# Why Robot?

# Speculative design, the domestication of technology and the considered future

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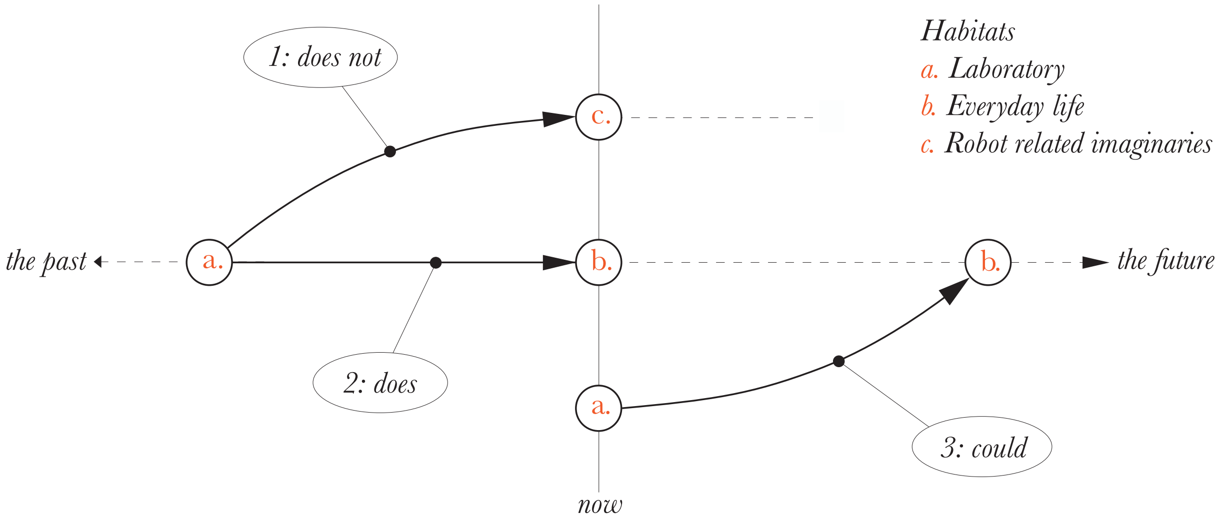

Habitats
a. Laboratory
b. Everyday life
c. Robot related imaginaries
1: does not
2: does
3: could
the past
the future
now
a.
b.
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a.
b.

# Abstract

One of the enduring objects used to represent the technological future is the robot. This legacy means that its *promise* has the ability to evolve in accordance with our societal and cultural dreams and aspirations. It can reflect the current state of technological development, our hopes for that technology and also our fears; fundamentally though, after almost a century of media depictions and corporate promises, the robot is yet to enter our homes and lives in any meaningful way.

This thesis begins by asking the question: how *does* an emerging technology (such as robotic) become a domestic product? In addressing this issue I draw from the theory of domestication and the method of speculative design to describe three possible technological journeys: how technology *does not, does* and *could* become a domestic product:

1. Technology *does not* make the transition from laboratory to domestic life.

Robots have made countless departures from the habitat of the research laboratory, apparently headed towards the domestic habitat, but the vast majority never arrive. This observation leads to the identification of a third habitat and the current destination for the majority of *proposed* domestic robots – robot-related imaginaries.

In this theatre-like environment, robots exist as either promises *or* warnings of a potential technological future. The habitat includes technology fairs, laboratory open houses, news articles and the films and novels of science fiction. I conclude by suggesting reasons why these visions of the future so often fail to become domestic products.

2. Technology *does* make the transition from laboratory to domestic life.

Borrowing from the science of ecology and biological concepts of evolution and domestication, I make an analogy between the shift of habitats that occurs when an organism successfully goes through the process of artificial selection (natural to domestic) and the transition an emerging technology makes in order to become a suitable product for domestic use (laboratory to domestic).

3. How technology *could* make the transition from laboratory to domestic life.

This section makes up the core of the thesis as I describe speculative design and how it can be used to present more plausible depictions of near-future technological applications. By stepping out of the normative relationship that ties technological development to commercial markets, speculative design opens a space for alternative perspectives, critical reflection and an examination of contemporary and near-future technological application.

Throughout the thesis these theoretical investigations run parallel to the practice-based element, allowing for interplay between the two. This resulted in three projects that exemplify the speculative design approach applied to robots, inviting dialogue and contemplation on what a *preferable* robotic future might be.

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# Preface

**“…the story of humanity’s repeated attempts to colonise the red planet. The first men were few. Most succumbed to a disease called the great loneliness when they saw their home planet dwindle to the size of a fist. Those few who survived found no welcome on Mars. But more rockets arrived from earth, and more.**
**People brought their old prejudices with them – and their desires and fantasies and tainted dreams.”**

Ray Bradbury, The Martian Chronicles, 2008

At first glance it might seem odd to begin a study on robots with an excerpt from a classic science fiction short story describing the human colonisation of Mars, but in these few choice words Ray Bradbury somehow manages to humanise one of our more spectacular technological futures. Space colonisation perhaps sits alongside the robot as one of the more popular and pervasive visions of the future, but here, in the hands of Bradbury, there is an anomaly: this is no spectacular utopian imaginary filled with complex techno-fetishistic portrayals of perfect extra-terrestrial future lives; nor is it an apocalyptic cautionary tale warning us of how badly things can go wrong when technology is allowed to progress without constraint, a perspective commonly taken by the writers of science fiction. Bradbury simply describes a future in which we will still be people. His moving description of the colonisation of Mars reminds us that the recipients of future technologies will have the same complex needs, desires and idiosyncrasies that define who and what we are today.

When speculating on how emerging technologies could become products, Bradbury's approach to fiction, technology and the future provides a rich vain of inspiration and an influence that runs throughout this thesis.

# Acknowledgements

Four years is long time on which to focus on one subject. But of course this is not an individual endeavour and this PhD dissertation would not have been possible without the support, patience, belief and knowledge of many people. Along the way a lot individuals came and went, sadly some in the most definite sense. My Grandfather, who greatly influenced my direction in life through his keen interest in machines and tinkering in sheds, passed away a few months ago. My greatest regret is that I didn't manage to complete six months earlier.

Also passing were Ray Bradbury and J G Ballard, whose novels and short stories have been so inspirational throughout the writing of thesis, and during the Happylife project. I didn't know them personally but hopefully a modicum of their genius can be found somewhere in this work.

First I would like to give my biggest thanks to the two individuals who have remained constant throughout the academic part of this process - my supervisors Anthony Dunne and Alex Taylor, who never ceased to impress with their wisdom, surprise with their rigour and humble with their generosity. You both make me realise how much I still have to learn!

I would like to thank Jimmy Loizeau for all the projects we've done together over the past decade – certainly my career to date would have been significantly different had we not had that fateful conversation about teeth and implants one day as students in the RCA computer room.

The others who kept me on track, either through engaging with the concepts, workshop banter, working together or simply passing quality time were (in no significant order) Noam Toran, Onkar Kular, Tom O' Brien and Trevor Harvey – good friends; Reyer Zwiggelaar and Bashar A Rajoub of Aberystwyth University for the fantastic time spent together working on Happylife; Tim, Brigitte and the students of Design Interactions past and present; Laurel Swann – who gave me the finest piece of advice at the start of the PhD – "don't set your expectations too high or you'll never finish"; Noel Sharkey for great conversations on robots; Jon Turney for excellent feedback on an early draft; Jon Oberlander for the title 'Why Robot'; Koby Barhad for being the most exceptional and patient graphic designer (amongst other things); and Rosie Spencer for feedback on the final draft.

I would like to thank Microsoft for their huge generosity and open-mindedness in funding this PhD.

Finally I would like to thank my family – first my parents John and Yvonne for trying their best to understand my projects and being enormously supportive regardless of their success. My 'beaux-parents' Denis and Monique for the French summers and the generous use of their house for writing holidays and finally and most importantly my long-suffering wife Elise and children Pépin and Lily who have stoically endured my long periods of window-gazing, stress induced grumpiness and research-related time away from home. I wouldn't have survived without you!

Thanks to you all!

# Introduction

When I began this thesis, some four years ago, my core question was centred on the impending arrival of domestic robots,[1] asking how practice-based design research could contribute to a better understanding of robots and the potential implications of their application in our homes. During this early period much time was spent researching the recent history of the robot in various disparate contexts, such as the films and novels of science fiction, advanced research laboratories, the corporate world of technology fairs and in some of our homes today. I quickly made the observation that aside from the last category, the majority of robots reside at polar opposites of social and cultural existence, being either entirely utopian (corporate futures) or dystopian (science fiction). In semiotic terms, the robot has effectively become a messenger for various vested futures, and its enduring

1. For instance, see Bill Gates' article in *Scientific American*: 'A Robot in Every Home' (2007).

presence in these future visions means that it has the ability to mutate and to evolve in tune with our dreams, hopes and fears. The philosopher of technology, Langdon Winner, suggested that "it is not uncommon for the advent of a new technology to provide for flights of utopian fancy" (1986, p.106). Alternatively, through the lens of science fiction, emerging technology can equally provide for flights of dystopian horror. And so the robot (as an example of advanced technology) has taken us on many such journeys: from the vast humanoid servants of the 1940s[2] and the sinister semi-synthetic replicants of the 1980s[3] to the swarming medical nano-bots[4] being proposed today. Whilst these visions of the technological future frequently exist at the polar extremes of possibility, contemporary everyday life does not; why is it that our future lives are so frequently portrayed in such dramatic and sensational ways?

As an aside from thinking about robots, I began reading Ray Bradbury's *The Martian Chronicles* and discovered something in his storytelling that made the human habitation of Mars conceptually more plausible than human co-habitation with many of the robots I had been researching. So often with technological futures, spectacular technology is cast as the lead character with people relegated to a generic support cast. In *The Martian Chronicles* I instead found radical techno-facilitated future scenarios described from personal, touching and very human perspectives. Taking inspiration from Bradbury I began to refine my

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2. See Electro, p.56, the humanoid robot exhibited by the Westinghouse Corporation at the 1939 New York World Fair.
3. As portrayed in films such as 'Robocop' (Verhoeven, 1987), 'Terminator' (Cameron, 1984) and 'Blade Runner' (Scott, 1982).
4. A common future application suggested for nanotechnology. See Patel, G M (2006).

original question to ask: 'How can practice-based design research craft and communicate plausible, engaging and critical speculations on the technological future?' In effect a shift took place, with the robot becoming the vehicle for a study on speculative design and its methods for imagining and presenting technological future concepts and critiques.

'Chapter one: Understanding robots' examines historical depictions of robots. The malleability of the noun *robot* means that tying down its meaning to a particular object or single definitive portrayal is impossible. I therefore begin by settling on an appropriate definition that will be applied throughout the thesis. I then look to the science of ecology for help in understanding how an organism is defined by the complex relationship between itself and its local environment. This discipline has given us the concepts of taxonomy, habitat and the ecosystem[5] as ways to better understand the interactions that take place in nature. These prove insightful when applied to robots in specificity.

'Chapter two: Why technology *does not* become a product' takes the findings of the previous chapter one stage further to propose reasons why robots are not, in any prolific way, becoming domestic products. The survey comprises an analysis of what I call 'spectacular robots' - those in the cultural domain that exist to capture our imagination and raise expectation, but fundamentally have yet to make it into our homes. Many common proposals display a distinct lack of common sense when it comes to domestic application: 80 year-

5. These terms will be described in chapter one.

old promises of labour-free lifestyles that continue to this day;[6] of facile functions for sublime technologies;[7] of hidden political agendas influencing future visions;[8] and perhaps most disturbing, of advocated visions for our future selves that effectively turn us into robots.[9] There is an enduring level of excitement and interest in domestic robots despite the lack of tangible progress. It is though, a dream in need of revision; stereotypical images and well-trodden concepts pervade, limiting potential through blinkering the imagination from new approaches. This chapter examines contemporary robots and why, in their current state, they are essentially maladapted for the domestic habitat.

'Chapter three: The domestic ecology: How technology *does* become a product' explores the circumstances and conditions behind the successful introduction of a new technological product into everyday life. I first look to the theory of domestication for clues as to how a wild and independent beast can be transformed into a pliable creature existing solely for the service of humans. I compare the paths taken by two very familiar and successful household products, the dog[10] and the computer, exploring how the domestication process changes the *original* object in terms of form, function, behaviour and modes of interaction.

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6. The utopian promises expressed through Electro can still be seen in many contemporary robots such as Honda's Asimo. See p.57 for elaboration.
7. For example, see roboticist Rodney Brookes' suggestion for an automated dining table, p.62.
8. For example, see chapter two on Cold War agendas and the subsequent effect on technological development, p.60.
9. Certain factions of the Artificial Intelligence community predict a coming together of the human mind with the computer. See section on Ray Kurzweil, p.88.
10. At first glance it seems odd to call the dog a product. However, its objectification through the process of domestication has resulted in an animal very far removed from its natural origins. We could argue that it is a *product* of 12,000-15,000 years of selective breeding.

'Chapter four: Speculative design: The products that technology *could* become' describes how speculative design can develop and present future *or* alternative technological applications. Speculative design proposals are essentially tools for questioning. Their aim is therefore not to propose implementable product solutions, nor to offer answers to the questions they pose; they are intended to act like a mirror reflecting the role a specific technology plays or *may* play in each of our lives, instigating contemplation and discussion. Here I outline two approaches:

First, through informed extrapolations of existing product lineages, 'speculative futures' imagine and present near-future products, systems and services. These are intended to act like a cultural litmus paper, testing and examining the implications of an emerging technology before we commit to specific applications or research directions.

Second, 'alternative presents' are speculative design proposals that question *existing* paradigms through the design of products and services that utilise contemporary technology but crucially apply different ideologies to those currently directing product development. These are speculations on how things could be, had different choices been made in previous times, and are used to examine the values of contemporary products.

I will describe, through case studies, how these two forms of speculation are crafted, specifically what informs the development, aesthetics, behaviour, interaction and function of the designed object. Once created, how and where do they operate? How can we gauge and understand their impact and meaning? Fundamental to projects based on emerging technology is expert knowledge on the subject, and many speculative design projects are therefore developed in collaboration with scientists. I describe how the collaborative element can be managed to best advantage.

'Chapter 5: Speculative robots' comprises three projects that examine how robot-related technologies could become products, applying the observations made in chapter three and the methodologies described in chapter four to the design of domestic robots. It begins with the Carnivorous Domestic Entertainment Robots developed in collaboration with designer Jimmy Loizeau and engineer Alex Zivanovic. This project was initiated at the beginning of the thesis and laid the early foundations to my thinking on robots. The project grapples with some of the key design issues that relate to everyday life and robots, specifically how they look and what they do.

Second is Happylife in collaboration with Aberystwyth University Computer Science Department, utilising the facial and thermal recognition technology they are developing for application in border control. The project imagines the application of this technology in a family home over a 15-year period.

Third, I describe a four-week project I ran with the first-year students on the Design Interactions course at the Royal College of Art (RCA), titled 'Living with robots'. The brief was written with the specific intent of addressing some of the issues outlined in chapter two.

This thesis is an enquiry into robots and their potential roles in near-future everyday life. However, it must be re-emphasised that the robot element is a vehicle. The real investigation is into speculative design and how it can be used to examine and question technological development and its subsequent application in everyday life. The methods developed and described here could therefore equally be applied to other forms of emergent technology to speculate on the products that could arise as a consequence of *their* domestication.

The significant underlying factor is the people who use, who benefit from, are modified by, who delight in, who fear and who increasingly rely on technology and the products that emerge from its research and development.

# 1

# Understanding robots

## Promiscuous robots: *The challenge of definition*

In a thesis about robots it is necessary to begin with a definition of the subject. This is by no means an easy task. The noun *robot* does not refer to one specific object; it is not based on a singular technology, context or function, and whilst certain stereotypical robot forms such as anthropomorphic pervade, other diverse and surprising configurations of technology can also be considered a robot. The definition for such a broad range of possibility is by necessity vague.

In *Philosophical Investigations*, Wittgenstein approaches the subject of games: board games, card games, ball games, Olympic games and so on. He asks: "What is common to them all? - Don't say: 'There *must* be something common, or they would not be called "games"' – but *look and see* whether there is anything common to all." He concludes that there is not something that is common to *all* but "a complicated network of similarities overlapping and criss-crossing:

sometimes overall similarities, sometimes similarities of detail." (1998, P.31). Wittgenstein ultimately characterises these similarities as family resemblances.

This is helpful in generating a pragmatic understanding of robots - indeed we can begin by listing the family traits commonly associated with things robotic[11] but still the problem of definition persists. First, unlike 'game', when used as a noun in popular culture, 'robot' is commonly used without a qualifier.[12] This suggests the existence of a generic notion, the mythical or iconic image of the robot. Second, unlike a game, the robot can exist simultaneously in multiple contexts and planes of reality, and for a multitude of reasons: as a functional engineered machine operating autonomously on a production line such as an industrial robot; as a corporate vision of the future such as a humanoid robot; as a complex construct of fiction such as an android,[13] or as a high-street product such as a robotic vacuum cleaner. And whilst the promiscuity of the generic concept of robots often leads to a blurring of these worlds, the *actual* artefact is very poor at migrating between them: fictional robots rarely become products.

The word robot has its etymologic roots in the play *Rossum's Universal Robots* (RUR) by the Czech writer Karel Čapek. Here the contemporary dichotomy of fiction and reality combine: artificial

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11. Family resemblances include: autonomy, movement, mechanisms, sensing, artificial intelligence, programming, agency, anthropomorphism and zoomorphism.

12. Whilst this is rarely the case in academia, where most research focuses on a specific branch of robotics such as 'humanoid' or 'social' usage, less expert circles commonly leave out the classification - for example Bill Gates' 2006 article in *American Scientist*: 'A Robot in Every Home'. For a more thorough investigation into this article see p.125.

13. A type of robot commonly featured in science fiction: a synthetic organism built to look and behave like a human.

humans (androids) operating as inexpensive production line workers, the word robot suggesting work, cheap labour or servitude in Slavic languages. Whilst there is a long history of objects, both real and fictional, that could have been labelled as robots before Čapek coined the term,[14] this moment (1920) serves as a sensible point from which to initiate the research - RUR was one of the first major works to move the robot beyond the world of magic and illusion and into the real world of manufacture and production. At the same time it built on a history of previous fictions such as the Jewish legend of the golem, several Greek mythologies such as 'Pygmalion' and 'Daedalus', and Mary Shelly's 'Frankenstein', in exploring the creation of artificial life and its potential implications.

In the years following RUR, fiction and reality diverged as Čapek's vision of automation came true, but the robots designed to operate on production lines emerged out of a logical progression of Fordism[15] - and, as such, manufacturing engineering and market demands informed form and behaviour rather than historical notions of humanoids. This engineering approach and the relative uniformity of the industrial robot has influenced many recent attempts at definition - for example the Robot Institute of America suggest the following:

> **"A re-programmable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through**

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14. Previously called 'automaton', examples include Wolfgang von Kempelen's 'Mechanical Turk' and Vaucanson's 'Canard Digérateur'. These were mostly illusions built to perform and entertain.

15. "The eponymous manufacturing system designed to spew out standardised, low-cost goods and afford its workers decent enough wages to buy them." (De Grazia, 2005, p. 4).

**various programmed motions for the performance of a variety of tasks." (1979)**

More recently the International Federation for Robotics (IFR) divide robots into two categories: industrial and service. Their definition of an industrial robot is not dissimilar to the above. A service robot they tentatively define as follows:

**"A service robot is a robot which operates semi- or fully autonomously to perform services useful to the wellbeing of humans and equipment, excluding manufacturing operations." (2007)**

Had the success of industrial robots diminished our fascination, or distracted us from more dramatic or sensational robots, then the above definitions would do, but the robot in contemporary culture has been far more influenced by the drama of science fiction and the theatre of the technology fair than the reality of the production line - and it is this spectacular image that continues to dominate public perception. Largely influential in this shaping of the popular robot was the Westinghouse Electric Corporation's Electro, a giant metal, walking, talking robotic man presented at the 1939 New York World Fair. Whilst this was not the first humanoid robot,[16] Electro's importance was in starting the trend for suggesting that robots could enter the home as domestic helpers. This presented an optimistic version of Čapek's cautionary tale and created a positive vision of the robotic future that

16. See p.56.

persists to this day. At this time, robots in fiction continue to be far more advanced than their real-life counterparts, but research continues to reduce this disparity and is a major motivational force in contemporary science and engineering.

It is now time to conclude with a hard definition of the robot, as this will help locate the technological and cultural boundaries of the research. We need a more considered way of classifying robots, effectively a robot taxonomy.[17] Taxonomies exist as a form of biological classification and began as a precursor to the study of the more intricate problems of animal communities (Elton, 1966, p.6). Here I will effectively be studying robot communities, and therefore many of the classification methods used by ecologists are helpful in developing a more thorough understanding of robots; these will be described in detail in the next chapter. Second, for the purposes of this essay it is important to state that the robots of interest here relate to domestic application, either through promise or suggestion.

In terms of actual definition, it is necessary to apply a rather broad set of criteria and in doing so give space for a rethinking of the term and its materialisation. The most minimal, generally accepted defining factors, and those that I will apply in this thesis are as follows: 'for a *thing* to be considered a 'robot' it should be able to sense and interpret in some fashion its environment, compute decisions based on that sensory information, and then act on those decisions in some mechanical way. This statement satisfies from a technical perspective,

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17. Whilst this would be extremely helpful in creating a more comprehensive definition of the robot, it is beyond the scope of this thesis. What follows is a more general study of robot-related activity and an examination of contextual existence.

but its dryness fails to reflect the mythical or emotive factor commonly associated with robots. To the technical definition I then add: 'the complexity or sublimity of either the sensing, computing or mechanics should elevate the status of robotic object above that normally ascribed to machines or products.[18]

## Robot ecologies

Many robots, both historical and contemporary, allude to becoming a part of our domestic lives, but the examples that served to fuel our desires and whet our appetites turned out to be mostly red herrings; products of complex motivations and hidden agendas never actually intended for application in our homes. Applying an ecological approach will help to demystify the existence of these robots. The word 'ecology' is derived from the Greek *oikos*, meaning 'house' or 'place to live'. Literally, ecology is the study of organisms 'at home' (Odum, 1971, p.3). What is of particular relevance here is this notion of 'home'; of studying the organism not in isolation but in the environment in which it exists.[19]

**"When an ecologist says 'there goes a badger', he should include**

18. In *The System of Objects*, Baudrillard describes pets as an intermediate category between human beings and objects (1996, p.95). Using this method of categorisation, robots could be an intermediate category between objects and pets.

19. From here on I will refer to this notion of *home* in the ecologists' more official term *habitat* to avoid confusion with the cultural use of the word home.

**in his thoughts some definite idea of the animal's place in the community to which it belongs, just as if he had said, 'there goes the vicar'." (Elton,1927, p.64).**

This advice from Charles Elton, one of the pioneers of natural ecology, is particularly helpful as it features both natural and cultural habitats, and hints at the layered and dynamic organisation of both domains. An expanded view of the habitat leads to the ecosystem and its sublime complexity, here described by the writer John Steinbeck:

> **"One merges into another, groups melt into ecological groups until the time when what we know as life meets and enters what we think of as non-life: barnacle and rock, rock and earth, earth and tree, tree and rain and air. And the units nestle into the whole and are inseparable from it ... all things are one thing and one thing is all things – plankton, a shimmering phosphorescence on the sea and the spinning planets and an expanding universe, all bound together by the elastic string of time. It is advisable to look from the tide pool to the stars and then back to the tide pool again." (2000, pp.178-79)**

Steinbeck's description of marine life poetically captures the complexity of scales, timeframes and interactions that operate in a natural ecosystem, a complexity that is echoed in technological and cultural systems. Factors within the system and the habitat itself are instrumental in shaping the evolution of the organism (and the artefact), defining its form and behaviour and ultimately its chances of *survival* in that habitat. These defining criteria apply equally to robots; the existential criteria for a robot in the academic domain are therefore completely different from those in the corporate world, in science fiction, and in everyday life. And it is by the last set of criteria that robots need to comply if they are to succeed in entering our homes.

## Robot raisons d'être

Elton's subjects are again helpful in addressing the complex question of existence – for example through asking the question - what is the badger's reason to be? – the fundamental difference between natural and artificial existence is exposed. This has long been the subject of study for both philosophers and biologists, and relates specifically to the subject of purpose. In his book on the natural history of life, Professor Richard Fortey notes: "it is attractive to compare natural evolution to a capitalist enterprise with an eye to ever increasing sales and productivity" (1998, p.26). However, unlike technological change, natural selection does not occur through goal-directed functions under the guidance of human intention, purpose or foresight.[20] In terms of the analogy between natural organisms and robots, this substantial difference in raison d'être is not problematic; the notions of habitat, adaptation and survival can still be applied to robots so long as it is acknowledged that behind every robot there are a variety of human

20. The term teleology was coined during the mid-20th century to specifically address the issue of the lack of a goal or foresight in the evolutionary process. This differentiates it from the Aristotelian term teleology, inferring either progress at the hands of man or supernatural forces such as a divine being. For further reading, see Grace A De Laguna's essay, 'The Role of Teleonomy in Evolution' (1962).

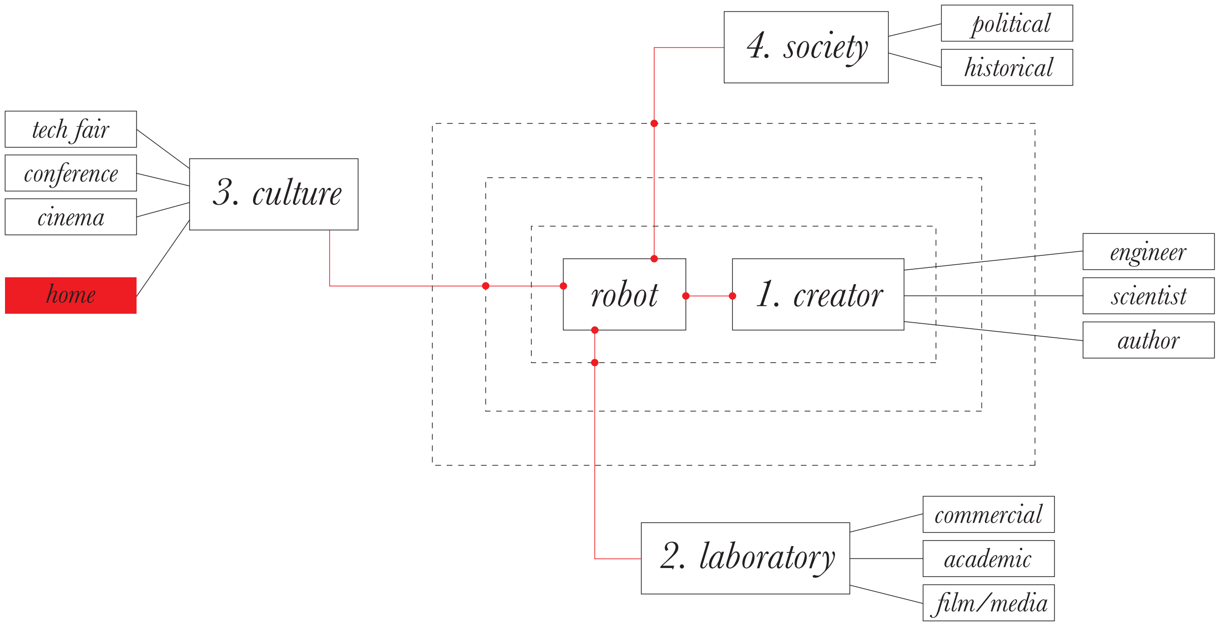


Fig.1: A simplistic robot ecosystem, emphasising the layers and scales of existence.
Layer 1 is the human scale and relates to the individual responsible for the physical creation of the robot. Layer 2 is the institution or corporate scale and represents the company or research laboratory the individuals described in layer 1 are employed or funded by. Layer 3 is the cultural scale and represents the culture in which the laboratory (layer 2) operates. Layer 4 is the societal scale and incorporates the historical and political issues that shape culture (level 3).

motivations at play. The layered approach used by ecologists is helpful here because the questions of intent and purpose can be asked at the various levels of existence: the individuals who conceive and build the robot; the employer or institution in which this activity takes place; and the cultural, social, political and historical factors at play in supporting or influencing this activity.

Figure 1 represents the layers and interactions in a modern technological system. The artefact (or its image) can migrate between layers - for example, technology developed in a commercial laboratory can shift up one layer when presented at a technology fair; the impact of this presentation might influence the policy makers operating at the societal level, encouraging them to finance the research at the company level, therefore eventually feeding back into the layer of creation. This example describes a common route through which technology migrates from the world of research and development into the commercial market. It is a migration that the majority of robots have yet to make,[21] even though it has been alluded to, promised or perhaps in some cases just dreamed of for the past 70 years or more. This enduring presence suggests other more complex raisons d'être that have maintained the robot's unique place and value in popular culture. These will be explored in the next chapter.

21. One obvious exception is the robot vacuum cleaner. I will explore this product and how it managed to enter our homes in the following chapter.

# 2

# Why technology *does not* become a product: *Ecological maladaptation and disrepute*

This chapter examines possible reasons why robots are yet to make it into our homes in the spectacular ways promised or proposed by roboticists, corporations and science fiction writers. I will expand on the ecological theme laid out in the previous chapter to suggest, through the use of case studies, that the majority of proposals for domestic robots are developed for other habitats and are therefore essentially maladapted for domestic use.

The evolutionary biologist Theodosius Dobzhansky defines adaptation as “the evolutionary process whereby an organism becomes better able to live in its habitat” (1968, p.1). This definition is helpful because it describes the dynamic relationship between the organism and its environment. By applying this concept to robots a few key observations can be made.

First, as described in the previous chapter, there is no goal or intention driving adaptation and development in nature. Technological development, however, is driven by extremely complex and diverse human motivations; whilst it has been inferred, these motivations are not necessarily related to bringing robots into the home.

Second, the current habitats where robots *do* exist such as laboratories and science fairs are considerably different from the habitat of the home. Images of robots from these habitats enter popular culture as false or premature promises. These act to perpetuate stereotypes, taint perceptions and sell promises that are extremely difficult to realise.

Third, adaptation suggests the organism has lineage in the given habitat. Robots in their current guises have no such lineage in the home. This raises the question of how robots evolve? What are they currently being adapted to? And how might a lineage start in the domestic habitat.

The following examples of ecological maladaptation do not comprise an exhaustive study but rather the seven examples are each intended to make one particular point or argument relating to why robots are not becoming products. These examples will each expand on the three observations made above, examining the habitats and existence of several key robots.

## Spectacular robots and technological dreams: *Motivations of creation*

I begin the list by examining one of the more enduring motivations behind the development of robots: the *challenge* of creating artificial life. In *The Evolution of Technology*, George Basalla offers clues to the allure of this quest in his description of technological dreams:

> **“Technological dreams are the machines, proposals, and visions generated by the technical community, whether in the Renaissance or the present time. They epitomise the technologists’ propensity to go beyond what is technically feasible. Fanciful creations of this kind provide an entry into the richness of the imagination and into the sources of the novelty that is at the heart of Western technology.” (Basalla, 1988, p.66)**

In the history of their development, many technologies go through an initial period of existing as a technological dream on route to either being discarded and forgotten or applied in useful machines and products. The fact that after countless years of development, iteration and promise robots are yet to make either transition leads to the conclusion that they are a *recurring* technological dream.

The key explanation for the longevity of robotic technological dreams is found in Basalla’s defining characteristic: that they epitomise the technologists’ propensity to go beyond what is technically feasible. As the renowned philosopher of science Karl Popper pointed out in a 1973 lecture on obstacles to scientific progress: “obstacles which are

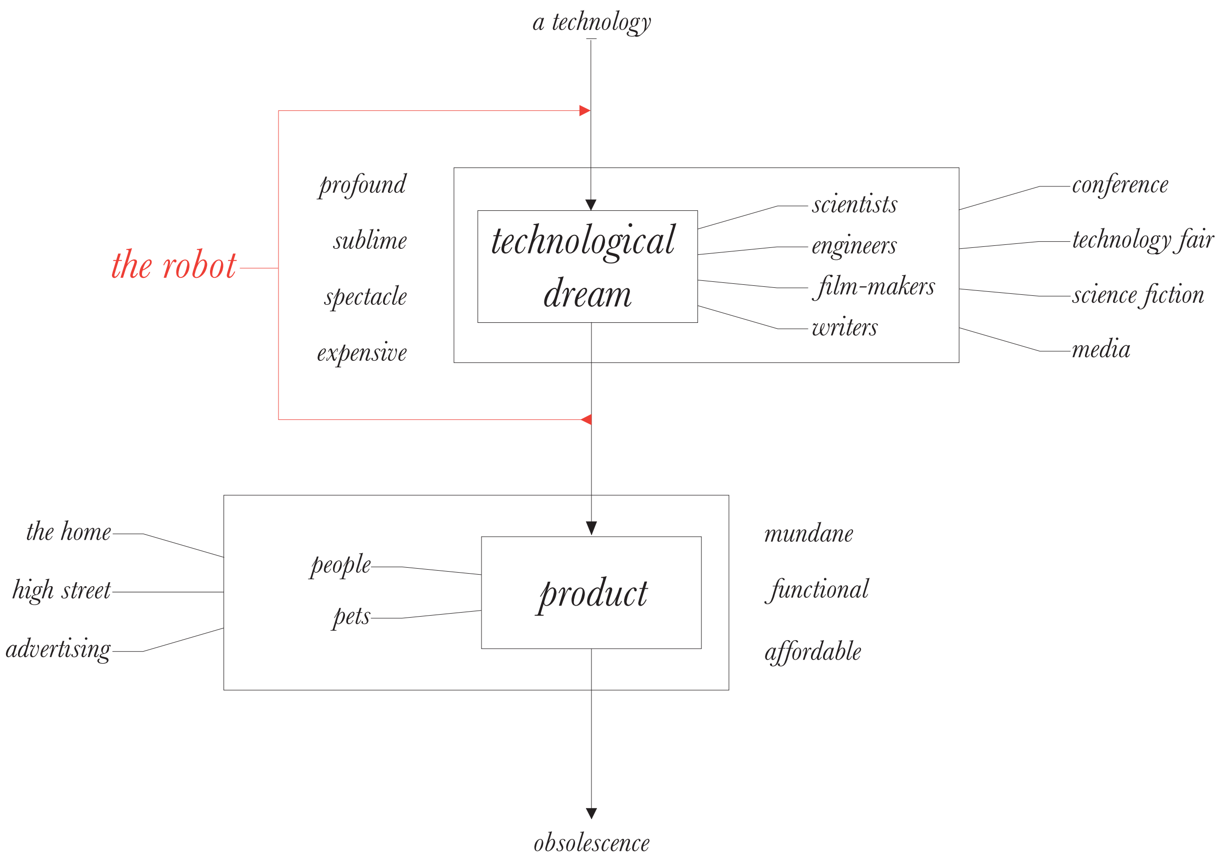


Fig.2: Journey of a technology showing the habitat of both technological dream and product.

due to the inherent difficulty of the problems tackled are welcome challenges. (Indeed, many scientists were greatly disappointed when it turned out that the problem of tapping nuclear energy was comparatively trivial.)" (1973, cited in Harré, 1975). For the scientists involved in the mechanical, electronic, synthetic or biological replication of life, the related obstacles and problems are far from trivial - and consequently, for numerous generations robots have constituted the *perfect* technological dream. The following passage from the founding father of cybernetics, Norbert Wiener, describes this relation between time, technology and automata:

> **"This desire to produce and study automata has always been expressed in terms of the living technique of the age. In the days of magic, we have the bizarre and sinister concept of the Golem, that figure of clay into which the Rabbi of Prague breathed life with the blasphemy of the Ineffable name of God. In the time of Newton, the automaton becomes a clockwork music box, with the little effigies pirouetting stiffly on top. In the nineteenth century the automaton is a glorified heat engine, burning some combustible fuel instead of the glycogen of the human muscles. Finally, the present automaton opens doors by the means of photocells, or points guns to the place at which a radar beam picks up an airplane, or computes the solution of a differential equation." (Wiener, 1965, p.40)**

Wiener's role as commentator for this theme is not accidental, as it is through the continuing development of his theories in the field of cybernetics[22] that we find one of the vanguards of contemporary robotic research. Until the mid-20th century, roboticists had focused almost entirely on the physical replication of the organism; these robots could be seen as products of the industrial revolution and its effect on production, mechanisation and material. At this time, sentience or intelligence was merely a fictional ploy used by creators to enhance the allure of the object.[23] Cybernetics, according to Wiener, would represent a "second revolution… whose object is the replacement of the human brain" (Ellul, 1964, p.42). The emergent notion of Artificial Intelligence (AI) provided a whole new impetus for robot-related research, and a fresh profound challenge that continues to this day.

