produced with unfair and unhealthy working conditions, furnished with non-modular hardware and non-sustainable materials together with proprietary exclusive software with security flaws [14] and prevent users to grasp the background of apps, such as data harvesting for monetization, or what the scholar Shoshana Zuboff calls “surveillance capitalism” pioneered by Google. [15]

## 4 CONCLUSION: TOWARDS A SUSTAINABLE POST-DIGITAL CONDITION

A more sustainable future requires a vision of and demands for modular, recycled and green technologies. But are alternative and sustainable digital media technologies even possible? If so, will they be manufactured from recycled materials, free and open-source software and hardware? Will they be produced under fair working conditions and result in socially oriented devices? That would include policies to ensure production with fair labour conditions and user rights to repair and reuse hardware components as well as software ethics that guarantee user freedom, as suggested by GNU GPL. [16] This aims to ensure ethical uses of software beyond

the seductive and sedative graphical user interface. One cannot expect this shift to emerge from the hegemonic big tech in the post-digital condition, after the digitisation of all media together with their banalisation. [17] Instead, one has to look elsewhere to find companies that already aim to develop sustainable digital media, or perhaps, the only alternative left is to create them ourselves.

In order to conclude, Alan Kay was well aware of media theorist Marshall McLuhan's credo: "the medium is the message" because it is the medium that shapes and controls the scale and form of human association and action." [18] The media devices we create turn around and reshape us. As Kay writes, "inadequate tools and environments still reshape our thinking in spite of their problems." [3] Consequently, the built-in flaws and the unintended consequences that result from software and hardware developed by big tech and others are not only rewiring our perception, influencing and spying on our behaviour, but also transforming the understanding of our bodies, homes, streets, cities, social relations, work, politics, education, health, and, last but not least, harming the environment without taking responsibility.

## ACKNOWLEDGMENTS

This paper was funded by national funds through the FCT – Foundation for Science and Technology, I.P., in the context of the project SFRH/BD/143713/2019 and UIDB/04042/2020.

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