The robots of today's technological dreams are far removed from their clockwork predecessors. The limitations placed on the early automata by the available materials and clunky movement of clockwork mechanisms mean that by contemporary standards they resemble clumsy and unrefined representations of the natural artefact. Today, a more advanced understanding of nature[24] combined with the vast advances made in material and manufacturing technology has led to the existence of truly sublime kinetic robots. The robots developed and built by the Bionic Learning Network,[25] for example, exhibit behaviour and

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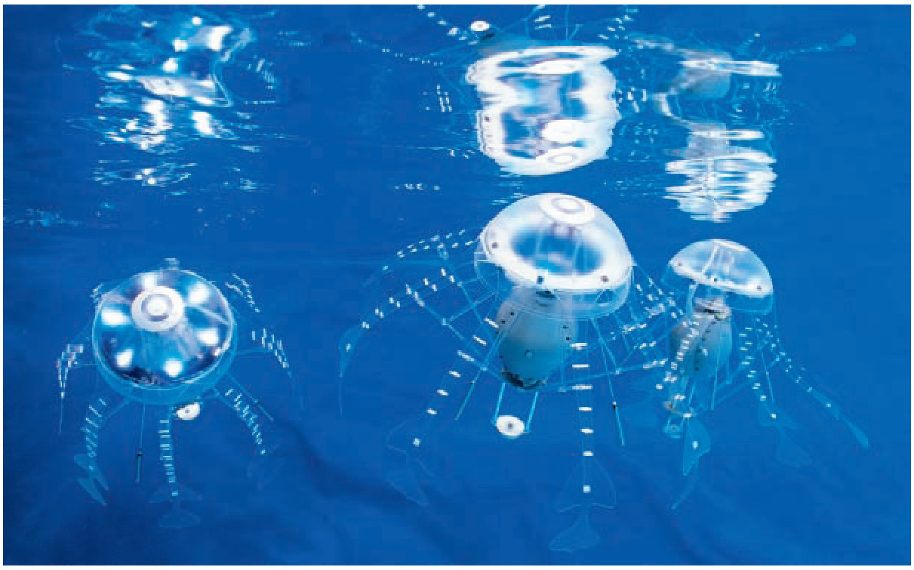
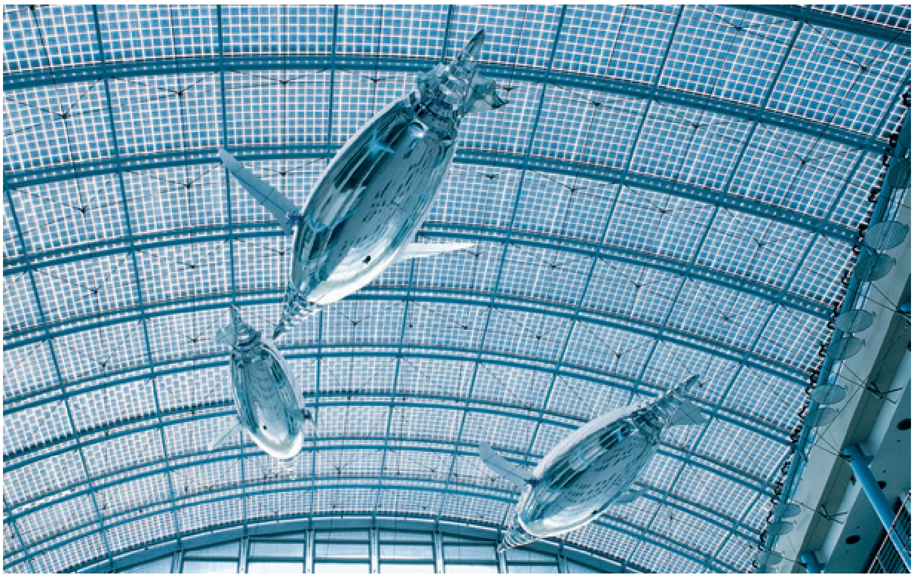
22. From the Greek for steersman, defined by Wiener as the theory of control and communication in both machines and animals and focused largely on feedback mechanisms.
23. For example the 'Chess Playing Turk'.
24. This practice has recently been classified as a science: the scientist and author Janine Benyus, in her 1997 book *Biomimicry: Innovation Inspired by Nature*, defines this practice as a "new science that studies nature's models and then imitates or takes inspiration from these designs and processes to solve human problems" (Benyus, 1997, p.xx).
25. Collaboration between the automation and tool company Festo and several universities, institutes and development companies.



Figs. 3-4: Robots developed by the Bionic Learning Network (Festo). Clockwise from top left: AirJelly; AquaJelly; AquaPenguin; AirPenguin (2009-2010).



Figs. 5-6: Robots developed by the Bionic Learning Network (Festo). Clockwise from top left: AirJelly; AquaJelly; AquaPenguin; AirPenguin (2009-2010).

movement that words and images struggle to do justice to.

The challenge of replicating nature remains as popular as ever, and as such many contemporary robots, in some way, have their genesis in a technological dream. These robots exist as products of their inventors' profound technological or philosophical imagination and ability - and as such the habitat they have been developed for is one of a purely technological nature, removed from any suggestion of useful domestic application or market appeal. As George Basalla concludes his chapter on technological dreams: "the argument that economic incentives were the driving force behind the invention and patenting of the majority of novel artefacts is not persuasive… technological dreamers [who] repeatedly, enthusiastically, and ingeniously provide solutions to problems that are mainly of concern to themselves." (1988, p.71).

From the outset, the robots that emerge from technological dreams are simply motivated by pushing the limits of knowledge and the intellectual pleasures of an extreme challenge. At this time there appears to be little end to both the developmental potential of the techniques and therefore the sustainability of the quest.

## Manifested dreams: *The theatre of robots and myths of progress*

'Manifested dreams' follows the progression of the technological dream to explore motivations in the outer layers of the robot ecosystem: the value to the corporation, institution or political party.

Rather than gathering dust on the shelves of their creator's workshops, the robots of technological dreams frequently transcend this isolation to become messengers for techno-utopian futures played out publicly in technology fairs, through the media or at laboratory open houses. This point looks at how and why the significant dreams realised by practitioners elevate their laboratory or workshop status and, more importantly, why these visions are not necessarily the precursors to domestic products. The study begins early in the 20th century, for it was during this period that the modern notion of the robot was formed. For almost a hundred years the popular press has been filled with stories of technological futures resembling those generated by science fiction writers, but purporting to be near-future science fact. The robots featured in many of these articles have their origins in genuine technical concepts, but the complexity and intangibility of an emerging technology means that there is limited potential to communicate its commercial or functional value to a non-expert audience. By exploiting the essential function of the technology to create spectacular and compelling demonstrations of potential products, a more tangible value can be presented to the world. Through this *productification,* an emerging technology is effectively transformed into a form of currency; in the eyes of the consumer or potential benefactor, hypothetical products communicate value far more succinctly than complex scientific or technical purity.

As a currency, the robot has clear value beyond the technology pertaining to facilitate its future existence. For reasons of simplicity I will break down this value into two strands: 'business value', the benefit to the company behind the development of technology, and 'political value', the benefit to those supporting or commissioning technological research and development.

## Business value: *Corporate agendas*

If we look behind the utopian promises made by corporate culture, it becomes apparent that many robots are primarily high-profile promotion tools - a role that they have successfully retained since the late 1920s. This *habitat* is more comparable to a circus or theatre than the home, so whilst there are often suggestions of domestic function such as housekeeping duties or caring for the elderly, the primary role of the robot is that of performer: captivating, entertaining and communicating to a wide-eyed audience the technical prowess or imagination of the organisation behind the spectacle. The robot perfectly suited for this role is the humanoid.[26] As mentioned in chapter one, Westinghouse Corporation's Electro was a major factor in shaping our culture's expectation of the robot; the following excerpt, from an interview with the engineer behind Electro's technology, is insightful in exposing how innovative engineering can be extrapolated into something far more profound:

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26. A robot based on human form. These captivate for reasons outlined in chapter one: our enduring fascination with the replication of the human.

“Now comes the funny part of the story. I, of course, was an ordinary engineer, thinking only of engineering matters and the ways and means of accomplishing certain technical problems. In building this machine, my only thought was the remote control of the substations. I little knew what I was getting into, because I set the thing up in the laboratory and made it work. We set up this device and began to operate it from different telephones and showed it off to some people who were interested. I took one of them down to the vice-president’s office. He became fascinated with it and called in a lot of other people. Then the publicity department wanted to see it. They said, ‘Why you have a mechanical man here. That is a good story for the newspapers. I am sure we can get a few publicity articles in some of the New York papers.’ So as a result, I was instructed to take this to New York a year ago last October and set it up in our New York office, and display it to our newspapers. This machine that could talk over the telephone and carry out orders. I did and the reporters came and saw it, asking many questions about future applications and what else it could do. The next morning I got up and I went to my hotel door and picked up the morning paper. I picked it up to find out what the morning papers had to say about my machine. I ran through the paper and didn’t find it. I was considerably disappointed. It was my first contact with the newspapers and I was curious to know what they would say. There on the front page was: ‘Inventor shows mechanical servant solving all the housekeeping problems of the age.’ I found that my poor little electrical machine was going to sweep, clean, dust, take care of the baby and everything else that ever happened, but of course

**such was not the case. I have a dickens of a time explaining to ladies in audiences that this machine couldn't do all those jobs." (Schaut, n.d., p.23).**

The success of these early demonstrations encouraged Westinghouse to develop more sophisticated staged events, culminating in their now famous presentation of Electro at the 1939 New York World Fair. Similar events this century, such as the live performances of Honda's Asimo (fig.8), highlight how little has changed: public crowds gathering to witness spectacular future technologies performing on stage under the banner of a large corporation. The technology has advanced and the forms are modernised, but the fundamental relationship between the robot and the audience remains the same.

On stage (as in fiction) robots can be messengers for spectacular technological futures, because in this habitat they are not constrained by the rules of everyday life: they do not need to be developed and manufactured to an affordable purchase price; they do not require a plausible function; and they do not need to fit aesthetically into the contemporary domestic landscape. The basic rule defining form and behaviour is spectacle - the more captivating this is, the bigger and more engaged the audience; an audience that will duly be convinced of the imagination, creativity and technical skills of the corporation behind its production. Seventy years separate Electro from Asimo and the other humanoid robots vying for our attention today, and whilst the technology has made enormous advances, the natural habitat of humanoid robots remains almost entirely the same.

Fig.7: Jamming every inch of space in the huge hall of Electrical Living at the Westinghouse Building, crowds watch Electro, the Westinghouse Moto-Man, perform his 26 mechanical tricks, including walking, talking, smoking a cigarette and counting his fingers (Image and text: Schaut, 2006, p.119).

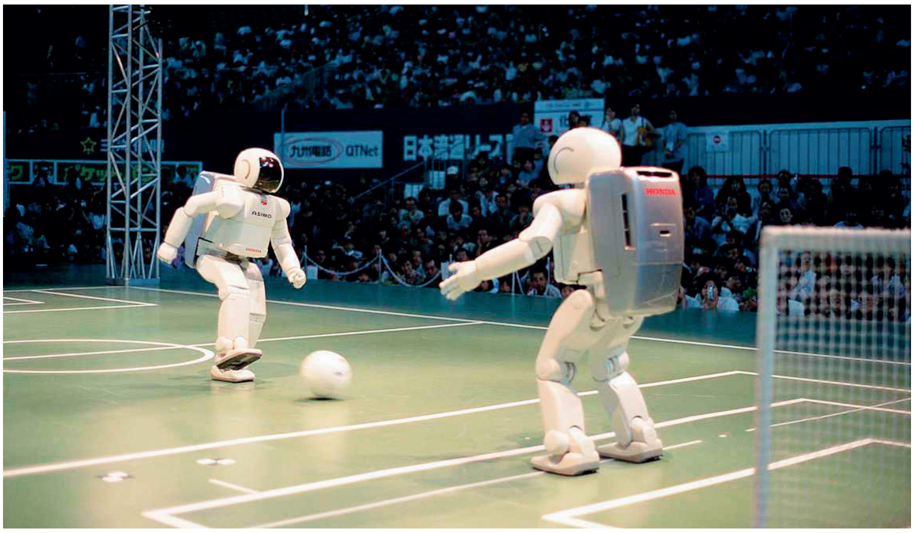



Fig.8: Asimo (Honda, 2000), playing football.

## Political value: *Myths of progress*

A deeper investigation into the outer levels of the robot ecosystem (fig.1, layer 4) reveals the degree to which a prevailing political agenda can direct the inner levels of technological and scientific research and development. Regarding the related issues of national defence and the spending of public money, a politician's role could be seen as juggling the need to financially support technological research aimed at bolstering the nation's defences,[27] whilst at the same time maintaining public morale and support through propaganda and the popularisation of that technology. No period better illustrates this complex relationship than the 1960s, and the role the Cold War played in progressing certain strands of controversial scientific research and increasing levels of propaganda through spectacular and very tangible uses of technology.

> **"We set sail on this new sea because there is new knowledge to be gained, and new rights to be won, and they must be won and used for the progress of all people."**
> **(John F Kennedy's Moon Speech, Rice Stadium, 12 September 1962)**

In his account of these events, John M Logson describes the short-term and more lasting impact of the Apollo programme on US international prestige and associated national pride (2010, p.238), and

27. A poignant example and one that had major influence on the Cold War period was the role of computer technology in deciphering the German Enigma code in World War Two.

how the early psychological and political advantages of Soviet space successes were quickly and effectively countered through the Moon mission. Three years later, at the1964 New York World Fair, spectacular exhibits such as the Eero Saarinen - designed IBM pavilion, with content by Charles and Ray Eames, revealed how this backdrop of profound technological development, Cold War fears and the spectacular challenge of the space programme were impacting on popular culture. The social theorist Richard Barbrook points out, in his aptly titled book *Imaginary Futures* (2007), how iconography and fetishisation were, for the first time, used to deny the principal use value of these new technologies (p.33) through neatly disguising them as profound benefactors to humanity. At the heart of the IBM pavilion was the Eames' multimedia, multi-sensory presentation, describing in highly aesthetic terms the benefits of this emerging technology – or, as Barbrook concludes, "In the IBM pavilion, the new technology of computing was displayed as the fulfilment of a science fiction fantasy: *the imaginary future of artificial intelligence.*" (p.21). Building on the 1950s positivistic image of the robot acquired through television series such as 'Robby the Robot', and some of the science fiction works of Isaac Asimov, IBM presented the utopian public face of Cold War developments in cybernetics.

In both the above cases, the robot's (or AI's) role is that of messenger, representing a vision of a future made better through the progress of technology. Electro, the IBM pavilion and Asimo portray the same utopian promise, simply updated through advances in mechanical, electronic and computer technologies. Behind the glossy and spectacular facades, however, lurk different agendas not necessarily related to bringing these technologies into our homes or lives. So long as 'technological dreams' retain their imaginary value, politicians, corporations and institutions will continue to present misleading or extravagant interpretations of technology and how it might be used in the future.

When we are presented with technological visions of the future, it is necessary to look beyond the spectacle and imagine the proposition not on stage or screen but in real life, applying the banal but very realistic constraints this would impose. At the same time it is helpful to remember that quite often vested interests are operating behind the scenes.

## Robotic research: *My home is not a laboratory*

Directly installing a laboratory robot into the habitat of everyday life would expose it to the rules of domestic life, modern consumer culture and the vagaries of taste and fashion. Research culture has its own rules and expectations that define a robot's form and behaviour, but fundamentally these are quite different from those in the home. For a laboratory robot to successfully enter everyday life, it would effectively need to go through the process of adaptation. I have broken this down into three categories: functional adaptation (what robots do), form adaptation (how robots look), and interactive adaptation (how we interact with robots). In reality it is through a complex combination of these three elements that a domestic object finds its value. However, for many robots these factors remain quite disparate research themes.

## Functional adaptation: *The niche*

Building on the ideas of Charles Elton (see p.38), ontologists Barry Smith and Achille Varzi liken the world of functional niches to “a giant evolutionary hotel, some of whose rooms are occupied (by organisms which have evolved to fill them), some of whose rooms are for a variety of reasons unoccupied but can become occupied in the future” (1999, p.4). Taking the idea of this “evolutionary hotel” into the realm of robots, we could imagine a room inhabited by industrial robots that have filled the niche for delivering cheap and accurate labour. Another room could be inhabited by military robots whose niche is operation in dangerous or inhospitable environments. There might be a science fiction room with futuristic spectacular robots or a room for science fairs occupied by shiny humanoid robots. Aside from the occasional vacuum cleaner, the rooms that represent the home remain mostly empty; the robot is yet to find a genuine functional niche in the home.

Proposing a clear and justifiable domestic function for their robots is the fundamental factor so often overlooked by roboticists. In his book *Enough*, Bill McKibben uses the following future proposition by the prominent roboticist Rodney Brookes to pose the question, how could daily material life be dramatically improved by the next dose of technology?

> **“Perhaps in the future our dining room tables will also be the place that we store all our dishes when we are not using them, in a large container under the tabletop surface. When we want to set the table, small robotic arms, not unlike the ones in a jukebox, will bring the required dishes and cutlery out onto the place settings. As each course is finished, the table and its**

**little robotic arms could grab the plates and devour them into the large internal volume underneath. With direct water hook-ups into our dining rooms, much as we have them now in our kitchens, the dining room table could also be the dishwasher. It would wash the dishes after each meal and leave them down in its recesses, waiting for the next meal at which they are needed." (Rodney Brookes, cited in McKibben, 2004, p.121)**

Brookes' table-cleaning robot, described above, is an example of advanced technology in desperate search of an application. A lack of imagination leads to following the traditional lineage of labour-saving devices. Whilst this lineage gives the proposal a plausible logic, it ignores the basic rule of 'cost versus benefit'. The fact is that the obvious labour-saving devices in the home have already been built in the form of white goods. The necessary complexity of a machine to complete the remaining domestic tasks such as shirt-folding or dishwasher emptying means that it is unlikely that in the near-future the benefits will ever outweigh the costs, yet labour-saving tasks remain one of the most common functions proposed for domestic robots.

Another popular proposition in the robotics community is 'care' robots for elderly people. As ethicist Robert Sparrow and aged care consultant Linda Sparrow point out in their essay on the subject, it is "remarkable just how much robotics research, if it is not being sponsored by the military, is promoted by appealing to the idea that the only way to deal with a looming demographic crisis is to develop robots to look after older persons!" (2006, p.142). A brief glance at the technology press reveals an excess of care robots both in development and already on the market. Whilst the issue of providing care for older members of society is a genuine and potentially grave problem (unlike

Fig.9: Kompaï by Robosoft.

Fig.10: Wakamaru by Mitsubishi.

Fig.11: Carebot by Geckosystems.

the saving of domestic labour), this is, in many cases, another example of the robot in search of a problem. The significance of this problem and the allure of the solution have resulted in many well-financed research projects, and much media speculation, but in reality are we genuinely ready to give up care of our elderly relatives to mechanical devices?

Care robots currently fall into two categories. First is a role similar to the servant or butler, performing day-to-day domestic chores in the home combined with elements of care-giving such as administering medicines and monitoring health. These robots mostly follow the humanoid route and will be explored in more detail in the following section on form.

The second, more contentious role is the robot as companion for lonely elderly individuals. This function for robots effectively combines historical notions of artificial life with contemporary research highlighting the emotional benefits of pet ownership (Gunter, 1999). However, there still exists a huge divide between real animals and robotic pets: returning to the niche concept, many roboticists simply attempt to replicate or mimic established occupants of the pet niche such as domestic dogs and cats. In terms of function, the justification for robots to replace animals is a paradox: it is claimed that elderly people may struggle with the demands of caring for real pets such as feeding, walking and so on, but it is through this nurture, responsibility and unpredictability that the emotional bond is made. As Sparrow and Sparrow's essay concludes, "Entities that are entirely at our disposal and under our control are *things* rather than potential friends." (2006, p.149). A functional niche means specialisation and a sophisticated and complex interaction with the given habitat. Success for organisms such as cats and dogs did not come quickly or easily, but through countless generations of adaptation, each bringing the wild animal closer to harmony with the habitat of humans. It is unlikely that this success could be replicated within a few generations of development.

For roboticists to find a genuine niche in the home, it would be helpful to base the function on what the underlying technology excels at, not to simply replicate existing objects, animals and roles.

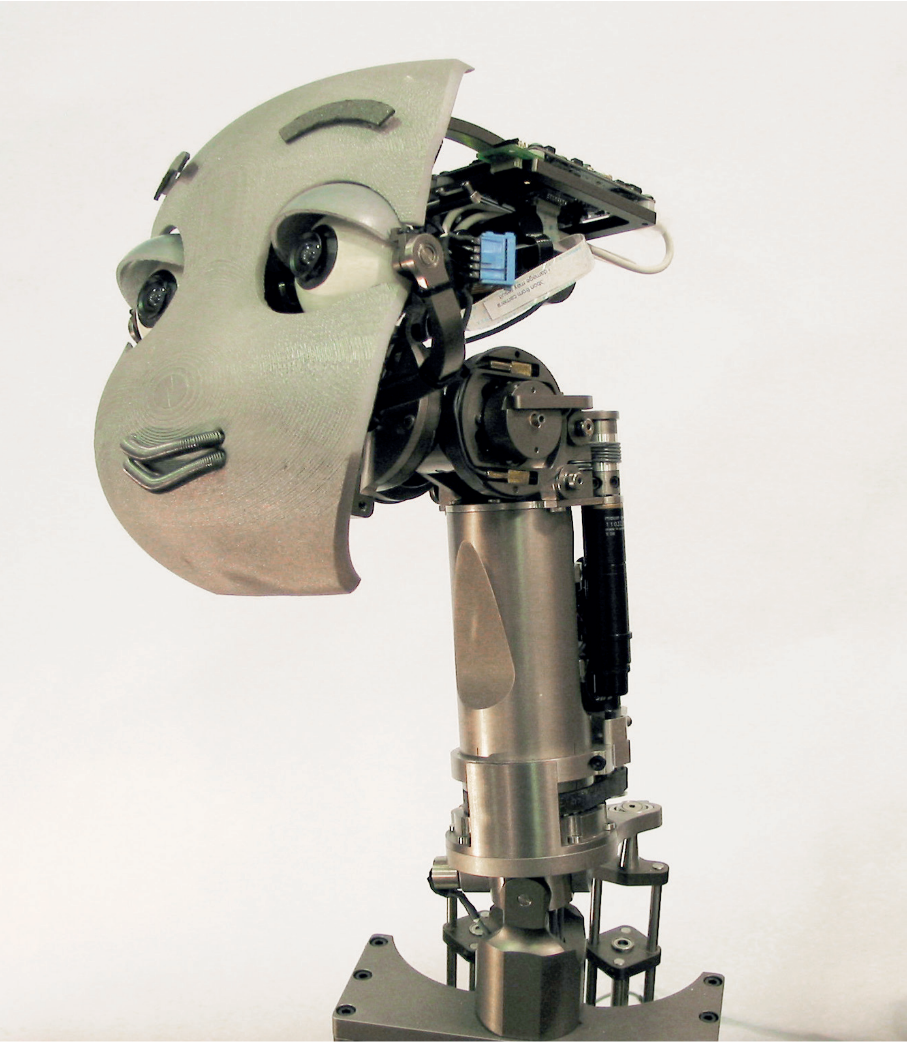
## Form adaptation: *Form follows fiction*

In his analysis on the evolution of domestic life, Witold Rybczynski points out that the various inventions that contributed to human comfort at the end of the 19th century did not have a profound impact on the appearance of the home: "the changes that did occur were due to fashion and popular taste." (1986, p.173). He observes that during this time of great engineers, there was no obligation to apply an engineering aesthetic - rather the interiors of steamships, trains and tramways always took comfortingly familiar forms (Ibid, p.174). This observation sits neatly with the notion of adaptation; that these new technologies, whilst alien in concept, were made familiar and acceptable by designing their appearance to fit in with the existing landscape: form follows normality.

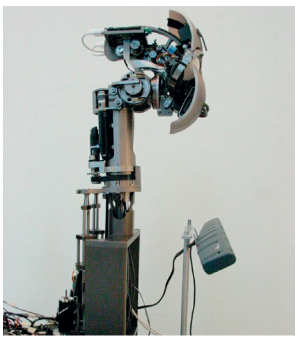
Those currently giving shape to robots, though, seem to be more influenced by their fictional forms than the contemporary domestic habitat: form follows fiction. In their defence, roboticists argue that as the domestic environment is built exclusively with the form of humans in mind (for example, staircases, door handles, tools etc.) then it follows that any robot intended to operate in this space should adopt the same form (Behnke, 2008). Another justification put forward is that it would be more natural for humans to interact with humanoid than abstract forms (Brookes, 1996; Dennett, 2003).

Fig.12: Nao by Aldebaran Robotics displays classic humanoid form.

Fig.13: Paro developed by AIST (Japan's National Institute of Advanced Industrial Science and Technology) described as a therapeutic robot and utilising pedomorphic form.



Figs.14 & 15: Mertz Active Vision Robotic Head by MIT. Developed for exploring human-robot interaction. A cute, childlike facade covers the mechanical interior.



Whilst there is an undoubted logic to both these arguments, they are undermined when the fundamental question of function is introduced: why is the humanoid robot in the home? It has an assumed place in our domestic futures as a result of countless and persistent promises such as those described in the section ‘manifested dreams’ and in the genre of science fiction.

Companion and care robots mostly follow zoomorphic or pedomorphic forms resembling cute animals such as puppies, kittens and seal pups. Roboticists argue that in order for robots to counter the frightening reputation built up by years of negative portrayals in science fiction, they should be given an unintimidating appearance. As with humanoid robots, the justification initially makes sense. However, many roboticists over compensate for what is a simple problem of overcoming negative first impressions.

The robot’s powerful fictional heritage continues to influence the design of its form. As a fiction, the real-world issues of taste, context and domesticity can be ignored - allowing form-givers a freedom to either exaggerate the mechanical aspect by exposing metal, gears and cables, to cover workings with sleek, shiny, stylised futuristic plastic and chrome, or to dress them in bright colours with childlike features.

By applying a normative product design methodology and specifically adapting the robot to the domestic landscape, it is possible to imagine an entirely different form for robots, in harmony with the contemporary home and the tastes of the people who live there. This approach is explored in the project Carnivorous Domestic Entertainment Robots (see p.184).

## Interactive adaptation: *Human people/robot interaction*[28]

How we engage and communicate with artificial entities is another major focal point for the robotic research community, in a field described as 'social robotics'.[29] The motivation behind this research often begins with the assumption that robots will soon become a ubiquitous part of modern society (Gates, 2007), and concludes that robots therefore "must be easy for the average citizen to use and interact with" (Breazeal, 1999). In her paper on the subject, Breazeal describes the importance of designing effective human-robot interfaces so that "untrained users can make safe and efficient use of the robot". (Ibid). Aside from a brief nod to humanoid robots for care applications, the paper at no point suggests what this *use* of the robot might be - rather it focuses on a very generic notion of interaction breaking down the interface problem into four design issues. The first is how people perceive SIARs (Socially Intelligent Autonomous Robots) and how these perceptions influence interaction. Secondly, what are the most natural channels of interaction with the robot? Thirdly, how does the interaction impact on people emotionally? Finally, what are the social constraints that shape the nature and quality of the interaction? Only the final point begins to suggest that there is some complexity and variety involved in potential interactions with robots. This approach is another example of stereotypical and mythical notions of robots influencing

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28. Concerning companion robots, the function to a large degree is *interaction*; there is therefore some overlap here with the previous section.

29. 'Social robots' is the robot community terminology for research into human/robot interaction. This research can manifest itself in care robots, humanoid robots and companion robots.

research, and it suffers accordingly by presenting a generic idea of human/robot interaction.

Many social robots operate in highly artificial conditions or circumstances, focusing on choreographed demonstrations in open houses rather than the complex reality of domestic interaction. This model can lead to successful papers, conference presentations and live performances, but these forms of research output are not necessarily relevant or meaningful in everyday life. On a trip to MIT's AI lab, sociologist Lucy Suchman described her meeting with their social robot Kismet as follows:

> **"While Kismet was operational, in contrast to the interlocutors pictured in the website videos none of our party of STS conference delegates was successful in eliciting coherent or intelligible behaviours from it. Framed as an autonomously affective entity Kismet, like Cog, must be said to have failed in its encounters with my colleagues and me. But as in the case of Cog, there are more interesting and suggestive lessons to be learned from the difference between Kismet's demonstrated competencies and the Kismet that we encountered. Those lessons require that we re-frame Kismet, like Cog, from an unreliable autonomous robot, to a collaborative achievement made possible through very particular, re-iteratively developed and refined performances. The contrast between my own encounter with Kismet and that recorded on the demonstration videos makes clear the ways in which Kismet's affect is an effect not simply of the device itself, but of Breazeal's trained reading of Kismet's actions and her extended history of labours with the machine. In the absence of Breazeal, correspondingly,**

**Kismet's apparent randomness attests to the robot's reliance on the performative capabilities of its very particular 'human caregiver'." (Suchman, 2004, p.7).**

Whilst this scientific research method and the consequent generation of knowledge can offer truly helpful clues on how we might improve our interactions with machines, the staged nature of the laboratory open house conflicts with the nature of the word *social*. To fully develop a meaningful interaction between humans and robots it is imperative to define the context for this interaction, otherwise the event is simply a showcase. Consider how differently we interact with other humans depending on circumstances and roles: with a policeman, a potential partner, a nurse... So, whilst it is certainly of value to explore specific human-computer interaction, for that interaction to be truly meaningful it is necessary to also ask the contextual questions: what does that robot do? Why is it here? Why am I interacting with it? Without tangible answers to these questions robots cannot fit comfortably into our everyday lives.

In his influential book *The Ecological Approach to Visual Perception*, James J Gibson stresses the value of moving out of the laboratory with regard to the study of natural vision and into the environment – the surroundings of those organisms that perceive and behave (1986, p.7). He suggests that "it is not true that 'the laboratory can never be life like.' The laboratory *must* be life like!" (Ibid, p.3). If robots *are* to enter our homes at some future point, roboticists would do well to heed Gibson's advice - only then will the combined value of their form and function and the way we interact with them be desirable to potential consumers.

## The robot paradox #1: *Sublimity and ephemerality*

By nature of definition (see p.38), robots have a special status above that of normal products. The problem arises when this special or *sublime* element is provided by novelty and curiosity. For as Edmund Burke points out in *A Philosophical Enquiry into the Origin of our Ideas of the Sublime and the Beautiful*, “curiosity is the most superficial of all the affections; it changes its object perpetually.” (Burke, 2008, p.29). Robots have effectively become victims of their success as vehicles used to represent the future, through the use of technological novelty to provide spectacle. The following passage from Ray Kurzweil, one of the world’s more vocal advocates of artificial intelligence, describes this relationship between technology and spectacle:

> **“A word on magic … I was [also] an avid magician. I enjoyed the delight on my audiences in experiencing apparently impossible transformations of reality. In my teen years, I replaced my parlour magic with technology projects. I discovered that unlike mere tricks, technology does not lose transcendent power when its secrets are revealed. I am often reminded of Arthur C Clarke’s third law, that ‘any sufficiently advanced technology is indistinguishable from magic.’” (Kurzweil, 2005, p.4)**

Kurzweil’s reference to Arthur C Clarke’s famous quote undermines his point, for Clarke does not make a generic reference to technology but clearly states “sufficiently advanced” - from this we can deduce that when the technology is no longer advanced it does become distinguishable from magic. This *normalising* of technology has been experienced by many people who bought Sony's robotic dog, AIBO - as the BBC's technology journalist Jon Wurtzel reports after living with the robot for a short time:

> **"What became increasingly clear is the power and importance of the emotional relationship with this robot dog. When I tried to develop a relationship with him, I felt let down. I stopped referring to him solely as a he, and started referring to him as the robot. This deflation felt even more acute because he had so successfully generated emotional cues and responses with me. He had seemingly promised me a canine relationship, and then failed to deliver. As art, AIBO is a tremendous success. He makes a great interactive sculpture, and is fun and impressive to watch. But, as a pet dog, AIBO fell down." (Wurtzel, 2001)**

This problem arises when roboticists simply attempt to replicate the behaviour of pets; the robots ultimately fall victim to the limits of their own programming. The same traits that make them perfectly adapted to production lines render them ephemeral in emotive roles. Automation reduces randomness, in turn increasing predictability. When first viewing the manufactured spectacle we can marvel at the sublime and surprising new use of technology. The profundity of this spectacle will define its potential for emotional sustainability, but ultimately, and inevitably, repetition leads to familiarity, which in turn leads to apathy; the robot ceases to be a robot and is demoted to mere product.

This observation is most crucial for those robots that rely on spectacle and mystique for success - particularly companion robots and entertainment robots. Through clever interventions, new methods of interaction or developments in computer technology, robots may one day find domestic success in this guise, but in their current forms they will be little more than a gadget, the most fleeting of all domestic objects. The robot paradox #1 suggests that real-life robots are victims of the profound utopian promises made by their fictional counterparts. For almost a century these have sold a dream that is going to be impossible to realise.

## The robot and the cinema: *The subversion of the robot*

One key difference between natural systems and domestic life is the role of a reputation in influencing the acceptability of a subject. Returning to the ecosystem diagram (fig.1), negative press or portrayals at the cultural level (level 3) can impact on a technology in profound ways, influencing policy makers and consumers alike. This sub-section looks specifically at the role of cinema in delivering *dystopian* imaginaries and how these have tainted the reputation of the generic robot.

> **"As in the theatre, each physical type expresses to excess the part which has been assigned to the contestant. Thauvin, a fifty-year old with an obese and sagging body, whose type of asexual hideousness always inspires feminine nicknames, displays in his flesh the characters of baseness, for his part is to represent what, in the classical concept of the *salaud*, the 'bastard' (the key concept of any wrestling match), appears as organically repugnant.: (Barthes, 2009, p.5)**

In *Mythologies*, Roland Barthes describes in exquisite detail the repulsive figure of Thauvin, the wrestler. As he describes, the extended use of signs in all-in wrestling acts to elicit a mixture of hatred and nausea in the audience. In the genre of science fiction, robots have been cast in a similar role since their very conception: if we accept the lineage of the robot (as suggested in the introduction) to have evolved from myth and legend, then in its fictional guise it has frequently and consistently played the role of villain:

> **"Oh! No mortal could support the horror of that countenance. A mummy again endued with animation could not be so hideous as that wretch. I had gazed upon him when unfinished; he was ugly then; but when those muscles and joints were rendered capable of motion, it became a thing such as even Dante could not have conceived." (Shelley, 1992, p.59)**

The raison d'être of all-in wrestling is straightforward: "the primary virtue of the spectacle, [which] is to abolish all motives and all consequences: what matters is not what it (the public) thinks but what it sees." (Barthes, 2009, p.3). Barthes suggests that this form of wrestling is purely spectacle, devoid of intellectual or philosophical undertones. In science fiction this is not necessarily the case, as Daniel Dinello points out in his study on the relationship between technology and science fiction: "the best science fiction extrapolates from known technology and projects a vision of the future against which we can evaluate present technology and its direction." (2005, p.5). In her book *Representations of the Post/Human*, Elaine L Graham acknowledges Mary Shelley's "evident knowledge and interest in the emergent discipline of natural science", concluding that she intended Frankenstein to "explore the serious issues of natural philosophy in the context of the scientific debates of the time" (2002, p.66). Shelley gives the monster the gift of speech and with it the opportunity to win over the heart of the reader, with passages describing in the first person, distressing and moving depictions of its miserable existence.[30] This acts to humanise the creature and in turn complicate the issue of its creation and the science behind it. In a chapter entitled 'Did Hollywood Make the Monster', Graham describes how Dr Frankenstein's creation was transformed in the popular Hollywood productions in the 20th century: "the 'monster' devolved to become silent or at best, inarticulate, a device which accentuates its brutishness ... the ambivalence of the monstrosity dissipates, to be replaced by pure horror." (Ibid, p.66). Frankenstein shifted from a cautionary tale of gothic horror to a more basic politicised exhortation, which, according to Andreas Rohrmoser serves to "reinforce conservative values and reactionary views, a tendency that has dominated Hollywood cinema from its beginnings to the present" (n.d.). This perspective is more simply expressed by Dinello: "not all science fiction is technophobic, and not all scientists serve corporate and military interests." (2005, p.7).

30. In one particularly moving passage after the monster has been secretly observing a normal happy family, he imagines winning over firstly their favour and then their love, likening his situation to La Fontaine's *L'Âne et le petit Chien (The Ass and the Little Dog)*: when the ass sees the lap-dog's master patting it as a reward for its friendly fawning, it tries the same thing, but gets beaten for its pains. (From the monster's own footnotes). This shows that the monster not only is sensitive and craves love but also is highly literate (See Shelley, chapters IV and V).

The message communicated by the majority of Hollywood films is that emergent technology, in the hands of hubristic scientists or ruthless corporations, is simply bad. In science fiction, this emergent technology needs a vessel, a tangible embodied form through which it can express its profundity and communicate its dark potential. Wiener's observation about the "living technique of the day" influencing the production and study of robots (see p.49) equally applies in fiction, and the robot villain has consistently been upgraded through utilisation of emerging technology at the time of production.

This fictitious use of the robot means that for nearly a century, powerful and memorable negative portrayals have been very effectively disseminated into the public domain, tainting perceptions, tarnishing its reputation and constructing a shared negative imaginary.

To describe the history of negative representations of the robot in science fiction is beyond the scope of this thesis.[31] I have therefore chosen one recent series of films that detail a particularly unpleasant future, arising from developments in computer technology. 'The Terminator' (James Cameron, 1984) offers few redeeming factors for technological application, and technology is cast simply as the harbinger of Armageddon, or, as Dinello puts it, "Terminator comes off as emphatically anti-technological." (2005, p.129).

'The Terminator' describes a plausible explanation for how computer technology could be responsible for the coming apocalypse through developments in artificial intelligence. The device used by Cameron to represent AI was the robot (or cyborg, see fig.20) and is the

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31. Daniel Dinello's *Technophobia!* describes in great detail the "dramatic conflict between the techno-utopia promised by real-world scientists and the techno-dystopia predicted by science fiction". (See Dinello, 2005, p.2).

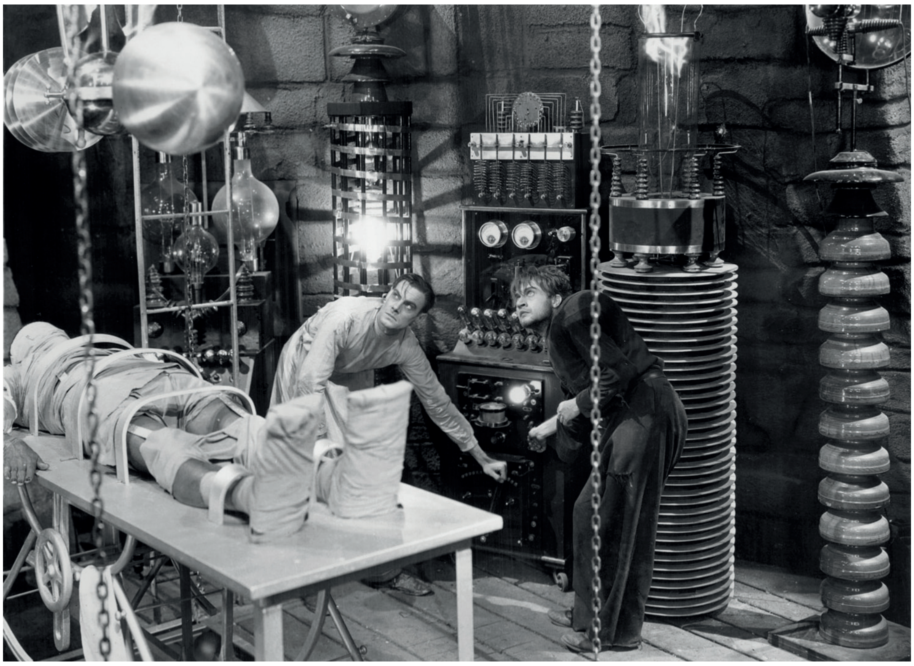

Fig.16: 'Frankenstein' (James Whale, 1931).

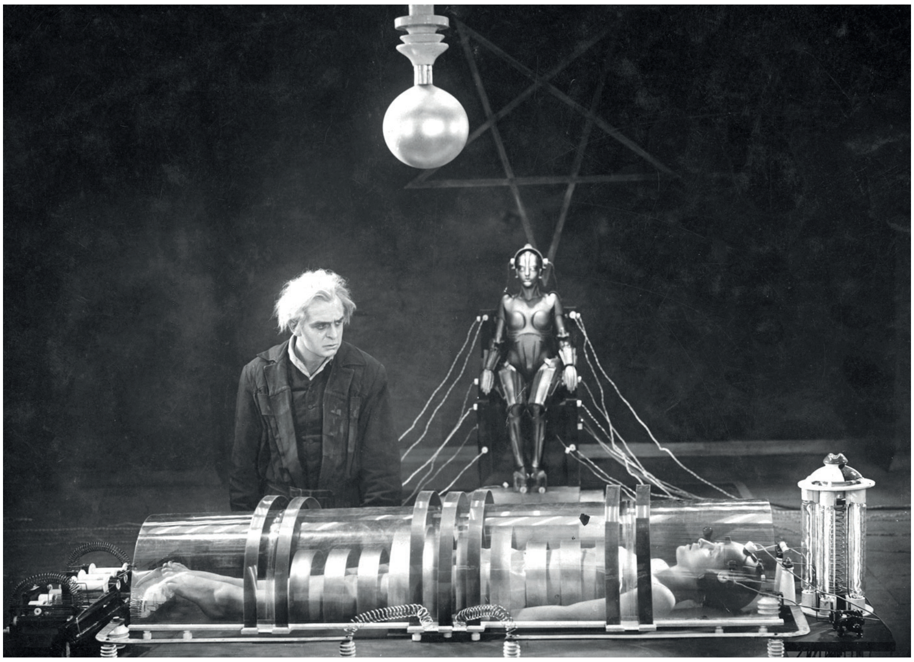

Fig.17: 'Metropolis' (Fritz Lang,1927).

Fig.18: 'Robocop' (Paul Verhoeven, 1987).

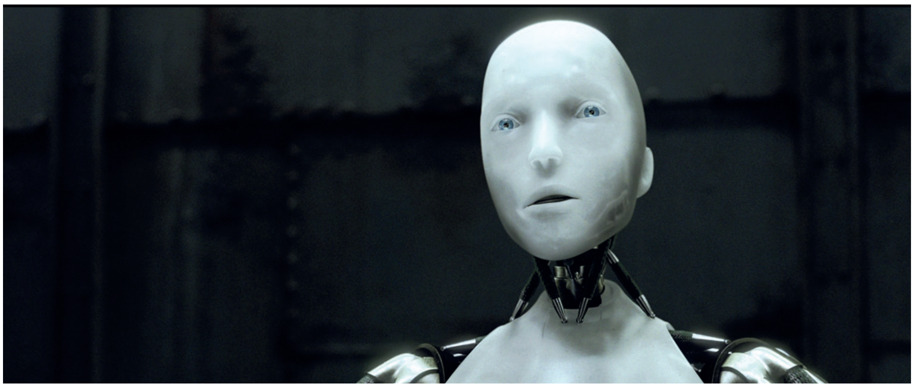

Fig.19: 'iRobot' (Alex Proyas, 2004).

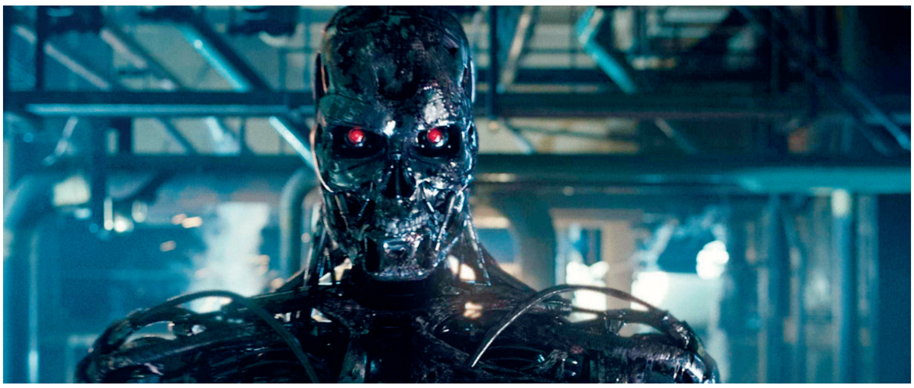

Fig.20: T-800 in 'The Terminator' (James Cameron, 1984).

dark lingering image that remains of this film. 'Terminator 2: Judgement Day' transforms the role of the T-800 cyborg (Arnold Schwarzenegger) into the underdog and defender of humanity. This role temporarily restores the reputation of the cyborg character, but, whilst the T-800 ultimately prevails, the relentless *dystopian* progress of technology is evident in both the spectacular computer effects used in the film and the creative extrapolation of the possibilities of nanotechnology. The mechanical technology behind the T-800 looks distinctly antiquated alongside the highly superior T-1000, a liquid metal, indestructible machine with unlimited transformational capabilities.

Whilst in the West, aside from a few exceptions, we have consistently subverted the image of robots and constantly improved the delivery of this presentation through advances in computer-generated special effects,[32] in Japan and other Asian nations the robot in science fiction has been portrayed in a far more favourable light. One of the most famous and popular fictional robots in Japan is Tesuwan Atom (Astro Boy), who emerged from the comic genre of Manga in 1951. The beginning of the story follows a similar route to Collodi's Pinocchio: a grieving father builds an artificial boy to make up for his lost son, but in this case the father is a rocket scientist and the artificial son is enhanced with superhuman powers and intelligence. What is important about Tesuwan Atom is his ability to fit comfortably (for a superhero robot) into the fabric and institutions of normal daily life, such as following Japanese traditions and going to school. "The message Astro Boy seeks to get across is that robots and humans could live together

32. Stanley Kubrick penned the original script for 'AI' but was not convinced by the special effects of the time. Eventually computer graphics (CG) effects improved and Steven Spielberg ultimately made the film in 2001.

and get on naturally. Over night he became a part of every Japanese family." (Ichbiah, 2005, p.86).

Powerful fictional representations of robots permeate from the outer cultural levels of the robot ecosystem to influence all other aspects - tainting the opinions and preconceptions of the potential robot-buying public, influencing the roboticists and engineers responsible for their creation,[33] and inspiring corporations to invest heavily in non-proven concepts. In his book on robots, Ichbiah claims that anime permeate Japanese society to such an extent that their traits are mirrored in commercial devices now on the market. This explains the cuteness of Sony's Aibo and many of the other Asian entertainment robots.

To conclude, in this case it is not the physical object that is maladapted for the home but the *perception* of the object. The cinema, and in particular science fiction, is extremely powerful in shaping people's expectations or understanding of a specific technology. The next section explores this specific conflict in more detail.

33. As described in the section on robot adaptation, the application of pedomorphic forms is a conscious attempt to overcome the fear factor of robots.

## The robot paradox #2: *Heimlich and unheimlich*[34]

*The home*: Bastion of comfort, security and the familiar. *The robot*: Alien, mysterious and threatening. For those whose agenda involves bringing robots into the home these opposing traits need to converge. In his book *A Small World: Smart Houses and the Dream of the Perfect Day*, Davin Heckman makes some insightful observations on the smart home.[35] Of particular interest are the advertising narratives that have been used to sell the homes of the future - as he points out, new technology offers consumers access to the things that are lacking, effectively describing the traditional route for modernisation in the home. The paradox is that with 'smart' technology, improvements need to be both spectacular *and* comforting. "They must embody a compelling new way of doing ordinary things." (2008, p.9).

Looking at this through the lens of the ecologist to explore the notion of adaptation – "every species is the product of a long history of selection and is thus well adapted to the environment in which it lives." (Mayr, 1966, p.60) - it is clear that natural organisms have lineages and therefore each individual organism is tried and tested in its habitat through countless generations of successful updates (mutations). Much the same can be said for products. Here the economist Robert

34. For housekeeping reasons I will focus on the unheimlich element of real (non-fiction) robots such as those proposed by corporations and research groups. The next point will provide a more detailed analysis of the non-homely element of robots in fiction.

35. By utilising similar sensing and actuating technologies, the smart home is effectively an extension of the robot: a robotic house.

Heilbroner describes how technological artefacts evolve:

> **"All inventions and innovations, by definition, represent an advance in the art beyond existing base lines. Yet, most advances, particularly in retrospect, appear essentially incremental, evolutionary. If nature makes no sudden leaps, neither it would appear does technology." (Heilbroner, 1967, cited in Kaplan, 2004, p.9)**

Smart homes are technological *environments,* and as such solving the 'familiar yet spectacular' paradox should not present an insurmountable problem. For example, sensing technologies could be neatly embedded in various crevices or behind screens, and actuation could be subtle and built into existing devices and spaces; the domestic landscape effectively remains visually unchanged, it simply behaves differently. However, this route has delivered little success, perhaps due to the uncanny 'haunted house' effect of well-functioning automated environments.

The few robots that have successfully entered the home follow the forms of traditional products. For example, robot vacuum cleaners and lawn mowers simply resemble their non-robotic counterparts; they are effectively roboticised versions of familiar elements of the home. In stark contrast the embodied robots being proposed by corporate advertising narratives both today and in the past represent the introduction of a very foreign species of product into the home - this would be analagous to inviting a wolf in through the door.

This observation highlights a problematic dimension for robots: whilst research continues unabated, hypothetically advancing us towards the spectacular visions imagined many years ago, there exists no domestic lineage for these robots to emerge from. If the convergence of research into artificial intelligence and complex mechanical engineering leads to readily available, cheap, operational, domestic humanoid robots, would we feel comfortable about their entering our homes, given the alien automated nature of their function? Overcoming the uncanny nature of automated objects is a major factor that will determine the success or failure of spectacular robots in domestic life.

## Playing to strengths: *Implications of a robotic future*

This final section represents a slight departure, for here I describe a likely route through which robots will enter everyday life and why this does not necessarily lead to desirable robotic futures.

At first glance it may seem obvious that a ‘thing’ should play to its strengths in order to improve its chances of survival, whether natural or artificial. The strengths of robot-related technology are complex sensing techniques, information storing and processing, and repetitive, continuous and autonomous movement. There is cold, rational and unquestioning computer logic that renders robotic technology perfectly suited to production lines, militarised zones and other inhuman or dangerous situations. These qualities undoubtedly conflict with the requirements of the home, but this has not hindered the gradual creep of automation into modern life. As long ago as 1958, the philosopher Gilbert Simondon warned of the implications of automation, using developments in the motorcar to illustrate his argument. Building on Simondon’s thoughts, Jean Baudrillard has more recently reiterated the dangers of this trend:

> **"… when it becomes automatic (on the other hand) its function is fulfilled, certainly, but it is also hermetically sealed. Automatism amounts to a closing-off, to a sort of functional self-sufficiency which exiles man to the irresponsibility of a mere spectator." (1996, p.118)**

Returning to the car, Simondon criticised the starter motor for over-complicating the mechanical purity of the internal combustion engine, preferring the simplicity of the manual turning handle. By today's standards, this perspective seems ridiculous and is indicative of Simondon's purist technocentric approach.[36] However, these early warnings, made when the automation of everyday life was in its infancy, become extremely poignant considering the advances in automation made in recent years. Paraphrasing Albert Borgmann, Bill McKibben raises a critical question: when is technological development *enough*?

> **"At a certain point, says the philosopher Albert Borgmann, technology mimics the great breakthroughs of the past, assuring us that it's an imposition to have to open the garage door, walk behind a lawn mower, or wait twenty minutes for a frozen dinner to be ready." Borgmann wrote that twenty years ago. Now the sales men insist that it's an imposition to have to press the button that opens the garage door when the smart id chip embedded in your bicep can do it for you." (2004, p.121)**

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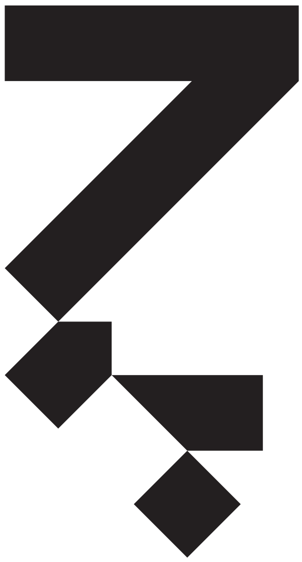
36. This will be discussed further in chapter three, see p.96.

Our cars now inform us that rain is falling by automatically turning on the windscreen wipers. They warn us if we're about to fall asleep and broadcast irritating beeps if the safety belt is not attached. 'Intelligent' systems are monitoring online purchases and behaviours, tailoring the browsing experience to what *it* thinks we'd like to view. The Sony Bravia WE5 television has an inbuilt movement detector that automatically turns off the picture if no presence is detected in the room. In a future proposal their television can differentiate between adults and children, automatically switching on parental controls if it senses a child is viewing. Robotic technology is beginning to pre-empt our needs and actions. The designers of smart homes have been experimenting with methods for reading human emotions, adjusting the lighting or music to match the mood of the occupant:

> **"Eventually, says Mary Walker, of IBM's home automation division, 'smart ID' chips will be implanted inside you. Then 'your body temperature might give your stereo system cues as to your mood and it would select appropriate music'; the chip could also 'compute how much of your body weight is fat, and offer suggestions for diet recipes to the refrigerator'." (McKibben, ibid, p.121)**

As the capabilities of sensing technology become more sophisticated, the ability of machines to gather more sensitive or emotive information relating to the human condition becomes a genuine possibility; this, combined with the computer's ability to store and analyse data, could result in a future saturated by automation. When robotic technology is employed to play to its strengths, the potential consequence is that we in turn become robotic – less emotional, more rational, programmed and predictable; technology effectively replaces human thought. This theme is explored from a speculative design perspective in the project Happylife described in chapter five. Technologies related to robotic research also excel at improving. Computer technology, for example, has its own dedicated law stating that the number of transistors on a chip will double every two years; this has proved to be approximately correct since Gordon Moore first made the observation in 1965. The exponential nature of this growth has led to scientists such as Ray Kurzweil and Hans Moravec proposing that computational power will exceed that of the human brain somewhere around the year 2020, and is a major argument in favour of the realisation of artificial intelligence defined by the cybernetics pioneers of the last century.

Reflecting on this chapter from a personal perspective, it is clear that I simply do not want to share my home with any of the robots I discovered in the course of this survey. This is quite a strong statement given the amount of positive press robots continue to receive and the ongoing predictions suggesting that we are on the threshold of a world of robot co-habitation. The problem mostly stems from the observations laid out in chapter one: that the fictional and mythical idea of robots continues to influence their development and design and, whilst the *ideas* are engaging and alluring, realisation leads to objects and functions that are essentially maladapted for the domestic habitat. If robots are to enter into our homes, we must begin by dismantling the stereotypical and romantic concepts that pervade. Robot technology can then be reconsidered with the domestic habitat in mind. We must, however, proceed with caution… as the final point highlights, when robotic technology *is* applied in ways that follow logical trajectories, the outcomes do not necessarily enhance domestic life.



# The domestic ecology: How technology *does* become a product

In the previous chapter I explored various contemporary and historical robot ecologies; the contexts or habitats we could call *their* home. This chapter explores the notion of *our* home.[37] "Few English words are filled with the emotional meaning of the word 'home.' It brings to mind one's childhood, the roots of one's being, the security of a private enclave where one can be free and in control of one's life." (Csikszentmihalyi, 1981, p.121). More specifically, I will explore some of the ways through which products and other artefacts have successfully

37. It is unnecessary here to delve too deeply into the concept of the home. For more reading, see ethnographic explorations into people and their relationship with the home such as Daniel Miller's *The Comfort of Things*; Mihaly Csikszentmihalyi and Eugene Rochberg-Halton's *The Meaning of Things – Domestic Symbols and the Self;* and Baudrillard's *The System of Objects*.

entered this complex and special place. If robots are to succeed in securing a place in our homes then they will effectively have to shift ecosystem: to make a transition from the habitat in which they currently reside (laboratory/film/technology fair) to the domestic.

One way of describing this journey or *migration* between systems is domestication: "Selection carried out by man for the purpose of adapting plants and animals to his needs." (Odum, 1971, p.242) And, fundamentally, these needs are extremely diverse. In his study on the domestication of natural organisms, Michael Pollan details the complex histories of four plants and the desires they elicit: *beauty*, in the form of the tulip, which for a brief perverse moment in 17th-century Amsterdam became more precious than gold (2002, p.xxiii); *control*, explored through the manipulation of the humble potato and its evolving relationship with human culture and technological development; marijuana and the human desire to become *intoxicated*; and *sweetness,* described through the spread of old world plants such as the apple across the American frontiers at the beginning of the 19th century. Humans will go to great lengths to shape the world in ways that satisfy their needs and wants.

For the purposes of this chapter, my subject for analysis will be the dog, not so much for the long journey from its natural habitat (although I will touch on this) but rather for the complex and transient organism it has become in adapting to human life. The dog, perhaps more than any other recipient of domestication, represents the complex and sometimes whimsical desires of humans: dog breeds ebb and flow with social trends, Hollywood films and celebrity ownership; they are the second largest recipient of cosmetic enhancement surgery after humans, and are at the core of a multi-billion-dollar global industry.

Alongside the dog I will examine the domestication of the computer. In a 2007 article for *Scientific American*, Bill Gates predicted that soon there will be a robot in every home. In arguing his case he made a comparison between the state of the computer industry in the mid 1970s and the robotics industry of today, concluding that the enormous successes experienced by computer scientists in bringing PCs into the home will soon by repeated by those developing robots.[38]

Like the dog, the computer had a long migration; from its first conception, through various utilitarian stages, before finally evolving into the ubiquitous technology it is today, existing in numerous and diverse domestic products. The key aim of this chapter is to understand how candidates for domestication are initially identified, what motivates, shapes and informs the domestication process, how the adaptations take place and what constitutes a successfully domesticated product/organism.[39]

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38. Coming from one of the most successful individuals in the world of technology, the analogy is convincing, but if we probe a little deeper into the article, flaws appear. The suggested roles for future robots are the same as those described in chapter three - Gates suggests that current limitations are simply an engineering problem that is on the verge of being solved. A more thorough analysis into the last 30 years of the computer tells a slightly different story; the route to full domestication was found simply through engineering.

39. It is important to note that domestication here refers to the ability of the organism to co-exist with humans in their homes - for example cats and dogs, not sheep or dairy cattle.

## Evolution and domestication: *A brief comparison*

In a study of ecological systems, especially when a temporal element is introduced, it is impossible to avoid the concept of evolution - how an organism genetically changes over time through random mutations to meet the ever-changing requirements for its survival. Comparisons between natural and technological evolution have been made as far back as the 19th century, when Charles Darwin first published his theory of evolution in 1859. This revolutionary work inspired philosophers, writers and anthropologists such as Marx and Engels, Samuel Butler and Augustus Pitt-Rivers to suggest that technological artefacts evolve in a manner similar to natural organisms. As noted in chapter one, the main difference between biological and technological evolution is the role humans play in shaping change - as Basalla points out when describing the difference between the theories of Darwin and Marx:

> **"In Darwin's theory biological evolution was self-generating; in the Marxian scheme the evolution of technology is not self-generating but is a process directed by wilful, conscious, active people and moulded by historical forces." (Basalla, 1988, p.207)**

This description bears a resemblance to 'artificial selection', the term Darwin himself used in 'Variation under domestication', the opening chapter of *On the Origin of Species*:

> **"One of the most remarkable features in our domesticated races is that we see in them adaptation, not indeed to the animal's or plant's own good, but to man's use or fancy." (2009, p.18).**

For these reasons I chose to adopt the more specific process of domestication rather than evolution for the analogy with technological development. This shift is subtle, but, as we shall see, the end stages of the domestication process reveal the true complexities of *man's fancy* manifested in or expressed through the final artefact. Unlike theories on the evolution of technology,[40] it places the same level of importance on the impact of popular cultural forces such as fashion trends as it does technological development;[41] this is imperative if we are to understand the factors influencing product success and failure, and, more importantly, to later apply these observations in the speculative design process.

Consistent, regardless of terminology, is the ancestral line or *lineage* of the organism or artefact. The tracing of the lineage represents a particular challenge to the thinkers in the field of technological evolution. Should we wish to trace a dog's ancestry back through pre-history, all of the necessary information would be held in its DNA - a straightforward linear path revealing the "recurrent and inherited

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40. Simondon proposes two major causes of technical evolution: economic and purely technical. The former, he suggests, are "not pure; they involve a diffuse network of motivations and preferences which qualify and even reverse them (e.g. the taste for luxury, the desire for novelty which is so evident amongst consumers, and commercial propaganda)". 'Pure' or not these factors are at the core of contemporary product development and must be considered.

41. Here we run the risk of becoming embedded in complex debates relating to technological determinism and the relationship between technological development and society. Whilst it is beyond the scope of this thesis to address this question in depth, the fact that the speculative design approach employs societal and cultural observations in its hypothetical 'progression' of technology with the aim of influencing development denies the deterministic approach.

characteristics that distinguish it from other species" (Vaccari and Barnet, 2009, p.7), or indeed breeds. With technology, there is no such DNA record. Various attempts at achieving an understanding of technological evolution have been put forward, most notably Gilbert Simondon's seminal essay 'On the Mode of Existence of Technical Objects' (1958), and Bernard Stiegler's 'Technics and Time' (1998). Whilst many of the observations and theories made in these studies are directly relevant to this essay, their approach tends towards the technocentric. As Vincent Bontems describes in his essay on the work of Simondon, "the unity of a technical lineage must not be determined by the function and utilisation of technical objects because such a criterion would regroup objects with very different structures and functioning." (Bontems, 2009, p.3). The approach, defined by Simondon as "Genetic Mechanology", aims to "establish a relationship between objects according to their internal functioning as opposed to their utilisation". (Ibid).[42] For the purposes of this thesis a more appropriate method of classification has been proposed by George Basalla in his book *The Evolution of Technology*. Here he emphasises the value of the artefact:

> **"A theory of evolution cannot exist without demonstrated connections between the basic units that constitute its universe of discourse. In technology those units are artefacts … it becomes apparent that every novel artefact has an antecedent.**

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42. In defining the problem, Simondon points out that we can get the "same result from very different functionings and structures: steam-engines, petrol-engines, turbines and engines powered by springs" (Simondon, p.18). Basically, the promiscuous nature of technological application means that it is difficult to define technical objects with reference to specific functionality.

**This claim holds true for the simplest stone implement and for machines as complex as cotton gins and steam engines." (1988, p.208)**

As a designer, the artefact approach is appealing, because from this perspective technology is simply a means to an end. How the technology operates is less relevant than what the object does and how we benefit from this function. Here I propose taking this notion one stage further, to focus on the actual human activity being augmented by the technological product. The artefact method of classification has been complicated in recent times by the convergence of many functions into one product. This has led to a blurring of product boundaries - for example, telephones are now also cameras, televisions and computers; computers are shops, libraries and social networks. This is not problematic for the historian, as the convergence points can be easily identified with the benefit of hindsight, but for the designer speculating on how products might evolve in the future, the projected lineage of an artefact offers few clues relating to potential convergences. The advantages of this method of understanding product lineage will become apparent at the end of this chapter, specifically when applied to recent developments in computer technology.

## Domestication theory

In 'media and communication studies' and the 'studies of sociology of technology', the concept of domesticating technology is an established field with a well-defined idea of what this means:

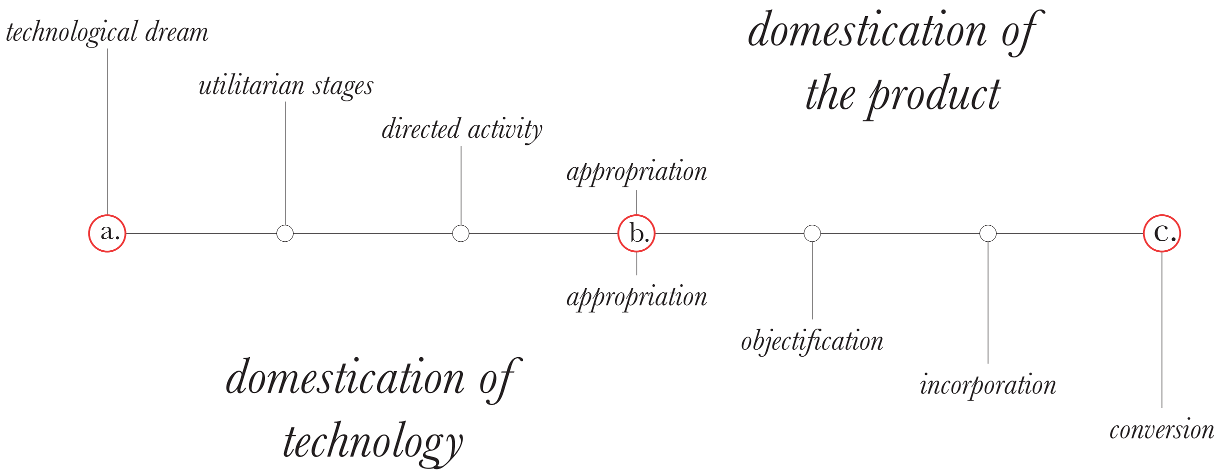


Fig.21: Domestication of products and technology

> **"In our understanding, domestication is, first of all, an analytical tool, which helps to illuminate the process where the user makes the technology 'his/her own'; a process through which both the technology and its user are changed. This process takes place through various phases or dimensions and the artefact is fitted into the routines and the practices of the everyday life of its user." (Berker et al, 2006, p.126)**

Or a more pragmatic description:

> **"Domestication, in the traditional sense, refers to the taming of a wild animal. At a metaphorical level we can observe a domestication process when users, in a variety of environments, are confronted with new technologies. These 'strange' and 'wild' technologies have to be 'house-trained'; they have to be integrated into the structures, daily routines and values of users and their environments." (Ibid, p.2)**

Through the use of the term 'house-trained', Berker's analogy specifically infers the time frame between the introduction of a puppy into the home and its complete integration with the rules, systems and behaviours laid down by its new owner. This definition completely ignores the journey made by that dog's ancestors over the best part of 15,000 years, the journey that *allowed* for the dog to be an appropriate candidate for human co-habitation.

There is a simple solution to this anomaly. By making a distinction between 'technology' and 'product', it becomes possible to see domestication as a dichotomy. Domestication studies, as described above, relates to the domestication of the 'product', and what is being examined in this thesis relates to the domestication of 'technology' - effectively the creation of a consumable product from technological potential.[43]

Roger Silverstone, one of the original contributors to theories of domestication, breaks 'product' domestication down into for stages:

Appropriation: the point at which the object is sold - from commodity to ownership.

Objectification: the act of the object becoming situated in the aesthetic environment.

Incorporation: the functional aspect of the object being incorporated into the routines of daily life.

Conversion: how the existence of the object reflects back in the outside world.

These four stages are helpful as they define the basic criteria for the consumable product to be a success - effectively the qualities it needs to exhibit at the end of the 'domestication of technology' stage. If these combined four stages are viewed as an *end goal* for technology, the domestication of technology can be understood as the journey between the habitat of (a) the entirely wild organism or emergent technology and (b) the appropriation stage, with domestication of the product taking place between (b) appropriation and (c) conversion:

The following section will examine this process in detail, pointing out observations that will be used in later chapters about speculative design.

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**43.** Here I specifically refer to a 'domestic product'. Of course a technology may exist as a product in the business or military domain before becoming available on the domestic market.

# Domestication of technology

## The genesis: *Hints of usefulness or observed potential*

Here I return to the beginning of the previous chapter to touch again on technological dreams and the character of the individuals behind the genesis of a technology.

By comparing the wild dog, prior to domestication, to an emerging technology, a few basic similarities can be observed. First, both exhibit a perceptible potential for useful human application. Second, this potential is perceived and consequently shaped and promoted by only certain members of the population. Third, the subject is complex and little understood - interactions are specialised and forms are unconsidered.

Over an approximate 12,000-15,000-year period, the wild dog successfully made a transition from its natural wild habitat to the domestic habitat. In the previous discussion on functional adaptation (see page 62), I introduced the ecological concept of the niche. Here the pioneer of ecosystem ecology, Eugene Odum, offers another definition:

> **"The ecological niche of an organism depends not only on where it lives but also on what it does. By analogy, it may be said that the habitat is the organism's 'address', and the niche is its 'profession', biologically speaking." (1971, p.234)**

The term 'profession' as used by Odum is particularly helpful because, non-biologically speaking, it neatly lends itself towards the suggestion of a role with some usefulness (to humans). There is supposition amongst natural historians as to exactly how the initial steps of dog domestication took place, but as Frederick E Zeuner describes in his theory on animal domestication, the general consensus is that the wild dog entered into human life with the *profession* of man's first 'refuse collector':

> **"The wild dog's habit of clearing away food debris, particularly well developed in the Jackal, which readily eats even vegetable matter is well known … The advantage which accrued to early man from the removal of food debris, which otherwise would have accumulated in or near the camps and villages, must have been noticed at an early period." (1963, p.83)**

It is worth noting that early modern humans had no formalised relationship with animals (e.g. pets, livestock, zoos), and therefore the notion of co-habitation would have been a revolutionary concept. I would like to return to Zeuner's point that the "benefits must have been noticed", to investigate the character behind those identifying the potential in their observations and conceptualising how this might be manipulated to their benefit. The following extracts are from Abbot P Usher's book on mechanical inventions, where he describes the character of the inventor:

> **"Discovery consists in the perception of relations existing in nature that were not previously recognized. Strictly speaking, the arrangements exist independently of our minds though obscured in many ways by the complexity of the phenomena. The perception of such relations turns largely upon**

**eliminations and simplifications of the items of experience that may distract attention from the orderly patterns that are finally recognized." (1929, p.10)**

**"The inventor, like the artist, lives on the borderland between the normal and the abnormal, and like artists and prophets finds in his daydreams a source of gratification and encouragement at the least, and at times a fruitful source of genuine accomplishment. Intuitive knowledge and the works of creative imagination are more or less directly associated with delvings into levels beyond the limits of our normally conscious life." (Ibid, p.29)**

Usher's theory on technological development describes the essentially cumulative character of mechanical achievement (p.269). The domestication of dogs could also have been seen to follow a similar pattern of progress, but any cumulative lineage *must* have a genesis - and these initial steps made by early modern humans in befriending wild dogs represent this genesis for all recipients of domestication: from dogs and cats; sheep and cattle; potatoes and apples to marijuana and tulips.[44]

Concerning the computer, the identification of a specific genesis is a greater challenge due to the more complex nature of the artefact and what might represent its primary incarnation. However, culturally it is customary to assign major inventions or significant

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**44.** The last four items relate specifically to the case studies described in Michael Pollan's *Botany of Desire*. It tells the story of each domesticated species and how they have thrived through satisfying humankind's most basic desires.

advances to a particular individual.[45] The computer is no exception, and whilst others had developed similar concepts,[46] Charles Babbage is commonly referenced as the founding father of the modern computer (Eames, 1973; Pugh, 1995). In line with Usher's 'daydreamer', Babbage here describes how the concept for his Difference Engine came about:

> **"The earliest idea that I can trace in my own mind of calculating arithmetical tables by machinery arose in this manner: One evening I was sitting in the rooms of the Analytical Society, at Cambridge, my head leaning forward on the table in a kind of dreamy mood, with a table of logarithms lying open before me. Another member, coming into the room, and seeing me half asleep, called out, 'Well, Babbage, what are you dreaming about?' to which I replied: 'I am thinking that all these tables' (pointing to the logarithms) 'might be calculated by machinery'." (Babbage, quoted in essay by Cohen, *New Scientist*, 9 October 1958)**

Charles Babbage's Analytic Engine was conceived to mechanise calculation around 1837. Neither the Analytic Engine nor his earlier

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45. For example: Thomas Edison: electricity; James Watt: steam engine; K Eric Drexler: nanotechnology; Craig Venter: genomics. Here it is worth noting that this chapter is written with the singular aim of informing the speculative design practice, not arguing either for or against the validity of assigning a specific name to a particular invention.

46. Significant predecessors include: John Napier, invents logarithms (1614); Wilhelm Schickard builds the first mechanical calculator (1623); Blaise Pascal builds a mechanical calculator (1642); Joseph-Marie Jacquard invents an automatic loom controlled by punch cards (1805).

Difference Engine were realised in his lifetime, but these proposals did come close to describing the workings of the modern computer. In *The Evolution of Technology*, Basalla makes the observation that “initially inventions are likely to be very crude models embodying new ideas in need of further refinement”. (p.141). Also relevant is his suggestion that “[each] invention offers a spectrum of opportunities ... The first uses are not always the ones for which the invention will eventually become best known” (p.141). These ideas apply to both the dog and the computer: the contemporary versions are far removed from their earliest ancestors. In both cases, though, the *essences* of modern function were present in their original incarnations.

These observations become relevant when the speculative designer contemplates the proposals or predictions made by modern inventors such as K Eric Drexler (nanotechnology) or Ray Kurzweil (AI), describing future possibilities for the emerging technology under development: the essences are of more value than the specific promise. The designer must look beyond the proposed applications to the raw functional potential, using this as a basis for design directions and ideas.

## Utilitarian stages: *Means and ends*

Once a concept has exhibited its potential to the larger community, development spreads to other areas, producing new applications or areas of research. With the dog, its general acceptance led to selective breeding and training, which made dogs more responsive and pliable to the needs and desires of their human hosts - allowing for the emergence of more complex functions and contrived forms. Specific breeds emerged, each somehow designed for a specific purpose.[47]

When humans are involved in the practice of shaping artificial rather than organic matter, the time constraints of breeding, gestation and maturing are removed. Progress happens with greater efficiency, with real-life events becoming the catalysts for the direction and speed of technological development. After Babbage presented his concepts for the computer, almost a century passed with little development, but during this time the world was being reorganised. In the US, mass immigration and a growing interest in social investigation and the statistical method resulted in the Census Bureau collecting more data than it could tabulate. In order to develop a more efficient census-taking system, the agency held a competition in 1888. Herman Hollerith won the contest with his electronic tabulating machine; modified versions of his technology would continue to be used at the Census Bureau until replaced by computers in the 1950s.[48] At the same time companies were growing in size and a research culture, so prevalent today in shaping the fortunes of a specific technology, was emerging as a genuine progressive force: these combined circumstances resulted in a revitalised interest in computing and statistical analysis.

Like Zeuner's basic categorisation of early dogs, *A Computer*

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**47.** In A History of Domesticated Animals FE Zeuner lists the four major types of dog in early Europe: C.f. inostranzewi has been regarded as a wolf-like polar or Eskimo dog, and it has ever been suggested that this breed was used to draw sledges; C.f. matris-optimae is believed to have been a primitive sheepdog; C.f. intermedius appears to be an ancestor of various breeds of hounds; C.f. palustris was a small house dog from which the later Pomeranians, terriers and so forth would be derived (1963, p.93).

**48.** From the US Census Bureau: http://www.census.gov/history/www/innovations/technology/the_hollerith_tabulator.html

*Perspective*[49] - an exhibition and book by the office of Charles and Ray Eames - categorised computers of the early 20th century into three clear areas:

> **“Calculating machines: Machines used in performing mathematical operations – for commerce, table-making, and scientific analysis.**
> **Statistical machines: Machines used to find relationships within information by sorting and tabulating masses of data.**
> **Logical automata: Machines that use information about their past performance to determine their next actions.” (1973, pp.14-19)**

The wars that consumed the world during the mid 20th century gave a new impetus for research into computer technology, resulting in the development of the first truly modern computer. One of the individuals responsible for these developments was Alan Turing. In his investigation into the role played by advanced technology for military application, Manuel De Landa describes both the circumstances surrounding the creation of Turing’s computer and its consequential development:

> **“The computer was born in 1936 as an ‘imaginary machine’. That is Alan Turing, its inventor, gave only a logical specification of the machine’s functions without bothering to give any details regarding its physical implementation …**

49. An exhibition and accompanying book conceived and assembled for IBM (1973)

> **Turing machines remained in that imaginary state for over a decade, until the pressures of cryptological research during World War II gave rise to the components necessary to give the machine a physical body." (De Landa, 2003, p.129)**

Like Babbage, Turing's concepts started in his imagination, but in contrast, his ideas were transformed into the operational *pre*-computer 'Colossus' that famously deciphered the German enigma code during the war. De Landa goes on to describe how the wartime machines were not *genuine* 'Turing' machines;[50] these machines would appear in the post-war period and represent the genuine descendants of the machines we call computers today.

Post World War Two, the function of computer technology transferred almost seamlessly into the Cold War - and with it an increasingly developed relationship between the scientific community and the military: "never before had science been applied at so grand a scale to such a variety of warfare problems" (De Landa, ibid, p.5). The nature of this relationship resulted in the computer remaining a steadfast tool for experts in the academic, business and military domains. Howard Rheingold describes below the industry's reaction to Doug Engelbart's suggestion in 1951 to use computers for teaching and interaction:

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**50.** "The personal computer is defined as a 'universal machine', a machine that can simulate the workings of any other machine… it can reproduce the behaviour of any other machine that works on 'symbols', or physical inscriptions of some sort: typewriters, calculators, piannolas." (De Landa, 2003, p.130).


Fig.22: Neiman-Marcus catalogue showing Honeywell Kitchen Computer (1969).

> **"The interactive stuff was so wild that the people who knew about computers didn't want to hear about it. Back then, you didn't interact with a computer, even if you were a programmer. You gave it your question, in the form of a box of punched cards, and if you had worked very hard at stating the question correctly, you got your answer. Computers weren't meant for direct interaction. And this idea of using them to help people learn was downright blasphemy." (Rheingold, 2000, pp.178-79)**

Political, cultural and social events drastically influenced and accelerated computer development between the late 19th century and the Cold War years. In *The Computer Perspective*, written in 1973, Charles and Ray Eames conclude by celebrating the spectacular growth of the computer – in numbers, in capability, in application (p.161). However, they make no reference or suggestion, at any stage, to computers coming into the home. It would take a more conscious effort to transform the potential developed in the contexts of business and military into a product suitable for domestic use.

## Directed activity: *A conscious shift towards domesticity*

At some stage in a successful domestication, the candidate takes a shift away from utilitarian roles towards a more complex emotional or status-based value. During the late Middle Ages, hunting became a recreational activity for the upper-classes, and this change from survival activity to a form of entertainment led to a new significance for the dog, elevating them above the status of other animals. Sophia Menache, in her essay on dogs in the pre-modern period, provides a detailed analysis of the changing relationship between humans and dogs:

**"The hunting treatises of the fourteenth and fifteenth centuries provide a vivid reflection of changing attitudes towards dogs. They hint at a meeting point where dogs were divorced from the animal kingdom to be allowed a respectable entry into the apex of human society, among the medieval nobility." (Menache, n.d., cited in Podberscek et al, 2000, p.56)**

This change of circumstance was perhaps the most significant step dogs took towards achieving their potential as a domestic species. During this period only the nobility were allowed to keep hunting dogs, but the eventual breakdown of feudalism, combined with the industrialisation of farming and manufacture, led to dogs being available to all members of society for reasons beyond their traditional utilitarian value.

Like the dog, the computer spent a large period of its development in utilitarian roles. Even as late as the 1960s it was still seen as a tool for industry. It would take a concerted effort to change this perception and encourage people to bring one into their home. In 1969 a computer product, the Honeywell Kitchen Computer, costing $10,600, finally became available to the public. According to an article by Dag Spicer,[51] not a single one was ever sold. However, as Davin Heckman notes in his book on the smart home, the Kitchen Computer was revolutionary in creating a shift in perception. As the large militarised mainframes of the 1950s gave way to smaller, more powerful

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51. The computer was basically a technical cookbook offering suggestions as to what dishes could be cooked with the ingredients at hand. Similar proposals continue to this day, mostly through smart fridges such as the Electrolux Screenfridge. See article: http://drdobbs.com/184404040.

and better machines, "the computer was quickly inserting itself into the everyday, not as an abstract and futuristic concept, but as a real and very personal fact of life." (2008, p.55)

However, whilst the computer was succeeding in making a perceptual shift, the physical object would still not make a true impression on everyday life until the 1990s. Even as late as 1986, some observers were commenting on the demise of the computer industry:

> **"By the mid-1980s the home computer boom appeared to be nothing more than a short-lived, and for some computer manufacturers, expensive fad. Consumers who were expected to use these machines to maintain their financial records, educate their children, and plan for the family's future ended up playing electronic games on them, an activity that soon lost its novelty, pleasure and excitement. As a result a device that was initially heralded as the forerunner of a new technological era was a spectacular failure that threatened to bankrupt the firms that had invested billions of dollars in its investment." (Basalla, 1986, p.185)**

Whilst few computers were making it into our homes, significant advances were being made in the background that with hindsight seem obvious. Here I will employ the same three categories used to analyse the robot's lack of adaptation in chapter three: form, function and interaction, examining the individuals and institutions who took the final steps towards creating the ubiquitous domestic computer products that exist today.

Fig.23: Xerox Parc's Alto PC.
The Alto personal computer (debuted 1973) featured the world's first WYSIWYG editor, commercial mouse for input, GUI, bit-mapped display with menus and icons, link to LAN and simultaneous file storage.
These sold only to industry and were never available to the general public. They were though highly influential for the designers at Apple.

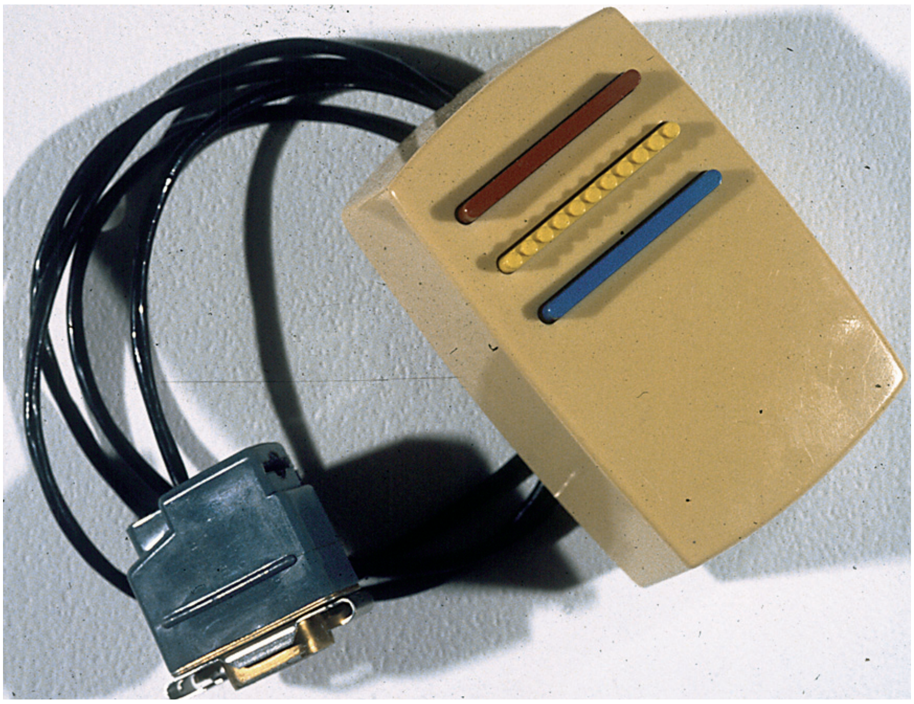

Fig.24: Xerox Parc's three-button mouse.
Three-button mouse (circa 1970s), Xerox PARC's choice of GUI pointing device for personal computing based on a principle called Fitt's Law.
The mouse evolved from Doug Engelbart's research for the ARC. (Augmentation research Centre)

## Interacting with computers: *Designing the interaction*

Many early personal computers inherited the complex methods of interaction employed by computer scientists. The Honeywell Kitchen Computer, for example, required the user to sit through a two-week programming course in order to operate the product. For technology to be truly domesticated it needs to be relatively simple to use, or for the benefits of the function to be worth the effort of learning. For many years the majority of scientists and researchers in the computer industry were happy for the computer to remain highly complex, accessible only to technically oriented minds and skilled operators. However, there was a small group of individuals pursuing a more intuitive and common sense approach. In the following passage Howard Rheingold describes Doug Engelbart's first presentation of his new interactive concept at the 1968 Fall Joint Computer conference in San Francisco:

> **"In front of him was the display screen … the screen could be divided into a number of 'windows', each of which could display either text or image. The changing information displayed on the large screen, activated by his fingertip commands on the five-key device and his motions of the mouse, began to animate under Doug's control. Everyone in the room had attended hundreds of slide presentations before this, but from the moment Doug first imparted movement to the views on the screen, it became evident that this was like no audio visual presentation anyone had attempted before.**
> **Engelbart was the very image of a test pilot for a new kind of vehicle that doesn't fly over geographical territory but through**


Fig.25: IBM PCjr.


Fig.26: Apple Macintosh. Both launched in early 1984. The IBM survived on the market for little over one year before being discontinued.[52] The Mac was the first commercially successful personal computer to feature a mouse and a graphical user interface rather than a command-line interface.[53] This computer was popular until the early 1990s.

52. For further reading on the demise of the IBM PCjr, see Castro, J, Buderi, B and McCarroll, T (1985), 'Kicking Junior Out of the Family', http://www.time.com/time/magazine/article/0,9171,964850,00.html accessed 7 August 2011.

53. Ken Polsson (2009), 'Chronology of Apple Computer Personal Computers', http://www.islandnet.com/~kpolsson/applehis/appl1984.htm, accessed 19 September 2011.

**what was heretofore an abstraction that computer scientists call 'information space'. He not only looked the part, but acted it: The Chuck Yeager of the computer cosmos, calmly putting the new system through its paces and reporting back to his astonished earthbound audience in a calm, quiet voice." (Rheingold, 1985, p.190)**

Engelbart's research for the Augmented Research Company (ARC) was extremely influential on the work that later took place at Xerox Parc, who in turn were responsible for Apple developing their famous GUI (Graphic User Interface). Here Steve Jobs describes his first visit to Xerox Parc:

> **"And they showed me really three things. But I was so blinded by the first one I didn't even really see the other two. One of the things they showed me was object orienting programming they showed me that but I didn't even see that. The other one they showed me was a networked computer system ... they had over a hundred Alto computers all networked using email etc., etc., I didn't even see that. I was so blinded by the first thing they showed me which was the graphical user interface. I thought it was the best thing I'd ever seen in my life … within you know ten minutes it was obvious to me that all computers would work like this some day." (Cringely, 1996)**

Whilst the research of both Engelbart and Xerox Parc did not result in successful commercial products, their simple and intuitive methods of interaction can be seen in every personal computer on the market today. A domestic technological product has to be simple to use, and in 1984 Apple released the Macintosh, the first commercially available and relatively inexpensive computer to use a graphic user interface. Microsoft would follow one year later with Windows 1.0, the ancestor of the operating systems that currently have around 90% of the market share.[54]

## The form of computers: *Any colour so long as it's beige*

In the early 1990s, personal computers mostly remained housed in the beige cases that were a direct throwback to their office heritage. There had been some earlier suggestions that computers could exhibit an aesthetic language more sympathetic to the domestic landscape, such as the gaming computers by Atari and the ZX series by Sinclair Research.

In giving form to his computers, Sinclair sent his industrial designer Rick Dickinson to visit Dixons, a large high-street electronics shop, to consider which existing products it should look like.[55] The resultant computer was small and elegant, resembling more a prop from Stanley Kubrick's futuristic and extremely stylised film '2001: A Space Odyssey' (1968) than an office product. Alternatively, the Atari 2600 gaming computer had veneer inlays on its facade, following the televisions and stereo systems of that period. Both computers benefited from plugging directly into the television set, an already established technological product in the majority of homes, giving them an interactive and aesthetic familiarity.

Things finally changed in 1997 when industrial designer

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**54.** Combined figures for Windows operating systems, see 'StatCounter Global Stats', http://gs.statcounter.com/#os-ww-monthly-201007-201107-bar, accessed, 23 August 2011.

**55.** See http://www.bbc.co.uk/news/magazine-12703674

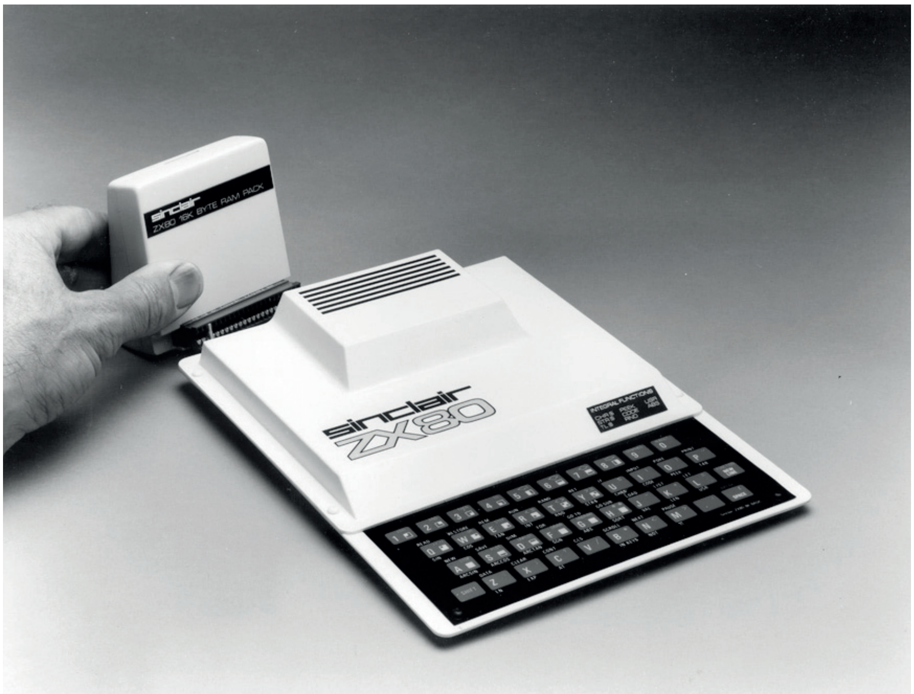


Fig.27: Sinclair ZX80 (1980)


Fig.28: Atari 2600 (1980).

Jonathan Ive revolutionised the industry with the launch of the Apple iMac. This ongoing relationship between Apple and Ive's design department has been partially responsible for the company becoming the most successful developer of electronic products in the world.

## Computer Function: *Beyond word processing*

As technology journalist Robert X Cringely describes in his Third Law of Personal Computing: to succeed, a PC architecture must have an application that alone justifies buying the whole box - a killer app.[56] In his book *Accidental Empires*, Cringely describes the flurry of activity in Silicon Valley during the early personal computer era, as countless companies and individuals attempted to bring their product to the mass audience. The early personal computers' emergence out of the office environment had not only informed their form and methods of interaction, but had also led to applications being based on business needs such as spreadsheets and word processing.

Viewing this 1970 *Life* magazine article (fig.29), sourced via the internet from my wireless laptop computer whilst on a working holiday in north-west France, it seems ludicrous that the ability to 'plan a dinner menu', or to 'print an invitation', would justify the not-insignificant outlay of the computer. The early Apple computers were launched with two programmes: a word processor (MacWrite) and a basic drawing package (MacPaint). Microsoft's alliance with IBM as software supplier had them ahead in the application game, but the computers produced during this era were predominantly still tools for the business market.

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56. From http://www.pbs.org/nerds/qa15.html, accessed 16 August 2011.

# The Handy Uses of a Home Computer

- Planning a dinner menu
- Balancing bank accounts
- Doing school homework
- Figuring out income tax
- Printing invitations
- Keeping the budget

Fig.29: “Computers for the home have been envisioned by science fiction writers and engineers ever since a huge, unwieldy prototype was developed 25 years ago. The whole futuristic age they prophesied, with an omnipotent electronic monster named Horace in every living room, is still a long way from realization, but compact consumer computers have quietly entered the household. While the market hardly rivals TV sets or refrigerators, the computer-as-home-appliance is now more than just a toy for the wealthy or a mysterious instrument for technical specialists.” (*Life* magazine, 1970).

Apple, through working with Adobe on desktop publishing products, would eventually cement their appeal to the creative industries, moving sideways from traditional business usage, but few computers were finding a place in our homes outside hobbyist communities and game players.

The significant elements that finally combined to justify the appropriation of the computer were a complex melange of disparate technological progressions. First, the gradual transition towards digitisation led to several domestic media devices requiring a computer for playback and product management. For example, MP3 players became commercially available in the mid 1990s; digital cameras in the early 1990s and digital video cameras around 1995. This simple shift in human interaction with existing and familiar products gave rise to the first real justification for appropriating a computer for non-business use. The development and introduction of the USB[57] during this period standardised and simplified connectivity between products, allowing for the computer to become a domestic hub for managing and viewing media.

The second and more significant development was the domestic implementation of the internet. Again, like the GUI, computer networks had been researched and used at Xerox Parc almost 20 years previously, but until the mid-1990s the internet was still a tool for experts and industry, lacking the infrastructure and breadth of purpose it has today. Returning to Cringely's law on the killer application, the early internet would struggle to justify the cost of the computer, as

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57. Universal Serial Bus: a standardised serial computer interface that allows simplified attachment of peripherals, especially in a daisy chain.

it was complicated to get connected, slow and lacking in content. However, once again things started to change with the 1997 iMac. In line with Apple's philosophy of making things intuitive and simple to use, the iMac connected to the internet in three simple steps:

> **Presenting 3 easy steps to the internet.**
> **Step one: Plug in.**
> **Step two: Get connected.**
> **Step three: Laughs … There is no step three … laughs … There *is* no step three.**
> **(Apple iMac television commercial, 1997)**

## Appropriation and more: *Post utility*

This section describes the final phase in the domestication process experienced predominantly as a shift in the value of the object. Baudrillard makes a poignant division when classifying domestic products. This stems from his rather specific use of the word *objet*: "anything which is the cause or subject of a passion; figuratively – and *par excellence* – the loved object." (2005, p.91).[58] He goes on to describe the two functions of any object: "to be put to use and to be possessed … these two functions stand in inverse ratio to each other" (ibid). This notion that the emotional object must be divorced from any utilitarian aspect has been noted by the ethnologist J P Digard in relation to pets:

58. Here Baudrillard quotes from Littré's French Dictionary with the definition for objet (object).

Fig.30: The 1997 Apple iMac perhaps deserves the title of the first domestic computer combining successfully the three elements described earlier: form, function and interaction.

> **"The most misunderstood yet perhaps the most interesting aspect of pets is doubtless the following: to be permitted to become close friends with their owners, these animals have to be completely available for them and to have no other purpose than just being their owner's companion."**
> **(1990, p.234)**

Conveniently in *The System of Objects*, Baudrillard, quoting Maurice Rheims, likens the object to a dog: "For man, the object is a sort of insentient dog which accepts his Blandishments and returns them after his own fashion, or rather which returns them like a mirror faithful not to real images but to images that are desired." (Rheims, *La vie étrange des objets*, p.50, cited in Baudrillard, 2005, p.95). This personalisation of the image neatly represents the complex emotional and psychological factors exhibited by the post-utility object: no longer are form and function defined by the satisfying of tangible and relatively stable human needs, but rather are governed by a much more complex and extremely ephemeral set of criteria. This is exemplified by the ebb and flow of dog breeds, in synch with cultural trends, Hollywood films and celebrity behaviour.[59]

This adaptation represents the "objectification" stage of Silverstone's domestication, as the object becomes "situated in its [owner's] aesthetic environment". Through customisation, the successful product becomes "the subject of a passion", lifting its value above that of the unmodified or purely utilitarian object.

The computer, however, achieved its post-utility status in a slightly different manner - for it is not in the malleability of the hardware that we find its value, but rather the scope of possibility facilitated by its software and content. Through the ubiquity of the internet, the computer opens a window to a highly complex network of potential, facilitating connectivity between groups of disparate people with shared interests. This factor was noted by the original creators of the networked

59. For example, after the release of the 1985 version of the Disney movie '101 Dalmatians', new Dalmatian registrations increased 6.2-fold, from 6,880 registrations in 1985 to 42,816 registrations in 1993, followed by a precipitous fall to 4,652 registrations six years later (Herzog, Bentley and Hahn, 2004). And the following statement was made on a Chihuahua enthusiasts website in 2004: "Following the release of the film 'Legally Blonde' three years ago and after several celebrities, including most famously X-Factor judge Sharon Osbourne, acquired Chihuahuas they have become highly sought after pets. Many people have been searching for their ideal Chihuahua for over a year. Please remember that a Chihuahua is not a fashion accessory."

computer, J C R Licklider and Robert W Taylor in their prophetic paper of 1968, 'The Computer as a Communication Device':

> **"First, life will be happier for the on-line individual because the people with whom one interacts most strongly will be selected more by commonality of interests and goals than by accidents of proximity." (Licklider and Taylor, 1968)**

The privacy of the home perfectly complements the ability of the network to bring together individuals with diverse and extremely specific interests, leading to super-niche forums and social networking sites that have revolutionised the way we interact. The domestication of the computer has resulted in what is perhaps the most customisable product ever to exist, simply because its flexibility lies not in the hard components that make up the physical object but rather in its dynamic, diverse and ever changeable content: it facilitates an infinitely customisable experience. It required a suitable interface and benefited from a more sympathetic form, but the key factor responsible for the success of the computer in broaching the defences of the home was the introduction of the internet: a global system of possibility and personal expression.

Having made this examination into two successful recipients of domestication, it is finally time to return to the robot. Reflecting on the previous passage I would suggest that to a large degree Bill Gates was correct in his first observation: the robot industry is in a similar state to the computer industry of 30 years ago; robots have cemented their place in both the industrial and military context; billions of pounds are currently being spent on their development; and there is a concerted

Figs.31 & 32: The complex migration between systems, from the wolf in its natural environment to the dog in the domestic environment, reflects the will of humans expressed through the domesticated object.

effort to bring them into our homes. The key question centres on Cringeley's law relating to killer apps and financial outlay. The 1970 *Time Magazine* article on the home computer mirrors the basic utilitarian proposals currently being made about robots, such as extended labour saving and stereotypical ideas of caring.

After Steve Jobs' visit to Xerox Parc in 1979, he almost entirely overlooked the potential of the networked computer to focus on the interface. Again this seems to echo the robot industry today, with the majority of research focusing on robot interactions and usability. Whilst these are of importance, without addressing the fundamental question - 'why would we need a domestic robot?', the final steps of the domestication process may remain unmade. I will leave it to Michael Pollan to conclude this chapter by reminding us why the dog has been so successful in entering domestic life:

> **"The big thing the dog knows about – the subject it has mastered in the ten thousand years it has been evolving at our side – is us: our needs and desires, our emotions and values, all of which it has folded into its genes as part of a sophisticated strategy for survival. If you could read the genome of the dog like a book, you would learn a great deal of who we are and what makes us tick." (Pollan, 2002, p.xv)**

# 4.

# Speculative design: The products that technology *could* become

In the previous two chapters I examined how technology 'does' and 'does not' become a product. This chapter is the last of the three enquiries: how technology *could* become a product. Here I discuss the practice of speculative design, describing how it can be used to present more plausible depictions of near-future technological applications. There is a lot of debate and discussion about the 'what' and 'why' of speculative design and related practice - for example, Julian Bleeker's short essay, 'Design Fiction' (2009), Bruce Sterling's article on Design Fiction in *Interactions Magazine* (2009) and Carl Disalvo's essay, 'Design and the Construction of Publics' (2009) - but as this is a practice-based thesis I will focus more on the 'how'. I will describe the methods through case studies, either of my own projects or projects completed by graduates and students of the Design Interactions course at the RCA, where I have been teaching since 2005 and carrying out this research.

## Speculative design: *Motivations*

As described in the previous chapter, technology mostly advances in small iterations, and many of the concepts behind contemporary products such as the telephone and the computer have a lineage that can be traced back to the beginnings of the last century and beyond. Initially these provided clear improvements to the human condition and their value was obvious. Now, many generations later, we find ourselves very far from where we started, but due to the incremental nature of this *progress* it passes largely unnoticed. We are like the frog in the famous anecdote, long since plunged into a pot of cold water and slowly but surely the temperature is rising as we imperceptibly begin to boil in our own juices.[60] This metaphor is perhaps over dramatic and pessimistic, but it does describe our relative unawareness of the technological journey we find ourselves on. There are few discernible methods for questioning this journey outside philosophical enquiries such as the writings of Martin Heidegger, Jacques Ellul and Langdon Winner, research in the social sciences such as Science and Technology Studies (STS), and alternative cultural approaches such as those practised by the Amish.[61] Speculative design builds on these dialogues using fictitious objects at the core of its enquiry. These are developed outside the rules and constraints that inform and direct the development of normative commercial

60. Whilst biologists have disputed the facts of the story, it still acts as a suitable metaphor for the development and consumption of technology.

61. For a thorough account of the Amish community and their use of technology, see Kraybill, 1999.

technological products. It is a space for dreaming, challenging and debating - and critically, through the use of designed artefacts as its medium, it is intended to appeal to a broad and diverse audience, from experts working in related fields such as designers, engineers and scientists, to consumers and users of technological products and services.[62]

## Historical and semantic issues

I began this thesis by addressing the complex issues surrounding the definition of the robot. Here I find myself in a similar situation: what to call this form of design practice? At this time there are several established terms being used both in academia and the design industry to describe practices similar to the one outlined here. After much consideration I have settled on speculative design, analogous to speculative biology coined by the geologist Dougal Dixon:

62. The practice of stepping out of conventional systems to present visions of either utopian technological futures or critiques of current cultural trajectories has a rich heritige in architectural practice. Whilst the motivation and context behind this activity bears many similarities to speculative design, from a practical perspective the techniques are quite different. Due to space constraints I have reluctantly chosen not to present a detailed analysis of conceptual architecture. For a thorough history of this subject, see Neil Spiller's *Visionary Architecture: Blueprints of the Modern Imagination* (2006).

> **"Speculative biology, or speculative evolution, is a term that refers to a very hypothetical field of science that makes predictions and hypotheses on the evolution of life in a wide variety of scenarios and is also a form of fiction to an extent. It uses scientific principles and laws and applies them to a 'what if' question (for instance: 'What if *Homo sapiens* never evolved?'). Since one cannot make a definite prediction of what would happen as a result of any 'what if' questions, this topic uses a great amount of fiction and creativity to create a speculative world." (Speculative Evolution Wiki, n.d.)**

Speculative design operates in a similar way, but rather than basing the predictions solely on scientific laws and principles it also incorporates a cultural element: the role of fashion, trends and human choice in shaping artefacts. Dixon's description fits well with my understanding of speculative design, but for reasons that will be expanded on in the following pages, the term still requires careful management.

Other terms in contemporary use that could have been used are described below. I will briefly list and define each of the terms before explaining the factors that determined my decision:

As a student of Anthony Dunne in the Design Products department at the RCA, his book *Herzian Tales* was a big influence on my design practice, in particular the motivation and methods of *critical design*:

> **"Critical design uses designed artefacts as an embodied critique or commentary on consumer culture. Both the designed artefact (and subsequent use) and the process of**

**designing such an artefact cause reflection on existing values, mores, and practices in a culture.**
**A critical design will often challenge its audience's preconceptions and expectations thereby provoking new ways of thinking about the object, its use, and the surrounding environment." (Dunne, 1999)**

Similar in intent is *discursive design,* coined by Bruce and Stephanie Tharp. Below they describe the motivation behind this form of design practice:

**"The primary intent of the discursive designer is to encourage users' reflections upon, or engagements with, a particular discourse; the goal is to affect the intellect. As distinct from objects of art, architecture, and graphics, which can all be agents of discourse, products have particular qualities that offer unique communicative advantages."**
**(Tharp and Tharp, n.d.)**

A similar kind of intellectual engagement with the role of objects is suggested by the following definition of *design fiction*, coined by the science fiction writer Bruce Sterling:

**"The deliberate use of diegetic prototypes to suspend disbelief about change. That's the best definition we've come up with. The important word there is *diegetic*. It means you're thinking very seriously about potential objects and services and trying to get people to concentrate on those rather than entire worlds or political trends or geopolitical strategies. It's not a**

**kind of fiction. It's a kind of design. It tells worlds rather than stories." (Bosch, 2012)**

Also using this term but in a slightly different way is Julian Bleeker:

**"Design Fiction is making things that tell stories. It's like science fiction in that the stories bring into focus certain matters-of-concern, such as how life is lived, questioning how technology is used and its implications, speculating about the course of events; all of the unique abilities of science fiction to incite imagination-filling conversations about alternative futures. It's about reading P K Dick as a systems administrator, or Bruce Sterling as a software design manual. It's meant to encourage truly undisciplined approaches to making and circulating culture by ignoring disciplines that have invested so much in erecting boundaries between pragmatics and imagination." (Bleeker, 2009)**

Philips *Design Probes* could be seen as having a similar agenda:

**"Design Probes is a dedicated 'far-future' research initiative to track trends and developments that may ultimately evolve into mainstream issues that have a significant impact on business. The Probes generate insights from research in five main areas; politics, economic, culture, environments and technology futures.**
**With the aim of understanding 'lifestyle' post 2020, the program aims to identify probable systemic shifts in the social**

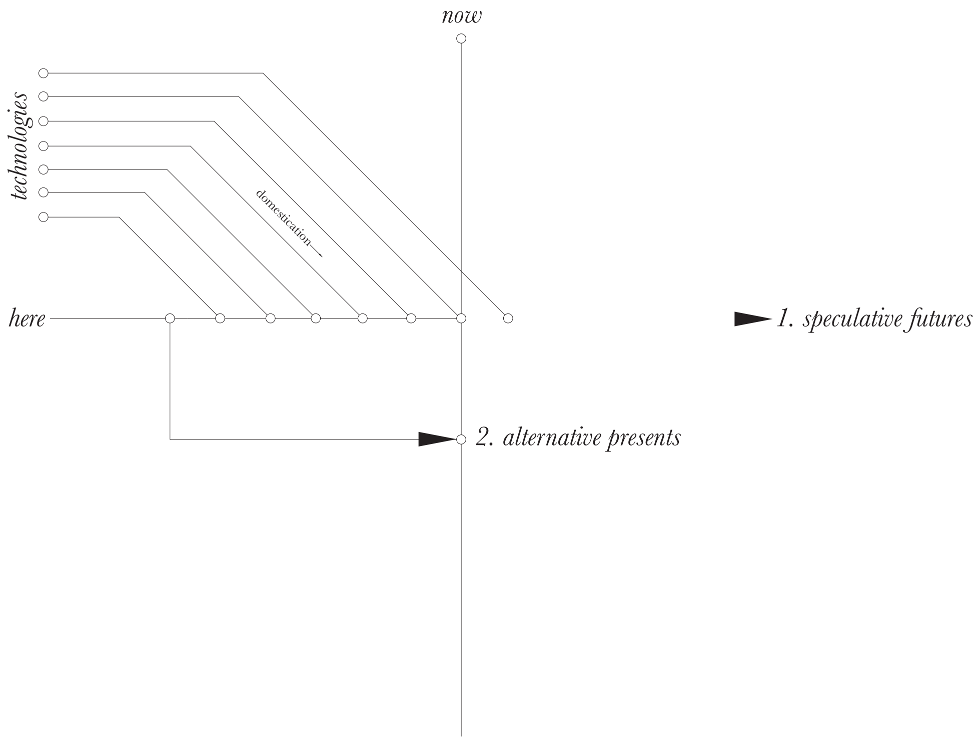


Fig.33: *Alternative presents and speculative futures.*
At the origin is the here and now: everyday life and real products available on the high street. The lineage of these products can be traced back to where the technology became available to iterate them beyond their current form. The technology element on the lefthand side represents research and development work - the higher the line the more emergent the technology and the longer and less predictable its route to everyday life (domestication). As we move to the right of the diagram and into the future we see that speculative designs exist as projections of the lineage. They are developed using a technique that focuses on contemporary public understanding and desires and extrapolate these through the imagined application of an emerging technology. Alternative presents step out of the lineage at some relevant time in the past to re-imagine our technological present. These designs can challenge and question existing cultural, political and manufacturing systems.

**and economic domains likely to affect our business and create intellectual property in new areas. It challenges conventional ways of thinking to come up with concepts to stimulate debate. Deliverables range from scenarios and narratives to the creation of experience prototypes and IP fortressing." (Philips, n.d.)**

There is much overlap between the descriptions above - all remove the constraints of the commercial sector that define normative design processes to create a space for thinking, questioning and dreaming. The differences are subtle and based primarily on geographical or contextual usage. With all these options available (and of course new proposals), my choice was informed mostly by semantics and the subsequent loading of experience: the *physical* object presented as a 'design fiction' may be identical to a 'speculative design' object or a 'design probe,' and so on, but the meanings of these words give the *cultural* object a substantially different value. For example, the word 'fiction' after design immediately informs the viewer that the object is not real; 'probes' infer that the object is part of an investigation; and both 'discursive' and 'critical' directly reveal the intentions of the object as an instigator of debate or philosophical analysis. These terms act to dislocate the object from everyday life, exposing their fictional or academic status.

For those within the design community these semantic details are less problematic, as familiarity with the discourse makes the terminology less important, but for those unfamiliar with these practices, semantics fundamentally influence how the work is assessed. As one of the core motivations of this practice is to shift the discussion about technology beyond experts to a broad popular audience, the choice of ‘speculative’ is preferable as it suggests a relationship between ‘here and now’ and the design concept.

## Speculative futures and alternative presents

Having settled on speculative design, it is now necessary to explore some of the difficulties with this term, as it is not ideal. With its etymological baggage, the word has a strong leaning towards conjecture, guesswork or meditation. Many of the classic ‘visions of the future’ such as jet packs and flying cars are pure speculations, playing to spectacle and techno-centric dreams rather than being based on concrete developments or logical trajectories.[63] By employing the factors outlined in chapter four, collaboration with scientists, respecting the rules of the domestic landscape and by not straying too far into the future, it is possible to craft a speculation that is more poignant, based on logical iterations of emerging technologies and tailored to the complex and subtle requirements of an identified audience/culture. The second problem with the word *speculative* is related to the close relationship between *speculation* and the future. Here it is important to state that speculative design is not only about the future but is also a way of analysing, critiquing and re-thinking contemporary technology. The practice can be separated into two categories:

63. Whilst these speculations might become feasible in the technological sense, they ignore the more intangible but nevertheless crucial reality of everyday life such as insurance, licensing, legal liability, traffic control, resource issues, effect on urban planning etc.

First, as described in the previous chapter, existing cultural systems, lineages and modes of technological development can inform future developments of an emerging technology: speculative futures imagine and depict near-future products and services. These are intended to act as a form of cultural litmus paper, testing potential products and services on both a mainstream audience and within the industry before they exist.

Second, alternative presents are design proposals that utilise contemporary technology but apply different ideologies or configurations to those currently directing product development. This method is similar to the historiographical practice of counterfactual histories,[64] and the literary genre of alternative histories,[65] but with the emphasis on products and technological genealogy rather than historical and political events. Here we break free of a lineage at a certain historical point to question why things are the way they are.

## Speculative design: *Crafting the speculation*

If a speculative design proposal strays too far into the future to present clearly implausible concepts or describes a completely alien technological habitat, the audience will fail to relate to the proposal,

64. For an excellent essay on the practice of counterfactual histories, see Bunzl, M (2004): 'Counterfactual History: A User's Guide', http://www.historycooperative.org/journals/ahr/109.3/bunzl.html, accessed 19 September 2011.

65. For a thorough description of alternate history, see Schmunk, R, *Uchronia*, http://www.uchronia.net/intro.html, accessed 19 September 2011.

Fig.34: "'I tried a bunch of different heads, but Steven Spielberg wanted to pay tribute to the shape of the spaceship in the original movie,' Sims said. 'No matter what I did with that head, we always went back to this shape. For the eyes, Spielberg kept saying they should be overly dilated, refracting with light almost like you'd see in a cat. Spielberg wanted one leg in the back and two in the front. At Stan Winston's we did an animation of the alien crawling on the ceiling, showing how his legs would function as arms as well and pick stuff up while using the other leg to balance.'"
(Hart, 2008)

resulting in a lack of engagement or connection. In effect a design speculation requires a 'perceptual bridge' between the audience and the concept. Inspiration and influence can be drawn from diverse fields such as observational comedy, psychology, horror films and illusion, for the insights they offer into the complex workings of human perception and how it can be consciously manipulated to elicit reaction.

Below I describe some of these bridging techniques.

## Design for context: *Where does the speculation exist?*

Previously I employed the concept of ecological habitats to critique existing robots.

This first point is a direct application of the advice given by James J Gibson: (see p.72) that the laboratory *must* be life like. The designer must consider the environment and context in which the speculative products or services would exist; this could be a specific space such as the home or office or a cultural or political situation based on current developments or trends.[66] This could be described as an ecological approach to speculative design and helps to ground the concept in a familiar or logical reality.

Below are two descriptions of the Martian from *The War of the Worlds*. The first is an excerpt from H G Wells' original novel of 1898; the second (and image) from Steven Spielberg's film version of 2005. If we take the Martian to be a speculative object we can compare the two approaches to its design.

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66. A comparison could be drawn here with approaches in literature - for example in Mary Shelly's *Frankenstein,* the scientific research of Luigi Galvani was used to inform the methods of Dr Frankenstein in giving life to the monster. This gave the novel a contemporary validity and believability.

Robot 4: This one is very needy. Although extremely smart it is trapped in an underdeveloped body and depends on its owner to move it about. Neediness is designed into very smart products to maintain a feeling of control. Originally, manufacturers would have made robots speak human languages, but over time they will evolve their own language. You can still hear human traces in its voice.

Fig.35: Technological Dream Series: No. 1, Robots (Dunne and Raby, 2007).

Robot 3: More and more of our data, even our most personal and secret information, will be stored on digital databases. How do we ensure that only we can access it? This robot is a sentinel, it uses retinal scanning technology to decide who accesses our data. In films iris scanning is always based on a quick glance. This robot demands that you stare into its eyes for a long time, it needs to be sure it is you. On another level, it asks what new forms of furniture might evolve in response to future technological developments.

Fig.36: Technological Dream Series: No. 1, Robots (Dunne and Raby, 2007).

**"I think everyone expected to see a man emerge ... But looking, I presently saw something stirring within the shadow: greyish billowy movements, one above another, and then two luminous discs – like eyes ... A big greyish rounded hulk, the size, perhaps, of a bear, was rising slowly and painfully out of the cylinder ... The incessant quivering of the mouth, the gorgon groups of tentacles, the tumultuous breathing of the lungs in a strange atmosphere, the evident heaviness and painfulness of movement due to the greater gravitational energy on earth … Suddenly the monster vanished. It had toppled over the brim of the cylinder and fallen into the pit, with a thud like the fall of a great mass of leather." (Wells, 2004, p.19)**

The question I pose here is not which interpretation is the most compelling, engaging, terrifying or memorable, but which is the most likely. The celluloid version has a certain familiarity, resembling many other filmic depictions of disconcerting aliens in recent years. It displays its physical superiority to humans with a cat-like deftness, employing its several arms to move three-dimensionally around a room. It is without question captivating and terrifying and therefore perfect as a form of entertainment, which perhaps was the primary factor influencing its design. Wells' Martian on the other hand is clearly suffering, ungainly, awkward and struggling to cope with Earth's gravity. Wells trained as a biologist,[67] so would have a good understanding of the concept of adaptation. Although this is pure supposition, logic suggests that Martians would be maladapted to life on Earth and his depiction

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67. Wells had a first class honours degree in biology from the Normal School of Science in London.

Fig.37: 'The Exorcist' (William Friedkin, 1973). Friedkin creates the uncanny through a gradual increase in contrast between the normal with the paranormal. The film depicts the demise of a young girl as a spirit possesses and subverts her body, the physical result being not unlike Frankenstein's monster described above.

Fig.38: Afterlife coffin with microbial fuel cell (2007).

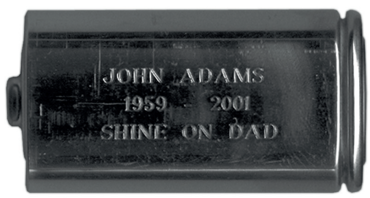


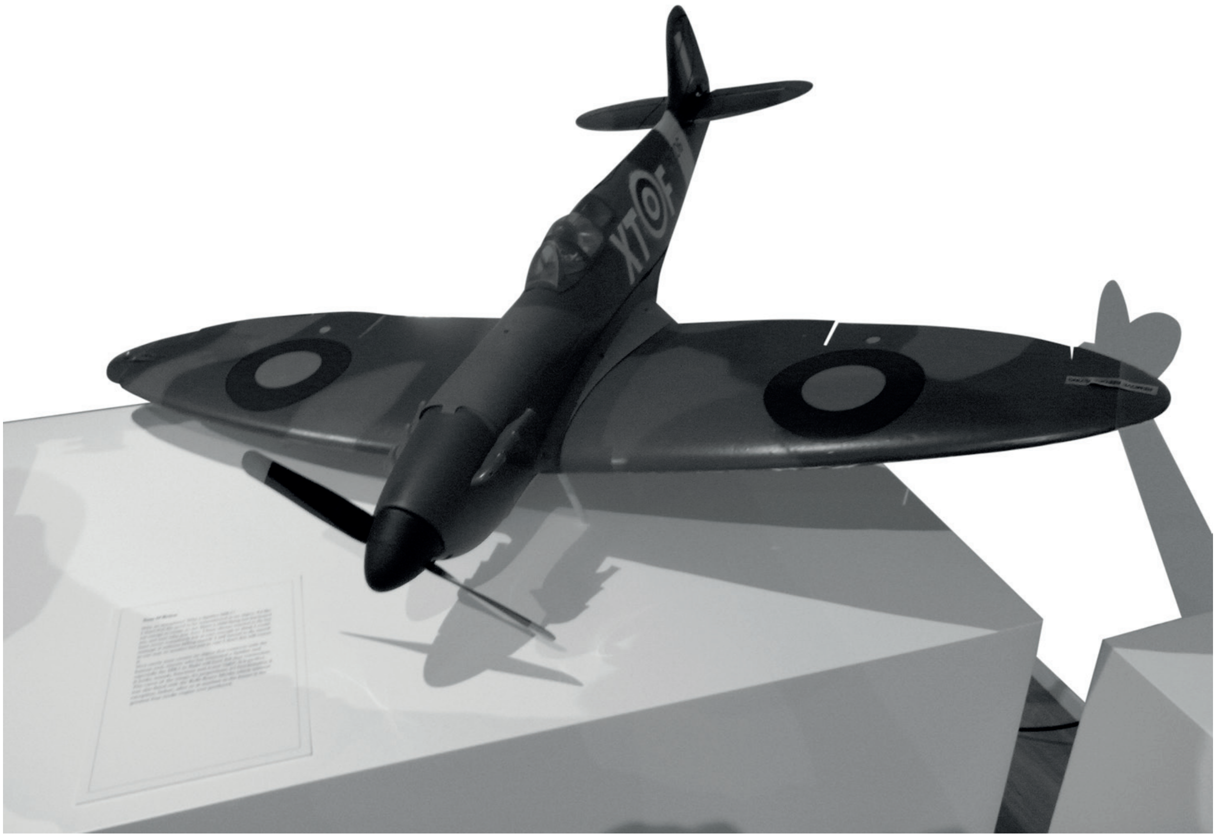

Fig.39: Engraved Afterlife battery (2001).

applies this theory to inform the design of the creature.

A similar approach has been employed by designers Dunne & Raby in their project Technological Dream Series: No. 1, Robots (2007). The stereotypical design of many robots could be compared to Spielberg's alien; Dunne & Raby dismantled this familiar image by designing their robots to be harmonious with the contemporary domestic landscape. The concept of adaptation here informs the design process, delivering objects that display an existential logic (or not in Wells' case) in their intended environment. Any experience that challenges a preconception will at first appear odd, but here the detail and finish of the artefacts, combined with the short explanations describing their functions and modes of interaction, entices the audience into exploring the concept further. The project successfully offers a new perspective on domestic robots by designing for the complex sensibilities of people: robots become needy and subservient to overcome our fear of them; furniture is adapted to accommodate new technologies, appearing familiar but with advanced functionality; technological interactions take place in odd but intimate ways. Even though their function is little described, we could imagine living with these robots due to their compatibility with the domestic habitat.

## The uncanny: *Desirable discomfort*

In order to elicit audience engagement and contemplation on a subject, it is sometimes helpful for a speculation to provoke. If a design proposal is too familiar it is easily assimilated into the normative progression of products and would pass unnoticed. However, proposals dealing with sensitive subjects such as sex or death can quite easily stray too far into provocative territory, resulting in repulsion



“Why an aeroplane? Why a Spitfire Mk 1?
I don’t feel the need to be remembered as an object. I’d like my energy to create an act. Since a child flying has fascinated me, not sure why, just does. I have always wanted to fly but have never completely felt at ease enough to think I could manage it without killing myself. I still intend to fly myself in one way or another but just in case I don’t this will ensure it.
Very rarely man creates an object that connects with the human soul; anyone who has witnessed a Spitfire and especially the MK1 in flight will have felt that connection. It looks, sounds, functions and is just ‘right’, it is perfect. The curve of the wings, its proportions, its functionality, it was also fitted with the Rolls Royce Merlin which without exception, before, after or at anytime in the future is the greatest four stroke engine ever produced.” (Tom O’Brien, 2009)

“We’d use our battery for a euthanasia machine.
As we are a couple, once one goes, we’re not sure how long the other one would be able to hang on. So, if it’s all too much, we could use the energy from the first one to go, to help the second one on their way. I’m not sure if it would be a form of conceptual murder or not, but definitely an ‘assisted’ suicide.
Ideally we’d like to propose an object based on an existing machine, it would foreground the battery, which would be inscribed and silver-plated. We would probably replace the usual questions the machine asks you to check your state-of-mind with something more personal.
We imagine you would set it up on a small table by your bed or a chair, insert the battery, put the mask on, then after a few minutes, insert the tube into the device which causes a green light to come on letting you know it is working and ready. Then, you can lie back on your bed, or armchair, close your eyes, and 30 seconds later the carbon dioxide will begin to flow ...” (Anthony Dunne and Fiona Raby, 2009)

Figs.40-41: Selected Afterlife concepts by invited individuals/couples.


"A regular event in my family life is the argument over the control of the TV remote and the programmes that we will collectively watch. There is a complex process of negotiation that involves give and take, selfishness and selflessness. I would like to be memorialized in an evocation of this process, not least because I want to be remembered in relation to mundane technology (one of my academic specialisms), as a typically contradictory human being, and as a loving partner and father who was intent in bettering his family (my preferred genre was nature documentaries) while being chronically silly.

I would like my Afterlife battery to power a small speaker mechanism (much like the sort you find in a singing birthday card) integrated into a remote control. Whenever the TV is switched on by the remote, a recording of my voice is played to say either: 'It's my turn, so I'm going to decide what we watch' or 'I really don't mind, it's your turn to choose.' Given how fragile and contentious everyday familial memory is, these two phrases should appear at random. Alternatively, and slightly more subtly, I'd like my Afterlife battery to power a circuit that makes the TV remote select very occasionally, automatically and unpredictably a channel showing a nature documentary. The channel cannot be changed for the duration of the programme, and the television can only be switched off at the mains." (Mike Michaels, 2009)


"My basic idea stems from the deceased (myself) being an attention seeking and needy individual in life, so it follows that death should not pry his grip from the ones around him. He must be remembered by providing a useful battery for his loved ones, but one battery isn't enough. To be remembered only twice more - when the battery is installed and when the battery dies - simply will not suffice. He wants to die many times so that his loved ones will recall, each time, how much they miss him.

The deceased requests that a series of cells are manufactured, each with a random volume of electrolyte, so that the user of the cell never knows how long it will last. One may last a month, another a year. The deceased then, in death, continues to get the attention they so desired in life.

The exact devices in which the cells are to be used are not specified by the deceased. Though, he does request they be used in devices that are used by his loved ones to perform banal but vital tasks in their lives. (e.g. hearing aid, pacemaker, bike lights, garage-door opener, etc.)" (Matt Karau, 2009)

Figs.42-43: Selected Afterlife concepts by invited individuals/couples.

or outright shock. The design solution is complex and contradictory, provocative whilst at the same time familiar. Sigmund Freud described the paradoxical reaction humans have - invoking a sense of familiarity whilst at the same time being foreign - as 'uncanny'. The term used by social psychologists is cognitive dissonance.[68] This is a complex and difficult reaction to manage, but when achieved responses to the design concept tend to be both meaningful and strong. As Freud describes, the most powerful experiences of the uncanny come through death, such as dead bodies, spirits and ghosts (p.148); or severed body parts and malfunctioning bodies such as epileptic fits and madness (p.150). Freud goes on to suggest that by using the uncanny, "the story-teller has a *peculiarly* directive power over us; by means of the moods he can put us into, he is able to guide the current of our emotions". Here he refers specifically to literary works such as the novels of gothic horror exemplified by Edgar Allan Poe's *The Fall of the House of Usher* (1839) and Mary Shelley's *Frankenstein* (1818):

> **"His limbs were in proportion, and I had selected his features as beautiful. Beautiful! Great God! His yellow skin scarcely covered the work of muscles and arteries beneath; his hair was of a lustrous black, and flowing; his teeth of pearly whiteness; but these luxuriances only formed a more horrid contrast**

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68. Leon Festinger coined the term in his 1957 book *A Theory of Cognitive Dissonance*. He described the experience as "the feeling of psychological discomfort produced by the combined presence of two thoughts that do not follow from one another". Festinger proposed that the greater the discomfort, the greater the desire to reduce the dissonance of the two cognitive elements (Harmon-Jones and Mills, 1999, p.3).

**with his watery eyes, that seemed almost of the same colour as the dun-white sockets in which they were set, his shrivelled complexion and straight black lips." (Shelley, p.58)**

Shelley creates the uncanny by first describing familiar signs of wellbeing and normality, then contrasting these with signs of disease and death. More recently, this deft juggling of signs has been practised by film directors such as Stanley Kubrick ('The Shining', 1980) and William Friedkin ('The Exorcist', 1973) to powerful cinematic effect.

Careful management of the uncanny is imperative when a project attempts to deal with subjects such as death or the invasion of the human body (for example technological implants). Whilst in the genre of horror, the maximising of this reaction is the end goal. For a speculative design project a more subtle approach is required.

The Afterlife project (Auger-Loizeau, 2001-2009) directly touched on the sensitive issue of human mortality. The core concept was the application of a microbial fuel cell[69] after the death of a human being. This intervention charges a dry-cell battery during the decomposition process of the body. The installation of the project, at New York's Museum of Modern Art (MoMA) exhibition 'Design and the Elastic Mind' (2007), presented the piece as a metaphysical dialogue, examining the cultural shift from belief systems upheld by organised religion to the more factual basis of science and technology. With Afterlife technology acts to provide conclusive proof of life after death, *life* being contained in the battery.

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69. A device that uses an electrochemical reaction to generate electricity from organic matter. For more information on this device see the project Carnivorous Domestic Entertainment Robots described in chapter five.

Unfortunately the viewers chose mostly to ignore the intellectual aspect, focusing instead on the more unsavoury aspects of the project - namely tampering with the process of death, the passing of a loved one and the material activity of the human body during the operation of the fuel cell (decomposition). This resulted in simple repulsion as the benefits of the concept were overlooked. The audience experienced the proposal as too uncanny.

In 2009 we were invited to present Afterlife at Experimenta 09, the Design Biennale in Lisbon, Portugal. This provided an opportunity to reflect on the problems of the MoMA approach, specifically how the presentation could be adjusted to move beyond material factors and repulsion to touch the sensibilities of the audience. In addressing this problem we shifted the emphasis from the fuel cell and coffin to the function of the battery. This effectively heightened the *familiar* aspect of the uncanny experience. To communicate the diversity and possibility of battery applications we invited 15 colleagues to propose what they would do with either their own Afterlife battery or that of a loved one. They were also asked to write a short paragraph describing their choice:

The installation in Lisbon focused on the 15 proposed Afterlife battery applications. The short narratives supporting the objects introduced an emotional and personal content that the project previously lacked. This encouraged the audience to reflect on how they themselves might use the battery, countering the initial repulsion factor and resulting in a form of desirable uncanny.[70]

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**70.** One visitor was lingering for some time at one of the proposals. I walked over to speak to her; she turned to me with tears running down a red face. She told me that in life, her father behaved in exactly the same way as the father described in the text, relating perfectly to the proposed function of his specific afterlife battery.

## Verisimilitude: *Design fiction or design faction?*

Thinking once again about *The War of the Worlds*, I remembered Orson Welles' famous radio play of 1938 that created widespread panic in certain US towns due to its realistic delivery. Looking more closely into why this particular broadcast was so successful in bringing fiction to life it became apparent that it was not down to one single factor but several disparate timely elements: the prevailing political and cultural atmosphere (coming war in Europe; Munich Crisis of 12-30 September); the product used for the dissemination and its contemporary relevance (the radio); the language and style of the broadcast (based on previous disaster broadcasts such as the crash of the airship Hindenburg); and the shift in setting from England to very specific real places in the US (where the play was broadcast).

The techniques employed by Welles bear many similarities to those used in the creation of convincing speculative design projects: the crafting of a complex narrative or artifice using the real-life ecology where the fictitious concept is to be applied, and taking advantage of contemporary media, familiar settings and complex human desires or fears.

It is these real-life delivery methods that differentiate design fictions from their science fiction cousins. We predominantly experience science fiction through film, television, novels or comics, and as such consciously and willingly enter into the fiction as soon as the curtain rises or the book is opened. Reality is temporarily suspended until the end credits roll and normal life clicks back into place. Speculative design fictions can be played out in real life. The presence of the designed artefact in popular culture allows for the viewer to project its presence into his or her own life. Then they effectively

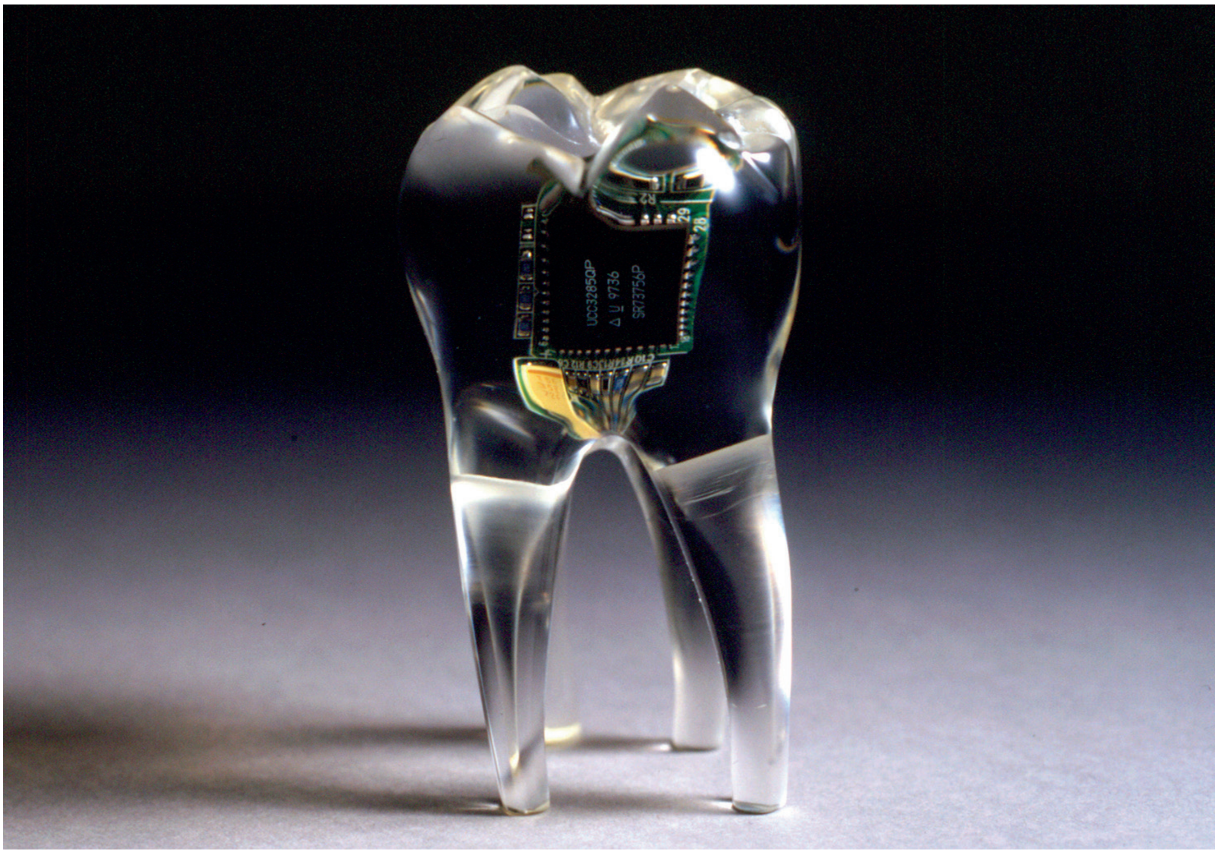


Fig.44: Audio Tooth Implant (Auger-Loizeau, 2001).

become the protagonist in the story, playing out individual and informative roles. Their reactions become the true products of this form of design research.

This blending of truth and reality was used in my first speculative design project with Jimmy Loizeau, Audio Tooth Implant (Auger-Loizeau, 2001). Our original project brief was to examine the implications of implantable technology for human enhancement, by proposing possible applications and access points for technology to enter the body. The resultant product was an implantable telephone:

The concept of implantable technology for enhancement purposes immediately conjures images from science fiction,[71] so it was important from the outset that we steered the proposal away from these more profound notions towards a more plausible suggestion. This was achieved by playing to the public audience's perception of three factors. First, the lifestyle benefit of having a tooth implant. By building on the cultural phenomenon of the mobile telephone, which at the time (2001) was revolutionising human communication, we aimed to deliver a concept that would play to contemporary aspirations.

Second, the psychological issues related to an alien object entering the body (managing the uncanny). We consciously chose the tooth as an entry point for the implant as this is the least invasive surgery available, creating a tangible balance between cost and benefit.[72]

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71. See for example, Bruce Sterling's *Schismatrix Plus* and William Gibson's *Neuromancer*.

72. Around the same period Kevin Warwick of Reading University was generating publicity for his Cyborg 1.0 project. Exploring similar issues, Warwick had an RFID tag implanted in his arm, enabling him to automatically unlock his office door and turn on lights. The question we ask is, would one be willing to experience invasive surgery on a body part for such basic added functionality? See http://www.wired.com/wired/archive/8.02/warwick_pr.html


2R THE SUN, Saturday, June 29, 2002 25

# Sex attack beast 'is no danger now'

A SCHIZOPHRENIC who dragged a woman into a garden and sexually assaulted her was yesterday jailed for five years.

But Judge Patrick Moran has suspended Jonathan O'Brien's sentence for all but two months if he stays in a psychiatric hospital.

Cork Criminal Court heard O'Brien, 19, is currently being treated at the Central Mental Hospital in Dundrum.

And Dr Sean O'Domhnaill said he was no longer a risk to society.

**Traumatised**

O'Brien beat up the woman, who was in her 40s, in Cork before she fled home naked from the waist down with a black eye, swollen mouth and cuts to her body.

Gardai said she was still traumatised.

O'Brien, of Cork, admitted assaulting the woman on January 27, 2001 and also pleaded guilty to assaulting three men.

He bit one's thumb and slashed another's neck with a knife.

**SONG AND DANCE**

Singer Khorvash Khalili's album Wild Gazelles has caused fury in Iran – it is the first solo record by a woman in the strict Islamic country.

# RADIO CHEW
## Listen to shows and phone via your tooth

Inventor . . . clever James

By PAUL CROSBIE

**RADIO fans could soon be able to pick up programmes and take mobile phone calls via a gadget in their TOOTH.**

The electronic device, including a receiver and a tiny vibrator, would be implanted in routine dental surgery.

It would pick up digital radio signals, then convert them to audio.

The sound would be transferred from the tooth to the inner ear by making the jaw bone vibrate.

**Helped**

*It could allow the listener to receive information anywhere and at anytime.*

So off-duty City traders could be kept up to date with vital stock market information, while spin doctors could send information to politicians as they are being interviewed.

The James Bond-style gadget can be turned on and off using a hand-held remote. It is believed to be the world's first in-body consumer product.

The device was invented by James Auger, from Derby – helped by his pal Jimmy Loizeau, 23, from Rhyl, North Wales.

Royal College of Art graduate James, 23, said: "It's not science fiction, it's the stuff of science fact.

"It's fairly simple technology and it was a conscious decision to put it in the tooth because this can be done during routine surgery.

"If you think about the Six Million Dollar Man with his X-ray eyes, that is not possible – but this is.

"We chose the tooth because we did not want to thrust this too far into the future to enable people to understand and believe it."

James and Jimmy demonstrated how the device would work at London's Science Museum yesterday.

*Museum visitors can also test the technology by using an adapted loudspeaker and a cocktail stirring stick.*

By placing one end of the stick into the equipment and biting on the other half, people will hear music clearly. But no one else can hear it.

At present, the device is only a mock-up and lacks the communications chip to make it work. But Jimmy said: "With the size of microchips it is feasible."

*By gum . . tooth device (above) sends sound up jaw and to the inner ear (right)*

Fig.46: *Wired* Online (21 June, 2002).
*Wired* initially featured the concept in an article by Lakshmi Sandhana. They followed up several years later (March 2006) with an article entitled: 'Lying through their teeth.' By Rachel Metz (Wired 2006).


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SCIENCE : DISCOVERIES

# Excuse Me, Is Your Tooth Ringing?

Lakshmi Sandhana 06.21.02

A wireless receiver can be implanted into your tooth with the aid basic dental surgery. The implant can allow a person to receive digital signals from radios and mobile phones, from the privacy of their own head.

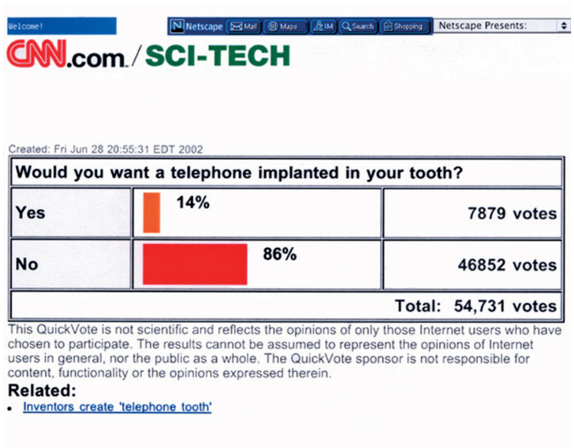
Soon the phrase "I've got something in my tooth" -- instead of conjuring up fears of root canal surgery and the like -- could refer to the latest in wearable wireless technology.

A new design for a tooth implant that receives digital signals from radios and mobile phones will be on display at the Science Museum in London beginning Friday.

Designed by Jimmy Loizeau and James Auger, research associates from MIT Media Lab Europe, this collaboration between the Science Museum and the Royal College of Art aims to increase public understanding of science, technology and the arts by showcasing young talent. Part of the "future products" exhibit, it is supported by the National Endowment for Science, Technology & the Arts.

Fig.45: *The Sun* newspaper (June 29, 2002).
Average daily readership 7,733,000 people. In the UK the Tooth Implant was also featured in *The Mirror*, *The Express* and the *Daily Star*.


Fig.47: *Sky News*.
The Audio Tooth Implant at the launch of the talking points exhibition at the Science Museum in London.


Welcome! Netscape Mail Maps IM Search Shopping Netscape Presents:

CNN.com / SCI-TECH

Created: Fri Jun 28 20:55:31 EDT 2002

| Would you want a telephone implanted in your tooth? | | |
|---|---|---|
| Yes | 14% | 7879 votes |
| No | 86% | 46852 votes |
| | | Total: 54,731 votes |

This QuickVote is not scientific and reflects the opinions of only those Internet users who have chosen to participate. The results cannot be assumed to represent the opinions of Internet users in general, nor the public as a whole. The QuickVote sponsor is not responsible for content, functionality or the opinions expressed therein.

**Related:**
- Inventors create 'telephone tooth'

Fig.48: *CNN.com*
*CNN* ran a poll asking the audience is they would want a telephone implanted in their tooth. Over 54 thousand votes were cast in a 48-hour period.

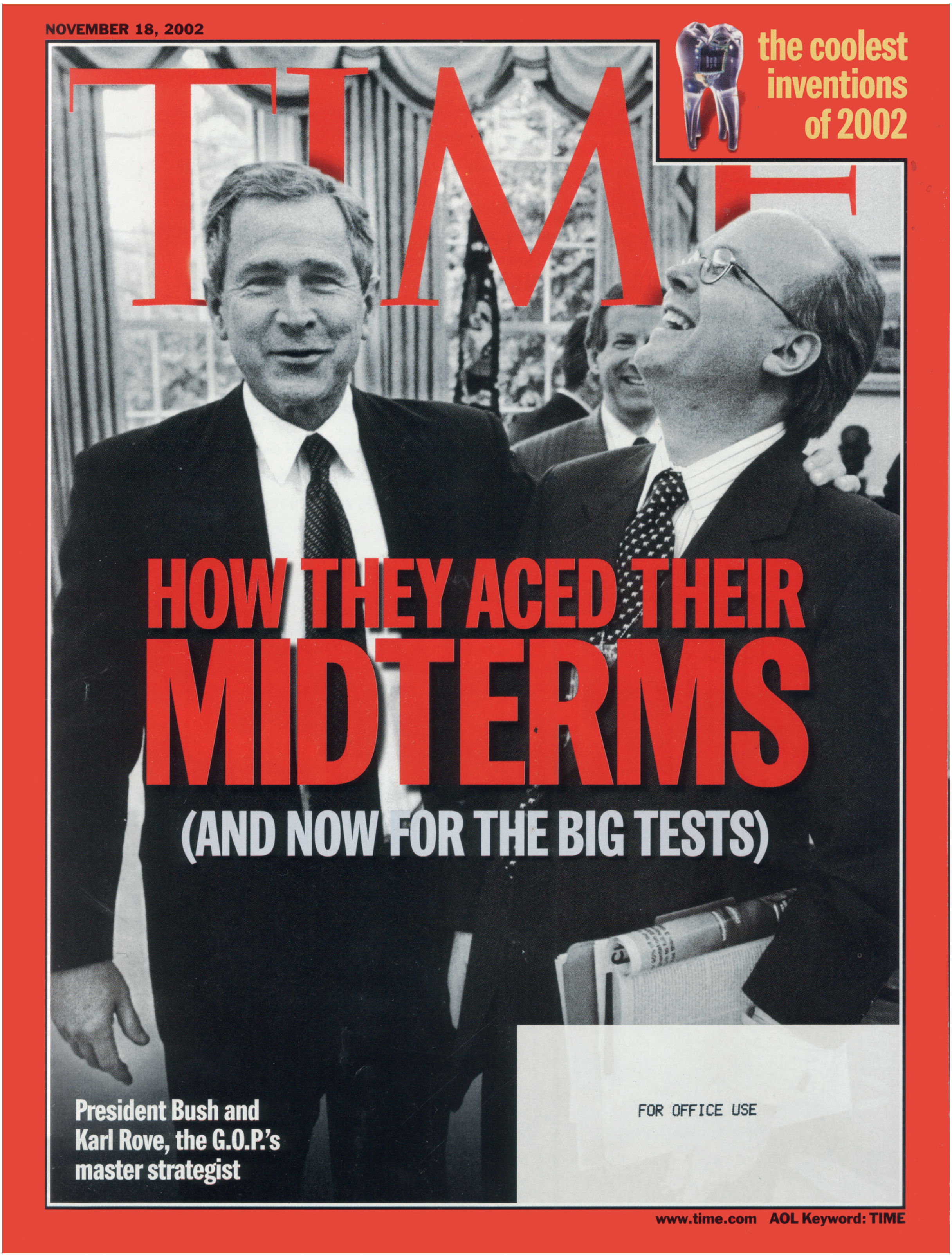



Fig.49: The Audio Tooth Implant was listed on *Time Magazine's* list of the coolest inventions of 2002, and was used as their cover image for this feature. The only dialogue we had with the magazine was their request to use the tooth image; there were no questions about the state or nature of the project.

And third, for technological believability, the Audio Tooth Implant relies on a general public awareness of hard and well-publicised facts, such as the miniaturisation of digital technology and urban myths such as dental fillings acting as radio antenna and picking up audio signals. These combine to give the concept a familiarity. It was also necessary to provide a convincing description, in layman's terms, of the technology involved. With the tooth implant we were assisted in this by approaching research scientists at a large telecommunications company, who offered the following:

> **"The moisture in the cheeks effectively make the inside of the mouth a faraday cage: a radio free space. Therefore the chip would have to receive low-frequency radio in the order of 150kHz. This signal would energize the dormant chip implanted in the tooth through near field magnetic effects. A transducer transforms this sound information into micro vibrations which through the process of bone transduction are transmitted along the jawbone and directly into the cochlea where they are experienced by the wearer as normal sound."**

This description helped in convincing those with a good understanding of electronic technology. To communicate the concept we created a clear epoxy resin model tooth with embedded computer chip (fig.44.). This model was photographed in a studio and used to accompany a text description of the concept.

With this material we presented the project at the Science Museum in London in an exhibition called 'Future Products'. From here it quickly entered the public domain through both the popular press and specialist media. Our initial goal was to disseminate the project as broadly as possible, from the contemporary technology magazine, *Wired* to *The Sun* newspaper, with its average daily readership of 7,733,000 people.[73]

By consciously avoiding the formal academic language normally associated with technological research and critique, and adopting a familiar product design language, we aimed to appeal to a more general audience. Using the press allowed the concept to disseminate globally, working particularly well with new media such as internet news sites and blogs. A possible problem with this approach is that it allows for little control once a project is in the public domain, and concepts quickly mutate and facts become embellished. With projects like the Audio Tooth Implant this is not problematic, as the core proposal is simple enough for the key message to not get lost in translation. We assumed that due to the extremely large numbers of individuals reached,[74] a percentage would be induced into contemplating a subject they had not consciously considered before.

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73. http://www.nmauk.co.uk/nma/do/live/factsAndFigures?newspaperID=17

74. It is impossible to state exactly how many individuals have been exposed to the concept, but it has been featured in news reports and magazines in Australia, Canada and Brazil. We have been interviewed on radio shows in the US, the UK and New Zealand and have received emails and letters from global locations. Slashdot, the technology-related news website, featured the concept and at last viewing there were 437 comments. http://slashdot.org/index2.pl?fhfilter=tooth+implant, accessed 16 November 2011.

----------------------------------------------------

Dear Mr’s Auger and Loizeau,

As a physician I believe the technology you describe in your press release, has the potential for producing immense social harm. This social harm would include psychological trauma, and angry behaviour in both the workplace and the home.

----------------

**XXXXXXX X. XXXXXX, MD**

Associate Professor of Medicine,

(Cardiology)

Stanford Medical School.[75]

**75.** The whole correspondence ran to two pages of writing, offering a detailed description of exactly how and why the Tooth Implant would cause immense social harm.

----------------------------------------------------

**Subject:** Cellular chip in the teeth

**Date:** Monday 1 July 2002 14:17

**From:** XXXXXXXXXXXXXX

**To:** <info@augerment.com>

Congratulations !!

A hole world of new possibilites was opened up by this
achivemnt.
I hope this path can inspire this brilliant group to develop another chip, this one to be into the eye bringing light to the blind man in the Earth.

In my dream the cams could be instaled in the eyebrown and the chip in the eye linked and stimulating the nervous system. This stimulation could when well dominated avoy glasses even in people with more than one hundred years.

Maybe all this sound a litte crazy, too much optimist or too much faith in science future, but why not dream with the day in near future when everyone can see the sun, the clouds, the sea, a child’s smille to her mother, a bird singing, a colorfull fish in the beautifull sea and so on, this list is endless.

Congratulation once more,

XXXXXX XXXX

-----------------------------------------------------

**Subject:** Re: implant retained crown test

**Date:** Sunday 16 February 2003 23:46

**From:** XXXXXXX

**To:** James Auger <jamesa@mle.media.mit.edu>

Mr Auger,

Thank you for your prompt reply. Since I am a dentist and my husband’s crown is implant retained not on tooth structure, we would be happy to be included in the test phase. I could make sure the crown was placed in a temporary mode and it could easily be removed for further modification.

Please let me know if you are interested in this test.

Sincerely,

XXXX XXXXX

---------------------------------------------------

**From:** XXXXXXX

**Date:** 17 October 2002 14:57:54 BST

**To:** "'info@augerment.com'" <info@augerment.com>

**Subject:** Audio Tooth Implant

Hello, James Auger
We are very interested in "Audio Tooth Implant" researches. Our company (http://www.mediinternational.com) is known as a leader of dental innovations in Russia. We offer you to choose ours dental clinics as range for your researches. MEDI Medical Association was established in 1991 in St. Petersburg, Russia
as a dental clinic. Since then, it has grown into the largest private medical/dental business in Russia. To-date, there are 11 Dental Clinics at St.-Petersburg and Moscow where 105 dentists worked. MEDI also owns three dental laboratories, an X-ray Diagnostics Center and Russia's first private "Institute of Dentistry" for post graduate specialization. In the long term we could organize "Audio Tooth Implant Course" in our Institute for the dentists from whole CIS. Also we can help you to certificate your invention in Russian Federation.

Best regards,
XXXXX XXXXXXXXXXXXX
President of MEDI Medical Association.

Fig.50: Selected correspondence relating to the Audio Tooth Implant.

One of the key advantages of speculative design is that there is no intention to bring the product to market. This means that critical responses are of equal value to positive ones. The negative aspect of this approach is that the designer is liable to receive accusations of fraudster and the project being labelled a hoax. This issue was discussed in a *Wired* follow-up article entitled 'Lying Through Their Teeth'. As we discussed with the journalist, the key difference is the motivation behind the creation of the fiction:

> **"Auger and Loizeau measure success by reactions to their idea, not the venture capital money (which Auger said they turned down) that stemmed from the swell of media coverage. What gratifies them are the hundreds of e-mails they received from people (including several dentists) interested in learning more, and a Slashdot mention that garnered 437 comments."**
> **(Metz, 2006)**

It is the nature of these responses that justify the approach, being genuine reactions to a new product rather than contemplations on a hypothetical concept - it is a means to a worthwhile end.

## Observational comedy: *Rooting the speculation in the familiar*

Presenting design proposals based on little-understood (by the popular audience) emerging technologies is a complex challenge. Too much technical information can alienate or simply bore the viewer, but too little can leave the concept intangible or whimsical. The problem lies in the amount or complexity of knowledge that needs to be communicated before a project can be understood. In their analysis of the evolutionary reasons for humour and laughter, Hurley et al describe the comedian's solution to a similar issue, suggesting that "shared stories are excellent data-compression devices … The more of a story you can tell with a few words, the more efficient your joke or witticism will be." (2011, p.164). Watching a recent performance by Sean Lock on the television comedy programme 'Live at the Apollo', I began contemplating the similarities between observational comedy and the tactics of speculative design. During the set he described the filthy state of the back seat of his car, boxes of organic raisins and the raising of small children. Here there are several relevant points. First, observations are of mundane but familiar aspects of daily life. This type of comedy is popular because the audience can personally relate to the situations described.

Second, observations are often specific to a particular time, place and person. Lock's analysis wouldn't have worked ten years ago, as these particular boxes of raisins didn't exist then. Also, to fully understand the observations and therefore the humour, the audience needed to be a parent of children between the ages of two and eight from a certain social class and culture.

Third, the importance of attention to detail. Lock meticulously describes how his children open the box of raisins and then shake the box in a very particular way, scattering them all over the car, and down the small cracks between the seats. As he describes this, a picture forms in my mind of my own children doing the exact same thing. This is a very familiar scene, but one I hadn't previously given conscious thought to.

Fourth, once the familiar short story has been told, the foundations are laid for wilder, more extreme anecdotes; these demonstrate the humour in the situation. In Lock's set he concludes by

Fig.51: Sensual Interfaces video still (Chris Woebken, 2007).
Using seeds to simulate smart dust, this video visualises new interactions such as breaking, sharing, throwing away and mining data. These new interactions not only generate new behaviours but will also define new relationships with products.

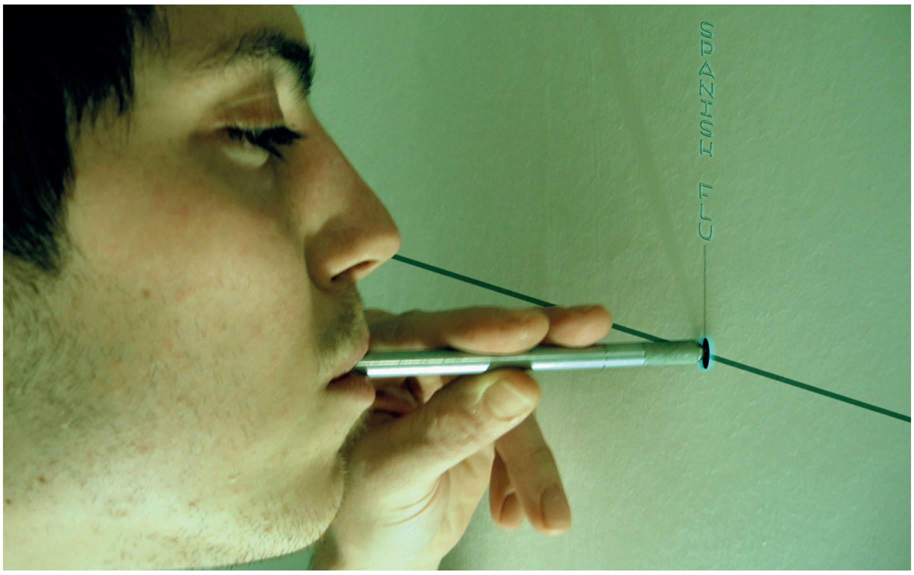


Fig.52: The Minutine Space (Mikael Metthey, 2006).
People can visit a space where they get infected by engineered organisms designed to provoke the physical and psychological reactions associated with sickness. The space is designed to emphasise the social aspect of sickness. It is composed of a viral area where the viruses can be chosen, facilities to rest and suffer relatively comfortably, and a 'central sick pit' where people can vomit. The visitor, once they have had enough, can leave through the 'minutine' zone where all harming organisms are removed by the nano-antidotes.

describing seagulls following his car as he drove past landfill sites and foxes retching as they walked past the open car door.

By utilising mundane, familiar and small, unnoticed details, the designer can provide spectacular, even preposterous, proposals with a tangible link to our contemporary sensibilities and understanding. It roots them in known contexts, limiting the need for complex explanations. The spectacular narratives that stem from the comedian's initial observations effectively represent the designer's technological future, made palatable through familiar elements.

In his project Sensual Interfaces, Chris Woebken uses hypothetical advances in nanotechnology to explore new ways of interacting with a computer. His video scenario depicts a familiar office scene: an anglepoise lamp, a desk, a nondescript computer screen, a suited man and a mug. The unusual element is the form of interaction - the keyboard is no longer present, but in its place is a large pile of seeds. The businessman sits at the table and, through a series of choreographed and considered movements, sifts, moves and sorts the seeds. This sounds bizarre and nonsensical when described in words, but, partially through the familiar elements and partially the choreography, it works in portraying a tangible and engaging new mode of interaction. Its power lies in the familiarity of the scene, making the film both compelling and thought provoking.

Another technique based on observation is to take advantage of stereotypical or commonly held assumptions about a specific subject to bypass the complex underlying technological aspect. For example, if an observational comedian chose to focus on the topic of nanotechnology, he or she could start the set with the grey goo scenario,[76] move on to cryonics and Michael Jackson[77] and finish with golf balls.[78] In his nanotech project The Minutine Space, Mikael Metthey follows the familiar promise of nanotechnology to potentially eradicate disease. In Metthey's fictional future, humans no longer suffer illness. In this utopian world of wellness, the extreme experience of being profoundly unwell becomes recreational:

Metthey's project, like Woebken's, requires a basic familiarity with the subject matter for the extrapolation to work. To those with an interest in emerging technology, the familiar promise of a zero disease society, made possible through developments in nanotechnology, is blended with the contemporary popularity of extreme sports to create a proposal that, whilst extremely odd, makes sense.

By observing and taking advantage of mundane, subtle, quirky but ultimately familiar behaviours or perceptions, the speculative designer can take the viewer on a journey to a technological future or alternative present that, whilst potentially alien, makes perceptual sense.

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76. See Prince Charles' article in the *Independent on Sunday* newspaper, 10 July 2004, describing the history of the 'grey goo' myth.

77. Cryonics is the process of deep-freezing the human body after death in the hope that future technological developments will enable the repair of damaged cells and revival of the deceased. The technology usually prescribed for this future use is nanotechnology. Michael Jackson allegedly subscribed to cryogenics, but missed the deadline due to the need for an autopsy.

78. Contrary to all of the spectacular future speculations for nanotechnology, one of the most common contemporary applications is in the manufacture of golf balls.

## Demo or die: *Overcoming oddness through aesthetic experience*

The methods outlined above relate predominantly to 'speculative futures', each technique in some way reflecting or projecting elements of contemporary everyday life into future proposals to make them more plausible, familiar and believable. This section describes an inverse problem. Returning to the concept of the habitat, by conflicting with, rather than embracing engrained systems and established modes of behaviour, 'alternative presents' *always* display an inherent oddness that can be difficult to present.

As 'alternative presents' aim to question and critique contemporary use of technology, some conflict is both unavoidable and helpful in highlighting the issue. However, for the proposal to not completely alienate the audience, they must see beyond its conceptual oddness to understand the logic behind it. 'Alternative presents' are basically reconfigurations of existing technology. It is therefore often possible to manufacture convincing demonstrations through the use of experiential prototypes. The power of a more immersive aesthetic experience can help build a convincing argument for the reconfigured object or function.

An example of this approach was the Iso-Phone (Auger-Loizeau, 2003) developed at Media Lab Europe (the European partner of the MIT Media Lab), to challenge the telecommunication industry's progression towards efficiency and ubiquity through the growth of the mobile telephone sector. The question we asked was, what if, rather than directing development towards notions of availability and mobility, the industry prioritised a qualitative approach to create an optimised environment for making a telephone call?

We achieved this through employing sensory deprivation

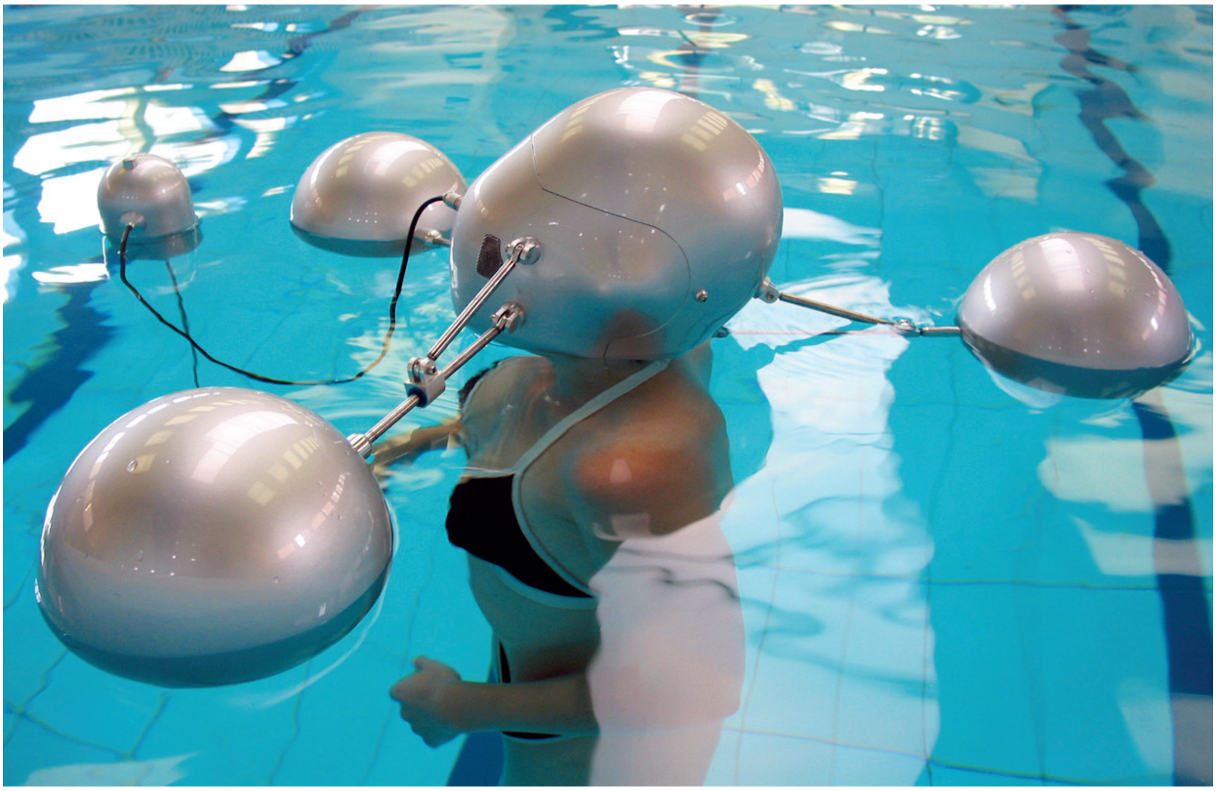


Fig.53: Iso-phone (Auger-Loizeau, 2003).
The caller floats in a pool, wearing a helmet that blocks all peripheral sensory input whilst keeping the head above the surface of the water. The water is heated to body temperature, blurring the boundary of the user's body. In combination, a space is created to provide a pure, distraction-free environment for making the perfect telephone call. The only sensory stimulus presented is a two-way voice connection to another person using the same apparatus in another location.

Fig.54: Iso-phone at Ars Electronica in 2004.

techniques to minimise distractions, facilitating a total focus on the conversation. The Iso-phone described a specific aesthetic experience through the development of a working prototype. This comprised the design and construction of two 1.5m-diameter by 2.4m-tall steel tanks with incorporated three-phase water heating element and two Iso-phone helmets:

The strength of a demonstration is that it can appeal to a broad audience. The live demonstration of the Iso-phone was a common feature at Media Lab Europe (MLE) open houses. These events were attended by scientists, engineers, designers and managers from the large telecommunications companies, enabling us to talk directly with the people responsible for putting mobile phones on the marketplace - and highlighting through the presentation alternative ways of thinking about telecommunication technology.

In 2003 the Iso-phone was presented at the Ars Electronica festival in Linz, Austria. The installation was situated in the city's main square and being in this public space meant not only the attendees of Ars Electronica used the device but also the people of Linz who happened to be passing through:

------------------------------------------------------------

User #1: I talk very straight, not influenced by other things around me.

------------------------------------------------------------

User #2: Gives you the feeling of being isolated, actually thinking back on it now you concentrate on the phone call much more than you did before.

------------------------------------------------------------

User #3: Absolutely concentrate on the conversation.

```
-----------------------------------------------------------------
User #2: To improve communication.
-----------------------------------------------------------------
User #4: It's like my friend is very near and I hear every
characteristic of his voice.
-----------------------------------------------------------------
```

Fig.55: Excerpt from post Iso-phone demo interviews filmed at Ars Electronica, 2004.

The Iso-phone created an extremely immersive and embryonic physical experience that images and words fail to describe. This highlights the power of the live demo in communicating to an audience complex experiential propositions that challenge their normative perceptions on a subject. Clearly this approach has its limitations - moving beyond the audio/visual senses rules out the more extrovert forms of media such as the internet and publications to disseminate the purest version of the project. It does however give some credence to the MIT Media Lab motto: 'demo or die.'[79]

## Alternative presents: *Counterfactual and alternative histories*

> **"It's America in 1962. Slavery is legal once again. The few Jews who still survive hide under assumed names. In San Francisco the I Ching is as common as the Yellow Pages. All because some 20 years earlier the United States lost a war and is now occupied jointly by Nazi Germany and Japan." (Dick, 2009)**

79. This was a reworking by the lab of the academic slogan, 'Publish or perish,'

Fig.56: Sascha Pohflepp, The Golden Institute Model (1:19) of a Nevada desert Lightning Harvester based on a Chevrolet El Camino.

Fig.57: Sascha Pohflepp, The Golden Institute Model (1:500) of an induction loop-equipped Chuck's Cafe, Interstate 5 near Bakersfield, CA.

Philip K Dick's *The Man in the High Castle* describes the consequences of one of the popular starting points for counterfactual histories, Germany winning World War Two. From the writer's perspective this theme offers a rich source of potential for re-imagining how the world might have evolved under these alternative circumstances. The speculative designer can borrow directly from the historiographical method by choosing specific events that shaped the course of today's technological products, and, by reimagining them, it is possible to create a very thought-provoking alternative present. One example of this approach is Sascha Pohflepp's project, The Golden Institute, based on an imagined, different outcome to the 1980 US general election, which would have enabled the perpetuation of energy-friendly initiatives undertaken during the term of Jimmy Carter. As Pohflepp points out, "Positioned at the right spot in the past, such counterfactual histories might offer an understanding of the forces at work as well as a fresh perspective on our present challenges."

The strength of such a project comes from choosing a poignant historical moment to initiate the fiction. By choosing a topical and well-understood issue or theme in contemporary everyday life, and finding a relevant or connected historical moment that *could* have a perceptible connection, the designer can develop a series of imaginary outcomes that instigate reflection on our current situation. In Pohflepp's case, the potential peak oil crisis and related energy issues that we face today make the 1980s election and its consequential closing down of energy-friendly initiatives a particularly provocative choice.

Taking a more aesthetic approach to an alternate present is James Chambers' project, Attenborough Design Group (ADG). Here he postulates the existence of a research group within the electronics company Texas Instruments led by the famous natural historian, cultural

Fig.58: ADG - The Gesundheit Radio (James Chambers, 2010).
An internal mechanism triggers a sporadic anthropomorphised sneezing behaviour, developed to protect early fragile microprocessors from dust.


Fig.59: ADG - Floppy Legs (James Chambers, 2010)
The portable floppy disk drive which stands up if it detects liquid nearby, and the Anti-Touch Lamp, which sways away if you get too close to it's halogen bulb.

icon and filmmaker, David Attenborough. The objects developed by the group, whilst based on orthodox and existing products, were given new behavioural rules exhibiting an underlying survival instinct inspired by complex evolved techniques in the animal kingdom. These new product behaviours act to enhance the chances of both physical survival through the inbuilt defence mechanisms, and emotive survival through eliciting a deeper relationship with the owner. This latter element was achieved through iterative behavioural prototyping, specifically based on anthropomorphising the various movements to elicit either sympathy (the Gesundheit Radio and Floppy Legs) or wariness (Anti-Touch Lamp).

Chambers' project shifts the subject of the alternate history from socio/political events to a subject more relevant to the design industry, examining notions of object obsolescence, value and meaning.

This specific technique offers the designer a rich narrative potential for reimagining and critiquing technological developments and contemporary products. As the two examples above show, the themes of the fiction can be extremely broad, from large-scale political events to the existence of a small imaginative research studio. As with all the methods described above, the success of the project in engaging an audience lies in the small details. James Chambers' choice of David Attenborough as head of his research studio, for example, not only captures the attention of several generations of UK television watchers due to his unique social standing, but also presents a captivating logic to the behaviour of the prototypes - in turn justifying the benefits of the fictitious studio's approach. Sascha Pohflepp's project takes as its starting point a subject close to the heart of any relatively political individual living in a democratic society: an election and the potential consequences of a poor decision.

## Domesticating technology: *Literally*

In chapter three, I touched on Michael Pollan's book, *The Botany of Desire*. In his investigation Pollan describes the power of the tulip in 17th century Holland - in his words the tulip "unleashed a brief, collective madness that shook a whole nation and nearly brought its economy to ruin". (Pollan, p.69). He describes Dutch growers borrowing techniques from alchemists, sprinkling pigeon droppings, plaster dust and paint powders onto flowerbeds in the hope of growing the perfect specimen. Later, the invention of the microscope unlocked secrets and growers learnt that the 'perfect specimen' was in fact the result of a virus, and as a consequence tulip development took a new direction. Today, advances in genetic engineering are promising to deliver flowers that do not wilt and frost-resistant geraniums.[80]

In the development and shaping of civilisation, domestication has been a constant driving force for change, and it subjects the early recipients of technological innovation.

In his speculative future project, Acoustic Botany, David Benqué builds on this ongoing human endeavour, specifically the fascination with the flower, to take us on a voyage to a garden of the future.

To extend methods of domestication beyond current means, he applies the emerging science of synthetic biology to propose a genetically engineered sound garden - effectively a combination of two art forms that have captivated human minds for centuries. The simple logic behind this method means that the complex language and

80. http://www.guardian.co.uk/uk/1999/feb/28/antonybarnett.theobserver2.

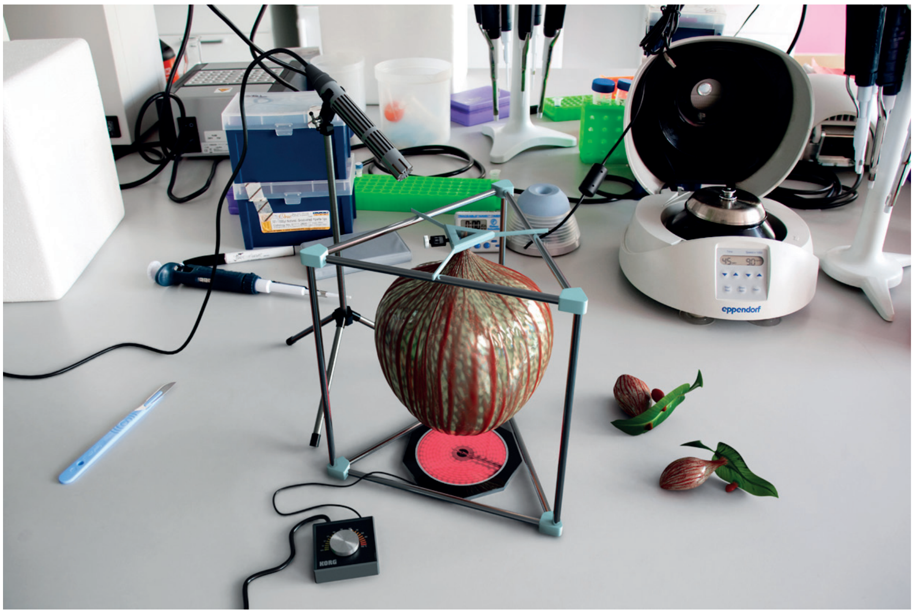



Fig.60: Acoustic Botany: Genetically Engineered Sound Garden (David Benqué, 2010).

Fig.61: Acoustic Botany - Singing flower
(David Benqué, 2010).
Because the parasite diverts the plant's energy for its own purposes, only small flowers manage to grow.

Fig.62: Acoustic Botany (David Benqué, 2010).
String-Nut and bugs engineered to chew in rhythm.

scientific details of synthetic biology are translated into the results of its hypothetical practice: spectacular gardens, plants and creatures that combine to offer delightful new aesthetic experiences.

The method of directly applying theories of domestication is limited to the sciences capable of manipulating the genetic development of natural organisms, but by blending new possibilities facilitated by science with the complex desires of humans, it can provide insightful speculations on both who we are and where we might be heading.

This chapter described some techniques and strategies for practising speculative design. The diversity of possible subjects, contexts, technologies, perspectives and audiences - and the expansion and growing sophistication of methods - make a definitive 'how to' guide impossible. This chapter rather describes ways of grounding the speculation to ensure that it connects with an identified audience's perceptions of the temporal world around them. These perceptual 'bridges' can then be stretched in precise ways: this might be a technical perception such as extrapolating how they *think* a technology is likely to develop; a psychological perception such as not breaking taste or behaviour taboos; or a cultural perception such as exploiting nostalgia or familiarity with a particular subject. In this way the speculations appear convincing, plausible or personal, whilst at the same time new or alternative.

# A speculative design approach to robots: *Three projects*

This chapter describes robot-themed speculative design projects undertaken during this research.

The robots described here were developed alongside the theoretical part of the thesis, allowing for interplay between theory and practice. Two of the projects are concluded and have been presented at conferences, in exhibitions and through the media. It was therefore possible to gauge the successes and limitations of this approach to questioning robots in relation to the specific audiences they reached, and feed this knowledge back into both the later projects and the theory. The third is a student project at the RCA's Design Interactions department. I include this as a way of describing how a speculative design approach can be transformed into a workshop that facilitates a rapid examination of technology (in this case the robot), based on the criteria and methods described in chapters three and four.

# Carnivorous Domestic Entertainment Robots: *A robotic alternative present*

This first project was responsible for establishing many of the core ideas that run through the thesis. It was part of the Engineering and Physical Sciences Research Council (EPSRC) funded research project Material Beliefs,[81] and developed together with designer Jimmy Loizeau and engineer Alex Zivanovic. The starting point for Material Beliefs was collaboration between designers and scientists for public engagement with technology. We chose to work with Bristol Robotics Laboratory (BRL), whose research aims to understand the science, engineering and social role of robotics and embedded intelligence.[82]

## The technology

BRL develop various robot research projects primarily examining the mechanisms required for the creation of intelligent,

81. Rather than focusing on the outcomes of science and technology, Material Beliefs approaches research as an unfinished and ongoing set of practices, happening in laboratories and separate from public spaces.
The lab becomes a site for collaboration between scientists and engineers, designers, social scientists and members of the public. Alongside existing research activity such as collecting experimental data, writing academic papers and funding proposals, the collaborations lead to a parallel set of outcomes including interviews, brainstorming, drawing, photography, filming and discussion.
The collaborations lead to the design of prototypes, which embed these parallel outcomes into something tangible. These prototypes are exhibited, transforming emerging laboratory research into a platform that encourages a debate about the relationship between science and society (http://www.materialbeliefs.com/).

82. http://www.brl.ac.uk/

autonomous robot systems. We became specifically interested in their robots examining notions of energy autonomy:

> **"A major barrier to the widespread deployment of autonomous robots in remote areas (away from power utilities) is the availability of energy. The present work represents a first step towards addressing this fundamental issue. Industrial applications include those requiring '*release and forget*' robots; where robots are required to accomplish a mission usually in dangerous or undesirable for people areas (such as perimeter/pollution/predator monitoring) with minimum maintenance." (http://www.brl.ac.uk/projects/ecobot/main.html)**

In generating their own energy, BRL's robots - such as the EcoBot series and SlugBot - utilised a technology that we had explored in an earlier project, the microbial fuel cell (MFC) for Afterlife (see p.151), and focused predominantly on its development and optimisation.

> **"Microbial fuel cell (MFC) technology is employed to extract electrical energy from refined foods such as sugar and unrefined foods such as insects and fruit. This is achieved by extracting electrons from the microbial metabolic processes. To be truly autonomous, robots will be required to incorporate in their behavioural repertoire actions that involve searching, collecting and digesting food. The robot will be designed to remain inactive until sufficient energy has been generated to complete its next task. (http://www.brl.ac.uk/projects/ecobot/index.html)**

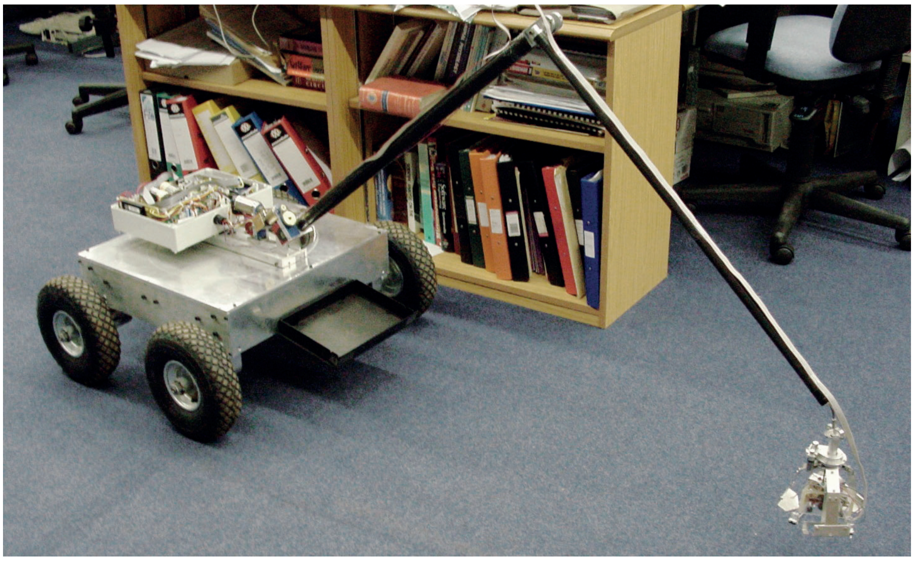


Fig 63: Slugbot (Bristol Robotics Lab, 2001)
The SlugBot Project represents the first stage of a study in energy autonomy; a proof-of-concept vehicle capable of detecting and collecting slugs.
(http://www.ias.uwe.ac.uk/Robots/slugbot.htm)

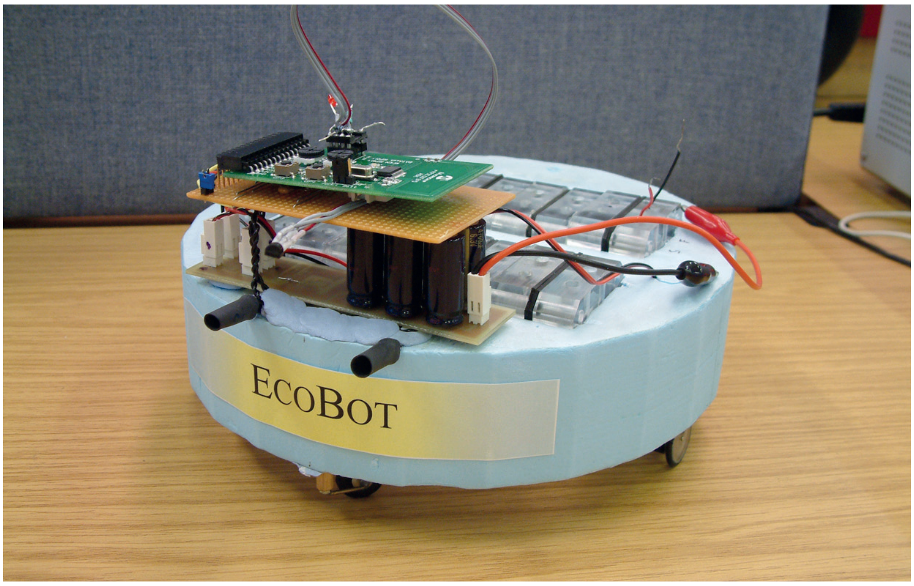
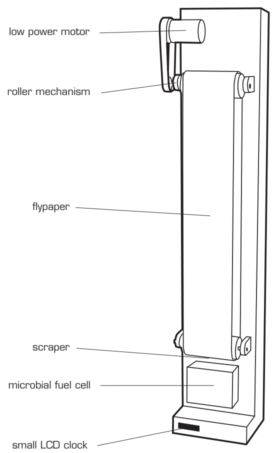



Fig 64: The fly consuming Ecobot I (Bristol Robotics Lab, 2002)
EcoBot I is a proof-of-concept study in our work. It is a 960g robot, powered by microbial fuel cells (MFCs) and performs a photo-tactic (light seeking) behaviour. This robot does not use any other form of power source such as batteries or solar panels.
(http://www.brl.ac.uk/projects/ecobot/ecobot%)20I/index.html)

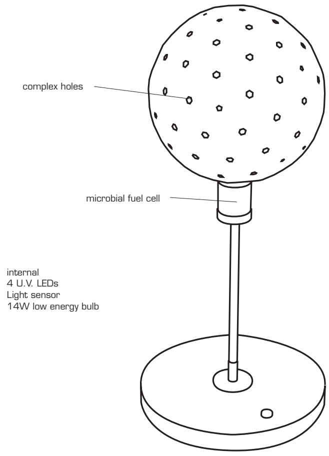
BRL described their MFC-powered robots as "proof-of-concept studies", and any proposals for application were merely suggestive.

EcoBot and SlugBot fill a niche as definitive laboratory robots like those described in chapter two, meaning that modes of interaction, aesthetics and behaviour were informed by the requirements of that habitat. The project provided an opportunity to experiment with how to migrate BRL's technology into the home using a speculative design approach. The outcome of the project was a series of five robots, each feeding off living organisms for electrical energy and built as semi-operational prototypes. I will briefly describe each robot before beginning a more thorough examination of the finer details of their form and behaviour.



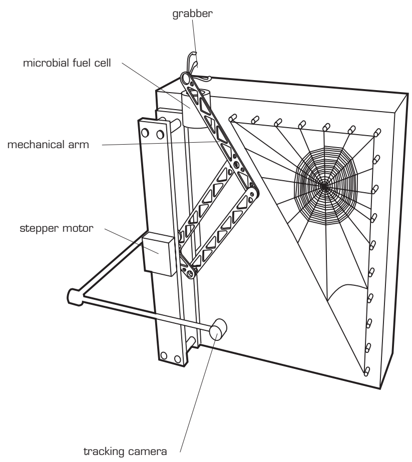

Flypaper Robotic Clock
A rubber belt revolves slowly around two rollers on a vertical plane. This belt is covered in honey, which attracts and captures various flying insects. At the base of the roller mechanism a blade is positioned, this removes any insects that have stuck to the belt and they fall into the MFC positioned below. This generates the electricity to power both the motor rotating the belt and a small LCD clock.
There is some basic sensing built into this robot related to seasonal change and its effect on the quantity of available insects. This means that the robot can partially hibernate during the winter months continuing to tell the time through energy harvested during the summer months, but not wasting energy through rotating the belt.

Fig.65: Carnivorous Domestic Entertainment Robots, concept sketches.




Lampshade Robot

During the evening period this robot operates as a normal lampshade using household mains power supply. Flies and moths are naturally attracted to the light emitted by the lamp. The lampshade has holes based on the form of the pitcher plant; these allow the insect access to the interior of the lamp but no means of escape. Eventually they expire and fall into the microbial fuel cell housed underneath. This eventually generates sufficient electricity to power a series of U.V. LEDs located inside the shade. These are activated when the mains lights are turned off and in turn attract more insects. This robot lampshade has the potential to be energy autonomous.

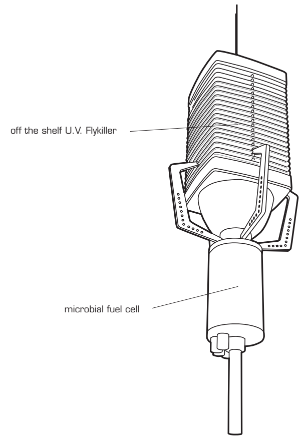



Fly Stealing Robot

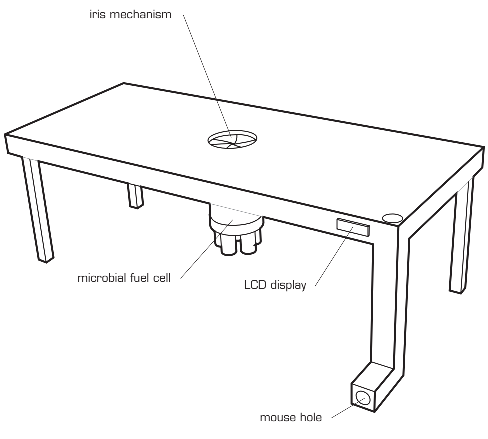
This robot encourages spiders to build a web within its armature.

A camera mounted on a boom in front of the robot captures live images of the web. A vision system seeks out and extracts the position of dark patches on the web and monitors them. Through machine learning the robot learns to differentiate between flies trapped in the web and the spider patrolling it, should it conclude that a dark patch is a fly, a robotic arm, actuated by stepper motors moves over its location and a small grabber picks it up. The fly is then transported to the microbial fuel cell housed at the top of the robot. The arm then powers down and robot reverts to monitoring the spider web.

The fuel-cell in unlikely to generate enough energy to power the robotic arm (it is an energy intensive task) so this robot relies on the U.V. Flykiller Parasite robot to supplement its energy needs.




U.V. Flykiller Parasite Robot.
A microbial fuel cell is housed underneath an off-the-shelf U.V. fly killer powered by the domestic electricity supply. The U.V. light attracts insects from up to 40 metres away; these are electrocuted and fall into the fuel cell generating electricity that is stored in the capacitor bank. Having no personal need for this electrical energy the U.V. Flykiller robot makes it available to the Fly Stealing Robot




The Mousetrap Coffee Table Robot
A mechanised iris is built into the top of a coffee table. This is attached to an infrared motion sensor. Crumbs and food debris left on the table attract mice that gain access to the tabletop via a hole built into one over size leg. Their motion activates the iris and the mouse falls into the microbial fuel cell housed under the table. This generates the energy to power the iris motor, sensor and a LED graphic display on the front of the table–top.

Figs.66–69: Carnivorous Domestic Entertainment Robots, concept sketches.

## Designing the speculation

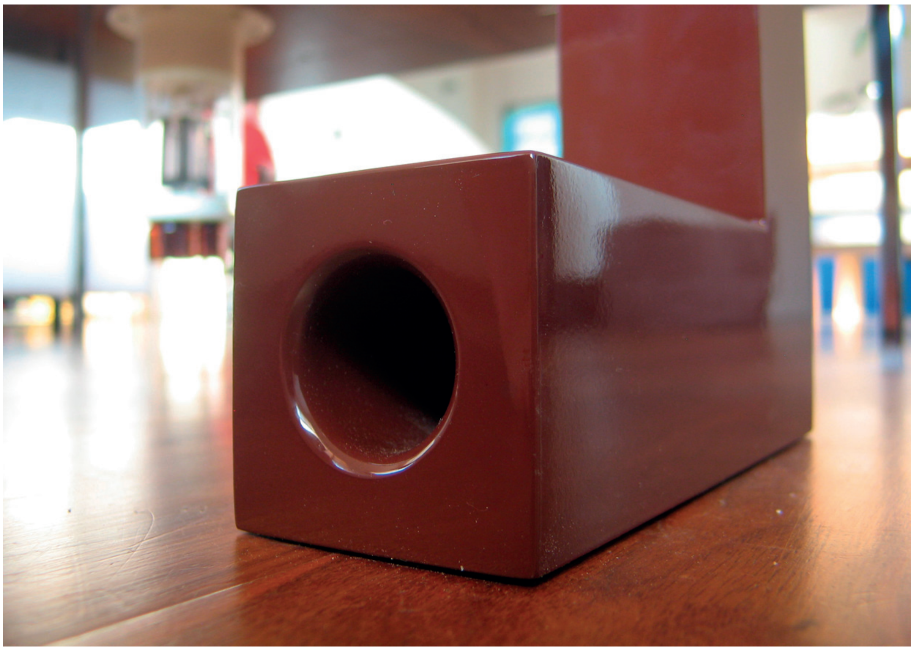
In previous chapters I broke down the requirements of a domestic product into three factors: form, function and interaction. Here I will describe how the same issues were addressed in the design of the Carnivorous Domestic Entertainment Robots (CDER).

**Form adaptation:** ***Form follows familiarity***

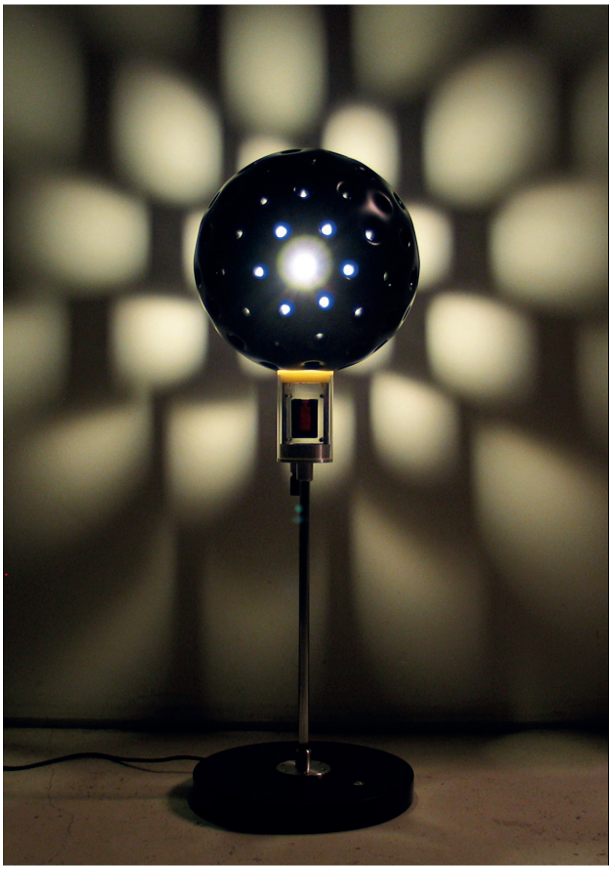
For a robot to comfortably migrate into our homes, appearance is critical. Here we applied the methods of adaptation described in chapter four to move beyond the functional forms employed at BRL, and the stereotypical fictional forms described in chapter two. In effect we created a clean slate for designing robot form, then looked to the contemporary domestic landscape and the related areas of fashion and cultural trends for inspiration. The result is that on the surface the CDER series more resemble items of contemporary furniture than traditional robots. This is intended to allow for a seamless transition into the home through aesthetic adaptation. There are, however, subtle anomalies or alien features that are intended to draw the viewer in and encourage further investigation into the object:

Fig.70: Mousetrap Coffee Table Robot reference material.

Fig.71: Mousetrap Coffee Table Robot.
This robot is based in a coffee table. The table is designed to comply with the mainstream modern style that could be seen at major retail outlets such as Habitat. Here it is photographed in a suitable domestic context.



Figs.72 & 73: Mousetrap Coffee Table Robot: close up of leg and graphic display.
The table has unusual features. One leg is oversize with a hole leading to the tabletop. An electronic graphic display showing energy bars is situated in the front of the table.



Figs.74 & 75: Lampshade Robot.
An intricate shade gives off an appealing light pattern, but under the shade is the exposed microbial fuel cell. This suggests some complex technical operation, encouraging the viewer to investigate its function.

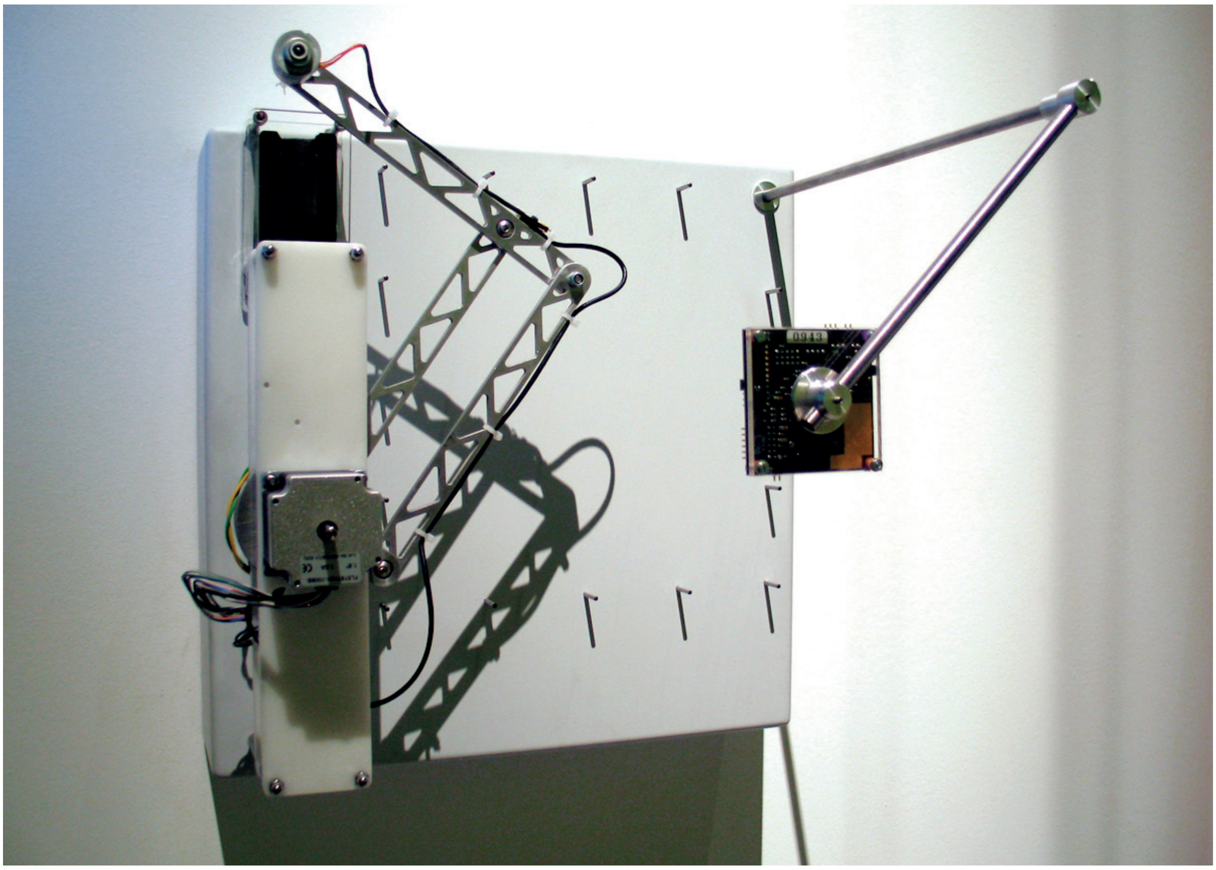


Fig.76: Fly Stealing Robot.
Of the series only the Fly Stealing Robot meets the standard expectations on how a robot should look with its mechanical arm and fly tracking camera. We felt that for the series to be taken seriously as a new proposition, it would help to exhibit, alongside the alternative concepts, a more normative robot. This proves that we understand both the meaning and definitions of robots and have related technical skills. The contrast between this robot and the others in the series highlight their lack of conformity to expectation.

As with Dunne & Raby's robots described in chapter four, by creating desirable objects in their own right and then assigning them the status of robots we presented a new approach to robot form, based on the logic of adaptation and familiar domestic objects.

**Functional adaptation:** ***The killing application***

In the home there are several established categories of objects, each in their own way justifying the product's presence through the benefit or comfort it brings to the occupant. These include utility, ornament, companionship, entertainment and combinations of the above - for example, pets can be entertaining and chairs can be ornamental. The simplest route for robots to enter the home would be to follow one of these existing routes but offering something above and beyond (the sublime – see p.38) the products currently occupying those roles.

The utilisation of the microbial fuel cell meant that the utilitarian functions commonly associated with robots would be severely limited by the amount of energy available,[83] ruling out complex mechanical movements or power-hungry electronic components. As described previously (p.65), one of the major themes of contemporary robotic research is the development of artificial companions. We began to consider and develop a new form of interaction and emotional relationship with an object, coming back to the Frankenstein myth and the notion of artificial life. By exploiting the narrative potential of the fuel cell - specifically its use of living organisms for energy, the

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83. Ecobot 1 recorded an open circuit measurement of 5.4v with a short circuit current of 15mA, and the operating range was between 1.93– 2.83 V. (http://www.brl.ac.uk/projects/ecobot/ecobot%20I/index.html)

consequential possibility of energy autonomy and the resultant *living* thing - we suggested a new category of object existing somewhere between a pet or houseplant, and a normal domestic product.

In setting up the dynamic relationship between the owner and the robot, we borrowed from well-established techniques in film genres such as horror and thriller to provide a spectacle. Susan Sontag describes in her essay on science fiction how the “freakish, the ugly and the predatory all converge – and provide a fantasy target for righteous bellicosity to discharge itself, and for the aesthetic enjoyment of suffering and disaster.” (Sontag: essay in Mast and Cohen, 1985, p.456). In our attempt to manufacture a similar experience on the part of the viewer, we embellished the predatory nature of the robots to create a suspenseful and dramatic aesthetic operation.

The use of a living organism as a food source also has the advantage of introducing a random aspect to the robot’s behaviour that overcomes the robot paradox #1 (see p.73); predictability is diminished by the unpredictability of the living prey.

Fig.77: Scene from 'Goldfinger' (Hamilton, 1964).
The audience is kept in suspense as the laser beam creeps slowly but surely towards the crotch of the restrained James Bond.

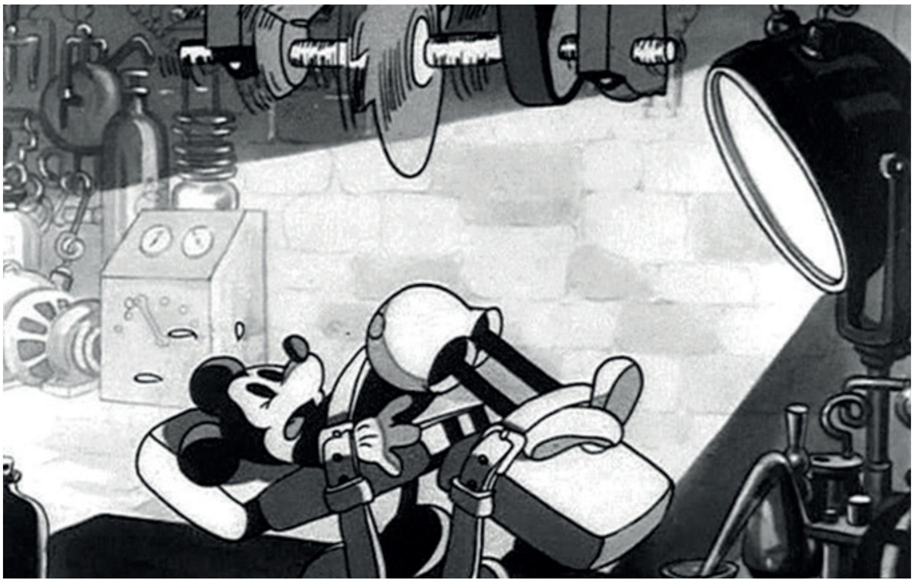

Fig.78: 'Micky Mouse and the Mad Doctor' (Disney, 1933).
A similar method of suspense is seen here in Walt Disney's animation.
This is a classic and often reproduced scene presented in various guises: the laser beam above, rotating saws, conveyer belts leading to heavy presses, boats heading towards waterfalls and so on.
The basic premise is a very visible and obvious element of danger and movement of this dangerous element towards the actor or vice versa setting up the anticipation of the coming unpleasant event in the viewers mind.

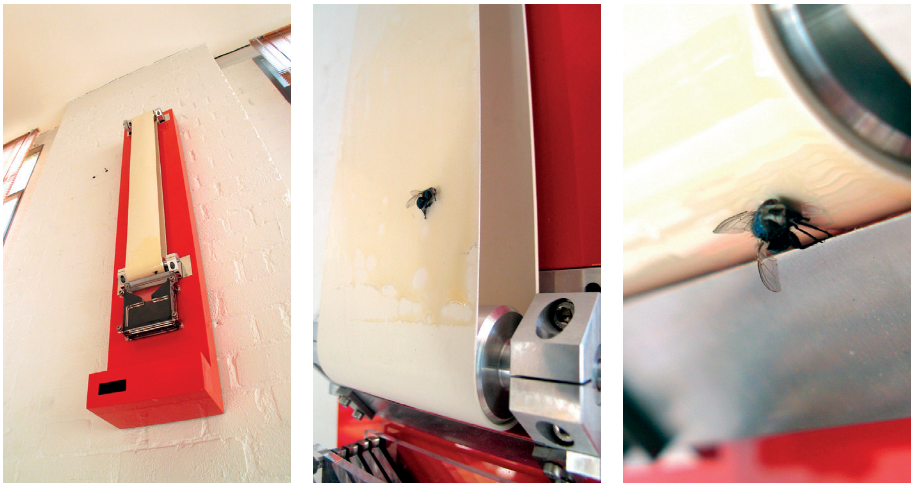

Fig.79: Flypaper Robotic Clock.
A fly is buzzing around the room. With a Flypaper Robotic Clock this fly is no longer a simple nuisance but a participant in a live performance: will it fly towards the clock? If so will it land on the belt? Will it stick to the honey? Watch as it is slowly delivered to the blade - will it escape before it gets there…?

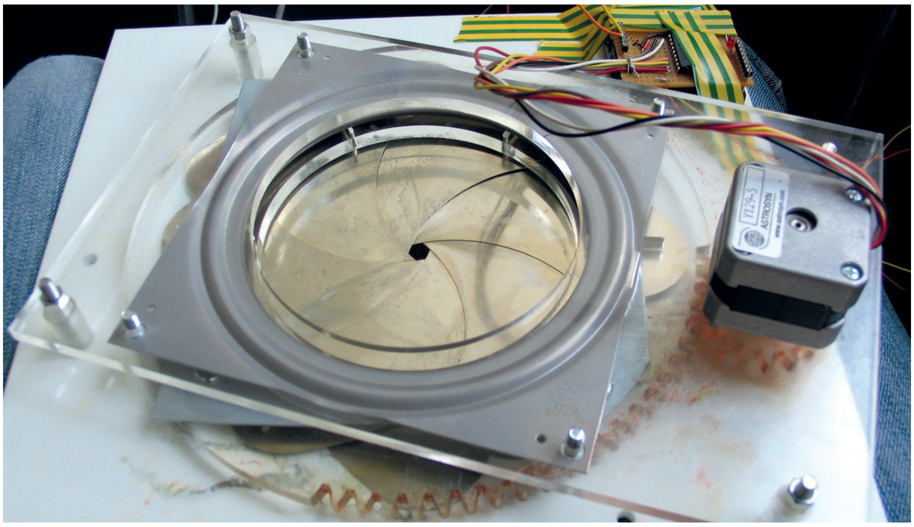

Fig.80: Mousetrap Coffee table Robot.
The mechanised aperture centred on the tabletop is activated by the breaking of an infrared beam referencing familiar scenes in spy thrillers such as 'Mission Impossible' and 'James Bond'. In this case a mouse becomes the protagonist in the story.
No flies or other creatures were harmed during these experiments or photo-shoots.[84]

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84. The fly in the image above was already dead when we placed it on the paper.

**Interactive adaptation:** ***People/insect/robot interaction***

BRL's Ecobot had no capacity for identifying and capturing insects - these were manually placed in the microbial fuel cell by the scientist. In domesticating the robot it was necessary to apply a more sanitised method of supplying food to it. To enhance the psychological impact of the robot we considered it necessary to reduce *physical* interaction to a minimum, as the robot's autonomy would be diminished should it depend on a human hand to feed it. By referencing predatory techniques of carnivorous plants and applying them to the robots, it was possible to create logical and low-energy techniques for the attraction and capture of prey. Interactions, then, are mostly psychological and emotional. Besides those described above, we used the qualities of nurture we might experience from caring for pets and houseplants, and the inevitable relationship and fear of death that comes through being responsible for living things.

Like Frankenstein's monster, the CDERs require human assistance to bring them to life, using either mains power or a standard battery to initially power their predatory mechanisms. Once switched on they begin to capture and accumulate the biomass necessary for the fuel cells to generate electricity. To show their energy status some of the robots have graphic displays, which might remain unlit for many months or even years, but they *could* turn on at any moment, keeping the owner engaged - just as a fisherman might watch a static float for hours on end in the anticipation that eventually it will dip into the water.

**Technical verisimilitude:** ***Suspending disbelief***

In the last chapter I described why, in terms of plausibility, Alternative Presents can be problematic due to conflict with established and expected forms and behaviour. It was imperative that we found ways of overcoming this oddness for the project to be a success in achieving the levels of dissemination we aimed for. In the first place we had to address the fundamental issue of definition – crucially, for the technical community, it was essential for the objects to be classifiable as robots. To achieve this we went beyond the basic definition laid out in the introduction and aimed to satisfy the more prescriptive criteria recognised by roboticists (these are highlighted below):

The CDERs are energy autonomous as a consequence of using the microbial fuel cell as energy source.

Their capability, via programming, to capture biomass gives them agency.

They move or have mechanical moving parts.

They can sense their environment.

Each performs a limited utilitarian function.

As described above, the Fly Stealing Robot (fig.75) more closely conforms to expectation, highlighting the disparity between itself and the other robots in the series - making their oddness appear considered rather that accidental.

The second factor came again from considering the home, specifically the rules of the domestic environment and what kinds of creatures are warmly accepted and which ones are vehemently rejected. It was important that the robots pose no danger to a family cat or dog, rather capturing and digesting only those creatures that we would normally describe as pests. Using pests also circumvents the cruelty issue as these creatures are already routinely and comfortably disposed of through various chemical or mechanical means. We simply expanded on this activity to generate energy from the process.

The final factor responsible for the series presenting a convincing presentation was the finish of the objects. The prototypes were built to a very high standard using various methods of construction and detailing. As with James Chambers' objects for the ADG (see p.175), it was necessary to carefully prototype the behaviour and movement of the robots. Here we collaborated with robotics engineer Alex Zivanovic, an expert on the cybernetic sculptor Edward Ihnatowicz,[85] to give the robots a captivating animated movement and behaviour through design and programming.

In reality microbial fuel cells are relatively basic, belying their complex function. We embellished the design of the cells, with the intention of making them look more 'functional'.

This comprised exposing some of the circuitry behind the cell's activity, and, in some of the robots, lighting the cell to emphasise its presence.

With the Lampshade Robot we worked with designer and three-dimensional modelling expert Tommaso Lanza to develop the high-precision technical detailing of the shade. This was made from 20 rapid-prototyped elements and professionally painted alongside the other objects.

### Dissemination

As with many speculative design projects, the output can exist across various media: a 30- minute presentation at a design or robot

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85. His ground-breaking sculptures explored the interaction between his robotic works and the audience, and reached their height with 'The Senster', a large (15-feet long), hydraulic robot commissioned by the electronics giant Philips for their permanent showplace, the Evoluon, in Eindhoven in 1970. The sculpture used sound and movement sensors to react to the behaviour of the visitors. It was one of the first computer-controlled interactive robotic works of art (see Zivanovic, n.d.).

conference; objects and supporting material in a gallery or exhibition; an article in a journal, popular magazine or design book; an internet forum or website. Dissemination methods and the descriptive language differ between destinations and audiences, but in all forms the first objective is to engage the audience - only then may the viewer have the inclination to investigate the deeper subject or question. In the current cultural climate, just adding the word *robot* to the title of an object can help in capturing public interest. This naming, together with the unexpected forms and the carnivorous nature of the artefacts, combined to present a group of robots that have been extremely successful in achieving dissemination on a global level across a spectrum of contexts and audiences. I will briefly list the key outputs before offering a more in-depth analysis of the project's value in questioning domestic robots.

Through the Material Beliefs programme, the CDER series immediately had an output in exhibitions at the Royal Institution in London and Laboral in northern Spain. Since their completion in 2008, the robots have been in exhibitions almost constantly. We developed a demonstration mode for the robots, programming their motors to go through a series of choreographed motions and rotations of belts to simulate their primed state. Elements of the audience in Laboral engaged with the predatory element of the robots to such an extent that captured live insects were left by the robot in our absence. See Appendix A. for an exhibition list.

Early in the project we also presented at conferences at the Victoria and Albert Museum in London and Lift 09 in Geneva. The duration of conference presentations allows for a crafted argument to be made, critiquing the familiar representation of domestic robots and spelling out the complex raison d'être behind the existence of these robots. The project has been included in presentations to a variety of

Fig.81: Exhibition and presentation at Techfest, ITT, Mumbai, India. January 2011

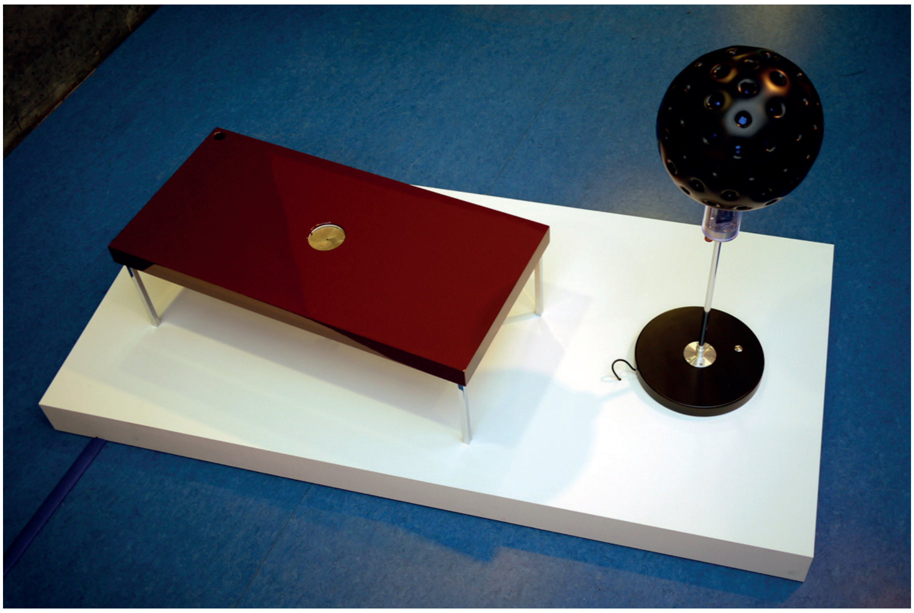

Fig.82: Shortlisted and Exhibition at Transmediale, Berlin, Germany . 2nd – 7th February 2010

Fig.83: Still from 'Wallace and Gromit's World of Invention' – 'Nature Knows Best.' BBC1 television. Aired 3 November 2010.

Fig.84: Presentation to the Swiss Design Network: Negotiating Futures – Design Fiction (Keynote) Basel, Switzerland. 29th – 30th October 2010

audiences such as academic researchers, the robot community and at design events. See Appendix A for a conference list.

The project has been very successful at capturing the imagination of a popular audience. It has been featured on the BBC's prime-time television programme 'Wallace and Gromit's World of Invention',[86] several interviews on live radio such as 'The Jay Thomas radio show'[87] in the US, and in the *Metro* newspaper and website in the UK[88] (with a daily readership of 3.1 million for the paper and 255,394 unique browsers per day for the website).

## Learning and observations

One of the key aims of this research method is the dissemination of design concepts with the aim of raising questions related to the existence of the speculative artefact in everyday life. Whilst the project has been extremely successful in achieving broad dissemination, it has been less effective at raising helpful questions about the domestication of robots.

**Mismanaging the uncanny**

One of the big challenges, and in retrospect one I'd suggest was not expertly handled, was the management of the sensational element raised through the use of living creatures as a source of energy. This behaviour, whilst helpful in creating intrigue and interest, tipped the balance towards the sensational or outright unpleasant rather than the

86. http://www.bbc.co.uk/bbcone/wallaceandgromit/
87. http://www.jaythomas.com/index.php
88. http://www.metro.co.uk/weird/855415-designers-create-furniture-that-eats-mice-for-energy

desired uncanny. This hindered the project's ability to draw an audience into deeper discussions beyond initial reactions. This is less of an issue in a conference presentation or exhibition - due to the audience's interest in the subject and the possibility of a more thorough delivery of information - but on a blog or in a newspaper a sensational headline can rapidly lead to a cessation of genuine engagement, leading to facile comments or first-response negativity.

Another issue was the use of the word 'entertainment' in the title of the project. With hindsight it is safe to say this was a step too far. Whilst many viewers were relatively comfortable with the notion of machines using living organisms for power, our claim that this process would be entertaining was too provocative. In live presentations we have used the video-sharing website YouTube to highlight human interest in the observation of death - for example, a clip featuring a Burmese python snake eating a rabbit had at last count been viewed 2,261,876 times.[89] The inclusion of the Coffee Table Mousetrap robot in the series inflamed the issue. We argued that the only creatures consumed by the robots were those already considered as domestic pests and were already being eliminated by a number of mechanical, electronic and chemical means. This helped in live presentations as a response to negative audience questions, but not on websites and internet forums where it would have been impossible to track and respond to every comment. Mice were a step too far, too close aesthetically to small cats and dogs, suggesting a logical progression that would ultimately see the table consuming its owner's pets.

With the luxury of hindsight I would remove the word

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89. http://www.youtube.com/watch?v=F6gZE0MdaVY, accessed 1 July 2011.

'entertainment' from the title and drop the Mousetrap Coffee Table from the series.

**Cultural and historical baggage**

After analysing the comments on blogs and websites it became apparent that the CDERs were suffering from the negative filmic depictions of robots described in chapter two (see p.75). In this case the similarities between the premise behind 'The Matrix' series of films, where humanity is captured by a race of machines that live off their body heat, and the carnivorous nature of the robots led to inevitable comparisons:

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This is nuts.....

**DanteAltem** 2 months ago

DEAR GOD!! Youv'e Given them a taste for flesh

**Billythewookie** 2 months ago

This is the start of the matrix

**StuartM62** 2 months ago

**@dorkylump** ITS A CLOCK. NOT AN EVIL ROBOT WITH LAZER CANNONS AND MISSLES. JUST A CLOCK... UNLESS ITS A TRANSFORMER. OH MY GOD WE ARE ALL GOING TO DIE! Nah, seriously now thats like what 25-30 yrs from now.

First step in THE MATRIX?

**BRIANTOWN33** 2 months ago

People are heading the wrong way. When a machine starts consuming organic substances for its own benefit, you're introducing a new spectrum to a possible artificial intelligence. When they can think for themselves, hello Matrix.

**dorkylump** 3 months ago

11 ppl are flies

**xixRASBERRYxix** 3 months ago

Bacteria and food? why not just take a shit on the battery?

**splendidmate** 3 months ago

I can't wait until I can throw my neighbors dog into the trunk of my prius to get to work.

**jssreid2** 3 months ago

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Fig.85: Responses to 'Wallace and Gromit's World of Invention' excerpt on Flypaper Robotic Clock. (YouTube, 2011).

Again, this factor was particularly prevalent on websites, steering the debate away from realistic questions relating to domestic robots towards either issues of animal cruelty and ethics or extreme scenarios of robots taking over the world. The utilisation of the microbial fuel cell completely overwhelmed all other aspects of the robot's design.

**Too many fronts**

A more complex problem emerged when we presented the project to the robotic research community, either through academic papers or at conferences. The project challenged robot preconceptions on too many fronts, attempting at the same time to explore alternative ideas of form, methods of engagement and entertainment, modes of interaction and energy autonomy. This diluted the impact of the individual elements and made for a complex and problematic presentation.

From the consumer's perspective, the resultant objects were also extremely hard to categorise: being furniture-like but not quite furniture; labelled as robots but not complying with robot expectation; inanimate but at the same time animate. This is problematic for the reasons outlined in chapter three, 'how technology *does* become a product' - specifically the conservative nature of how new products enter the home. Of the five product proposals, only the Flypaper Robotic Clock was taken seriously as a potential product.

From a personal perspective, the investigative and developmental potential of the project opened up many relevant themes that helped to build a strong foundation for the thesis. As a speculative design project, whilst it was very successful at achieving high levels of dissemination, it failed to open up the more specific discussion we had hoped for. This failure facilitated a more focused analysis of the methodology, feeding directly into the next project, which resulted in a more simple and direct approach to the subject.

## Happylife: *A robotic speculative future*

The foundations of this project were similar to Material Beliefs. Happylife was commissioned as part of the 'Impact!' exhibition, a joint project between the RCA, EPSRC and Nesta, bringing together 16 EPSRC-funded research teams with designers from the Design Interactions department at the RCA:

> **"This is a unique collaboration between science and design that explores the importance of engineering and physical sciences in all aspects of our lives.**
> **To communicate the impact of the research we fund, the Engineering and Physical Sciences Research Council (EPSRC) coordinated a mixed media exhibition of original design proposals that explore the relationship between science and society." (From the project website: http://impact-art.ning.com/)**

I collaborated with the Aberystwyth University Computer Science department (AUCS), whose research project, in partnership with the Home Office and HM Revenue and Customs, develops new technologies to assist in the policing of borders:

> **"This project will develop an operationally and technically viable approach to cargo threat investigation. The main aim of the project is to provide a real-time dynamic passive profiling technique to assist Border Control Agencies and has the potential to improve hit rates; i.e. to improve targeting the**

**people that carry contraband and hence ensure less is entering the UK. (http://gow.epsrc.ac.uk/ViewGrant.aspx?GrantRef=EP/G004137/1)**

As with the CDERs, the speculative design aim of the project was to imagine how this technology could be developed and deployed for use in the home, and what the consequences of a device mediating and displaying human emotion might be.

## The technology

Aberystwyth University's ongoing research utilises real-time dynamic passive profiling techniques to detect malicious intent through understood physiological processes. In practice, the thermal image of an individual passing through a border control point is captured on entry to secure a datum setting. A computer programme then analyses changes to the live image during a period of questioning, looking for particular patterns of thermal flow that suggest an individual may be smuggling contraband or illegally entering the country. The thermal camera operates from up to four metres distance, is completely non-invasive and is capable of detecting minute changes in thermal flow.

The technology is currently operational and going through a testing and validation process through controlled user testing studies.

Historically, many domestic technologies have their genesis in the field of military and national security research, Happylife pre-empts this transition by speculating on how AUCS's research could be applied in the home. The technology lent itself to a more oblique enquiry into robot futures, focusing less on practical functions and physical objects to examine how passive profiling techniques could display and mediate the most private and emotive aspects of home life.

Fig.86: Thermal image camera.

Fig.87: Output from the thermal image camera.

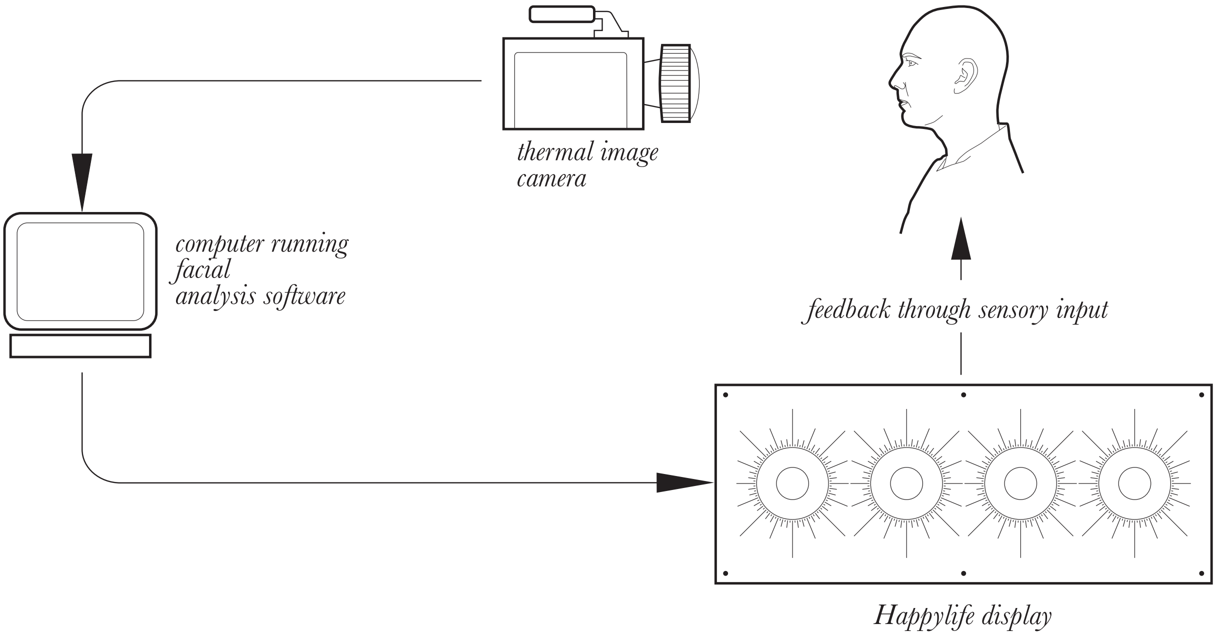


Fig.88: Happylife technical description.

## Designing the speculation

I will break down the criteria of adaptation as with the Carnivorous Domestic Entertainment Robots, but with the Happylife concept, function and interaction combine. These factors will therefore be described together.

**Form adaptation: *Domesticating the technical***

Giving form to a device that presents human mood or emotion presented a complex challenge. After several incarnations and experiments with three-dimensional bar charts, inflating balloons and kinetic light displays, I came across an aneroid barometer similar to the one pictured below. This gave the impression of being a highly calibrated machine; a technical piece of equipment offering indisputable information relating to atmospheric pressure. Barometers frequently translate pressure change into weather predictions, offering suggestions such as 'rain' or 'fair.' The model I had seen simply converted this information into a line drawn on a heavily calibrated rotary barrel. I observed the movement of the device for a number of weeks and became captivated by the relationship between the actual weather, the direction the line was taking and my perception of the combined experience. This appeared to be a suitable parallel for the Happylife device, an emotional barometer.

Stylistically it was necessary to adapt the display element to the modern home. The final version (fig.90) was CNC-machined from Corian,[90] for its translucent and material qualities, and lit from behind by

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90. http://corian.co.uk/Corian/en_GB/index.html

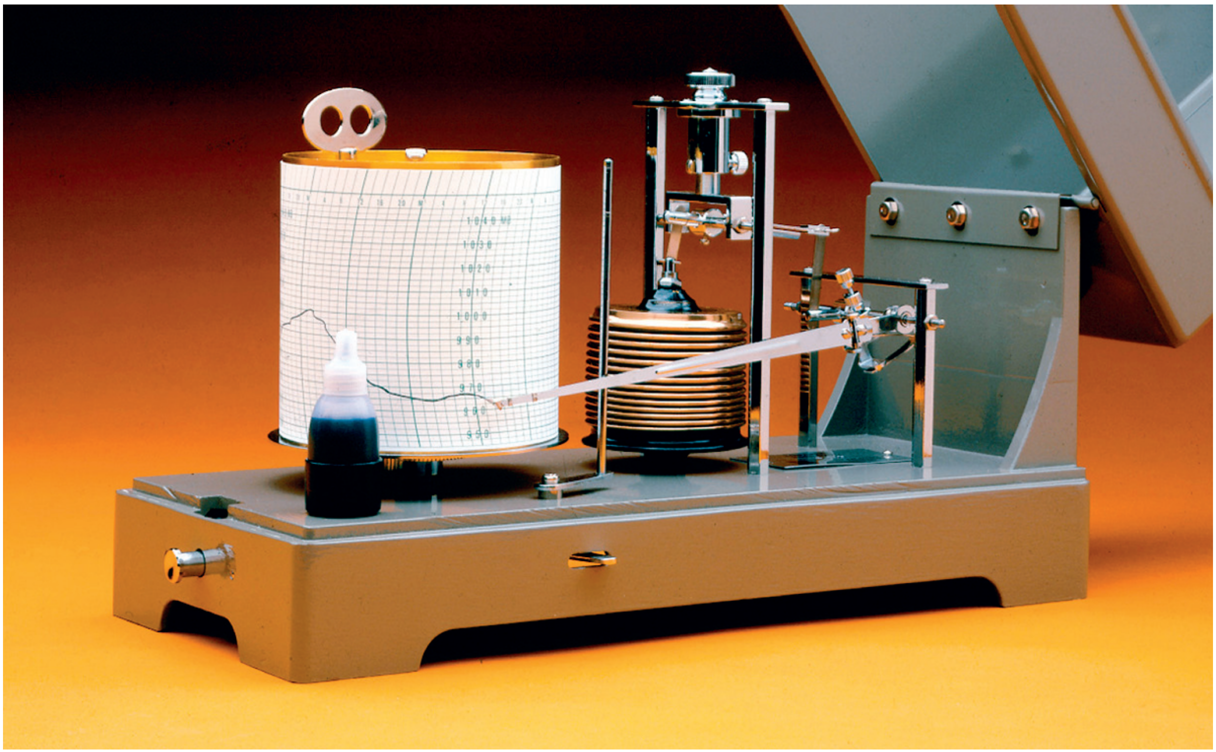

Fig.89: An aneroid barograph makes a continuous record of pressure changes.

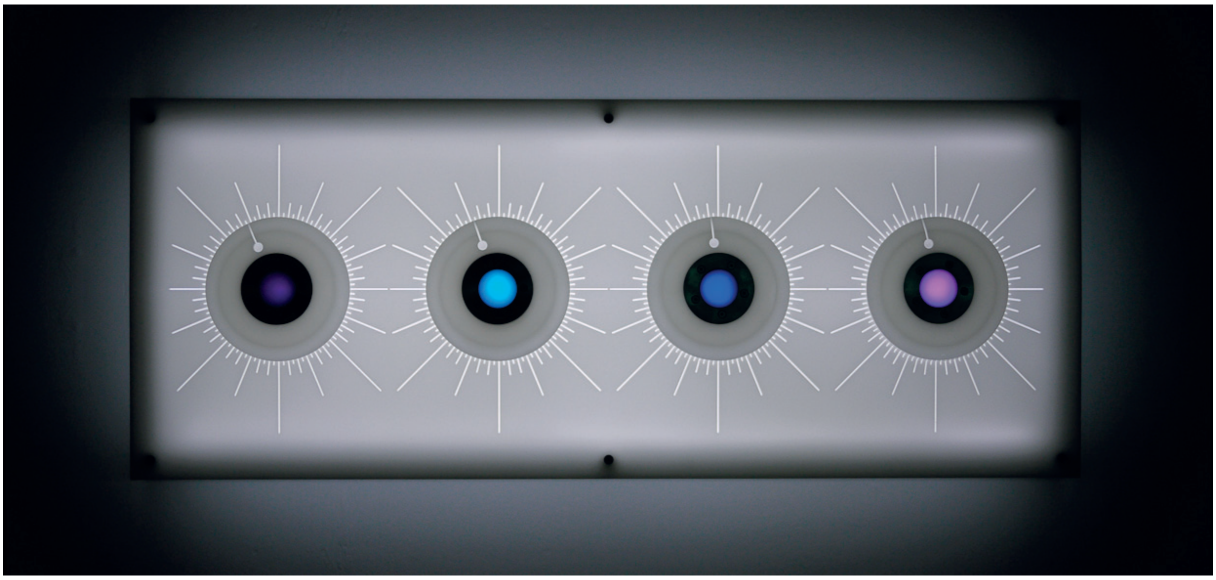

Fig.90: Happylife display, 1000mm x 400mm x 100mm (Auger/ACSD, 2010)

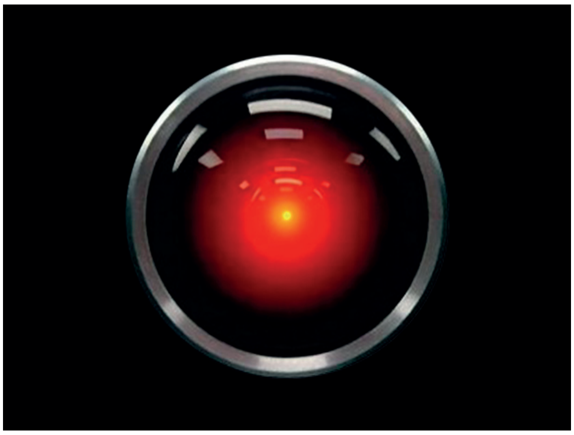

Fig.91: HAL 9000, '2001: A Space Odyssey'.


Fig.92: Embedded Happylife thermal image camera.

an adjustable superbright LED panel. The display features four heavily calibrated output dials, one for each family member.

Each personal dial has two pointers, one showing the current state taken from the most recent thermal image capture and one showing the predicted state where the system would *expect* the dial to be based on the processing of accumulated statistical data. The device was built as a functioning prototype.

The thermal image camera is embedded in the wall, referencing the artificially intelligent computer HAL 9000 in ‘2001: A Space Odyssey’.

**Functional and interactive adaptation: *Emotional automation***

Whilst the behaviour of such a device introduces a new role for technology in the home, its function can be understood as an extrapolation of contemporary products that connect mood with product behaviour, such as light adjustment or automated music selection.[91] Happylife suggests a more direct link to affective state, displaying hard information rather than ambient adjustment.

When dealing with the subject of human mood, an obvious output, like the less technical barometers described above, would have been pointers towards states such as *happy* or *sad*; whilst this would have made the project more accessible and sensational, it would have been factually incorrect, alienating the scientific community and in particular my collaborators in the computer science department. We decided on a heavily graduated rotary dial with no literal pointers. This would allow for the user to calibrate the dial over time, generating a

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91. For example, see Philips Living Ambience range of products: http://www.philips.co.uk/c/livingambiance/180548/cat/

more complete and personal understanding of its output.

To fully exploit the narrative potential of the technology, it was necessary for the device to be in a home for some time - allowing for the accumulation of data and its subsequent mining and analysis, and checking for the emergence of patterns or long-term shifts in status, both of which might go unnoticed by the occupants. This plays to the strengths of computer technology and facilitates new forms of interaction with technology.

To examine the consequences of Happylife, we speculated on the emotional impact of its deployment in the home of a traditional nuclear family over a 15-year period.

**Cultural verisimilitude: *Building on political and cultural angst***

A glance at the cultural and political landscape into which Aberystwyth University's research will be applied reveals the increasing use of advanced surveillance technology for national security. The terrorist attacks in New York, London and elsewhere in the last decade heightened fears around the globe, with the consequence of accelerating the development of security-related technology. In addition to this, the global SARS epidemic in 2003 added a different dimension to the culture of fear, introducing the use of thermal image cameras to check the health of incoming passengers at many Asian airports.[92]

Running parallel to the implementation of technological devices for policing and monitoring is the increasingly popular migration of similar devices into the world of entertainment. One example of

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92. For an in-depth analysis of this 'fear'-based culture, and the role of the media and information bias in strengthening popular perception, see Dan Gardner's *Risk: The Science and Politics of Fear* (2009), particularly chapter one.


Fig.93: Incheon International Airport: thermal imaging system screening passengers for H1N1 flu.

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# Rail staff face 'smile police'

**A Japanese rail firm has introduced a system to check that staff are smiling enough at all times.**

Computerised scanners around 15 Tokyo stations will measure the smile's curvature to ensure it is broad enough.

Those failing to measure up - literally - will be advised to look less serious and more cheerful.

The smile scanner aims to improve service to customers

The system will also be introduced at a hospital in Osaka to check staff friendliness and at a truck stop to measure the tiredness of drivers.

Fig.94: Japanese Rail firm introduces computerized system to check that their rail staff are smiling enough.

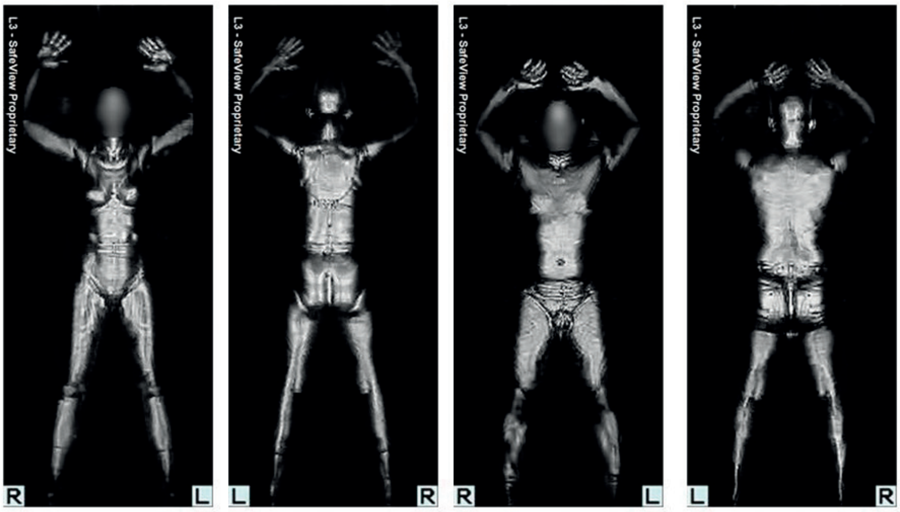



Fig.95: Millimetre wave technology, Generation 2 scanner. Being employed globally for Airport security and leading to many debates on the invasiveness of technologically aided security.


Fig.96: Still from 'The Jeremy Kyle Show', broadcast on ITV in the UK. The show regularly relies on both lie detector and DNA tests to solve family disputes.

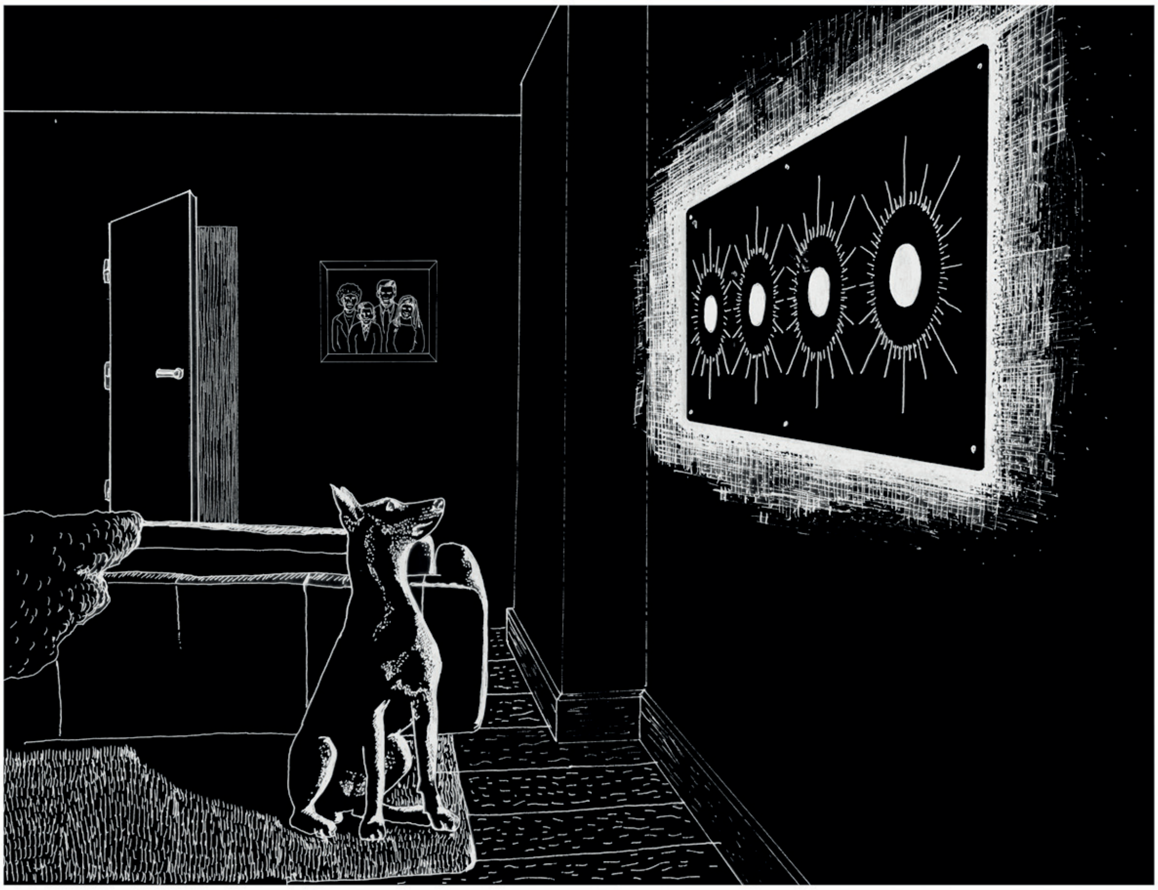
this shift is the (pseudo) science of polygraphy. With a history going back over a century, lie detection devices were originally tools used by experts on potential criminals, spies and paedophiles. Although the credibility of lie detection devices has long been in question, their progression into popular culture is almost complete. Lie detectors (often partnered with DNA test results) are a regular feature on daytime reality television programmes, where they are used to mediate family disputes and solve fidelity issues. In the context of popular culture, technology is becoming an infallible judge of human character.

Like Orson Welles' radio broadcast, the project took advantage of contemporary cultural and political events to build a foundation for the design speculation, giving the project familiarity and a poignant logic. The challenge then was to shift the emphasis away from the predominantly negative contexts or usages outlined above to describe a more positive function in the home.

**Avoiding stereotypes**

Another challenge was for the proposal not to be confused with existing 'smart' home concepts such as those described in chapter two. These follow the utopian tradition of technological futures and are commonly based on home automation, labour-saving devices and technologically implemented notions of comfort. These proposals, however, commonly neglect more complex human factors, ignoring the emotional interactions that take place between family members and friends in the home. More inspirational were the short stories in classic fiction such as the 'Happylife Home' in Ray Bradbury's *The Veld* and J G Ballard's 'Psychotropic House' in *The Thousand Dreams of Stellavista*:

**"'Maybe I don't have enough to do. Maybe I have time to think**

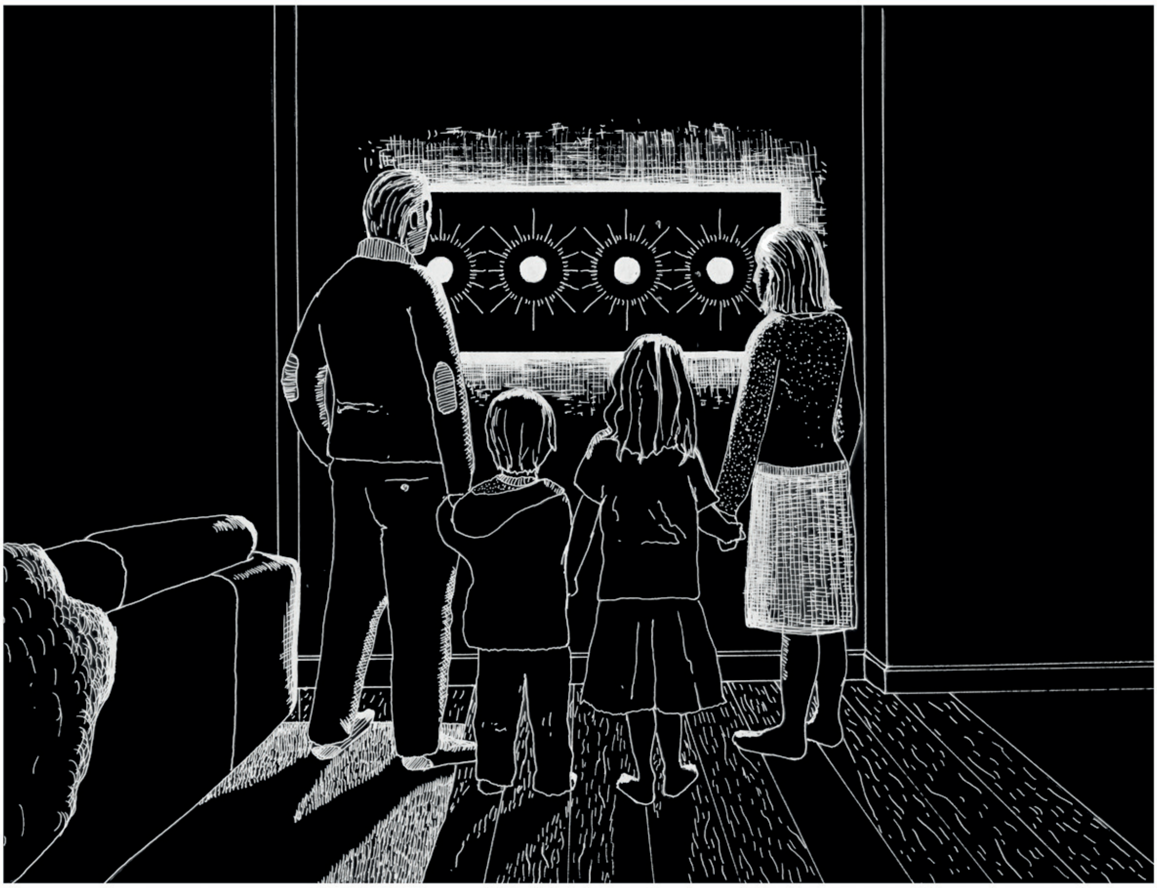


We installed Happylife.
Not much happened at first: an occasional rotation, a barely appreciable change in the intensity of light. But we felt it watching us, and knew that some kind of probing analysis had begun. After only a few months, we found ourselves anticipating the position of the dials. The individual displays rarely contradicted our expectations, but when they did it encouraged us to look inwardly at ourselves.

Fig.97: Happylife scenario #1. Introduction.

I arrived home from the meeting, pushed off my shoes and glanced up at the Happylife display. Sandra's dial had rotated 2 clicks further than I'd ever seen it. The orb was pulsing wildly. She'd seemed fine when I left.

Fig.98: Happylife scenario #2. Guilt.



It was that time of the year. All of the Happylife prediction dials had spun anti-clockwise, like barometers reacting to an incoming storm. We lost David 4 years ago and the system was anticipating our coming sadness. We found this strangely comforting.

Fig.99: Happylife scenario #3: Mourning.

The morning Paul had to go, Sandra's dial was barely registering. I'd seen it that pale only once; then, for obvious reasons, it stayed that way for weeks. I tried to comfort her, saying it wasn't as if he'd be away for ever. She turned to me with her face blank and puffy and then ran out of the room.

Fig.100: Happylife scenario #4. Leaving.

We were all sitting in the lounge, like any evening. Sandra and I were watching some nondescript documentary and the kids were playing with their lego. The moment stole up on us. Paul was first to notice the unusual glow coming from Happylife. It continued to brighten – a gradual, barely conspicuous build up of intensity until we had to look away.

Fig.101: Happylife scenario #5. Glow.

**too much. Why don't we shut the whole house off for a few days and take a vacation?'**

**'You mean you want to fry my eggs for me?'**

**'Yes.' she nodded.**

**'And darn my socks?'**

**'Yes.' A frantic watery-eyed nodding.**

**'And sweep the house?'**

**'Yes, yes - oh yes!'" (Bradbury, 2008, p.13)**

**"It's always interesting to watch a psychotropic house try to adjust itself to strangers, particularly those at all guarded or suspicious. The responses vary, a blend of past reactions to negative emotions, the hostility of the previous tenants ... " (Ballard, 2006, p.415)**

Whilst both stories follow the common dystopian science fiction route, they embrace the dynamic complexity of the home environment, introducing technology to mediate and manipulate human emotional experience. The Happylife proposal was designed to sit somewhere between the dystopian worlds of Ballard and Bradbury and the utopian corporate smart home, acknowledging the complexity of domestic human interactions whilst employing near-future informatics technology.

**Designing the audience experience: *Storytelling***

Whilst the Carnivorous Domestic Entertainment Robots lent themselves to a more immediate and direct presentation, Happylife required a more complex method of communication - due to the timeframe over which it operates and the complex human behaviour the system is capable of monitoring. The sensitivity of the system means that it would be capable of detecting tears rolling down a person's face. Human fat tissue acts as an insulator, so if the camera captured the thermal image of the same face over a long duration it could detect weight gain or loss. During experiments on live test subjects the scientists observed differences in thermal reaction between induced stressful situations and being read poetry. The camera can see a person blushing.

To communicate some of the more complex emotive possibilities of the concept, five fictional narratives were presented as vignettes, written in collaboration with poet Dr Richard Marggraf Turley. The aim of these was to highlight emotional real-life family scenarios that would somehow be modified or augmented by the Happylife technology. We were careful that these were not wholly dystopian in nature, but showed genuine and even poetic benefits of employing the technology in this context.

The vignettes reflect many aspects of emotional life, such as the mourning of a loved one - and how Happylife would become capable of predicting the onset of such emotions through analysing patterns of previous ones created by recurring events such as birthdays and anniversaries. It was important to not only focus on obvious moments but more subtle and unique situations - for example, scenario five depicts the moment when the last four captures of the camera show the entire family to be in exactly the same state. This extremely rare event is recognised by the display glowing brighter than it ever has before. *This* kind of 'magic' moment would only be possible through the application of technology.

## Learning and observations

**Collaboration: *Moving design upstream***

One of the most fruitful outcomes of the project was the collaborative element, verifying that speculative design can successfully shift design research upstream to not only engage the scientific community, but to also become involved in their research. As the practice is relatively new, many scientists are unaware of the benefits of collaboration, or worse, make entirely the wrong assumptions about design. To overcome these problems it is necessary for complete transparency, and to present a very clear role of what the designer aims to achieve. This understanding was reached through a presentation of previous projects and their outcomes at the outset of the collaboration and discussion on the following points. First, the role of speculative design is not to simply *communicate* to the public the technology being researched, but to make informed speculations on the products, systems or services an emerging technology may become. Second, the designer's intentions are about exploring implications as well as applications. It is necessary to be clear about this as negative portrayals of a technology, however relevant, can upset and therefore threaten the collaboration. Third, showing a reasonable level of understanding of the subject/technology being researched by the scientists, and having some idea of what the design element will add, is extremely helpful in making the presentation convincing. Fourth, it is important to be clear that the speculative design approach to research facilitates an emphasis on how things could be through the prototyping of *ideas* rather than things.[93] And fifth, one must understand the nature and limits of collaboration. It might be that the designer simply needs advice or more specific information relating to a particular technology. This is not collaboration.

**Technological critique: *Shifting context***

In the context of national security, criminal activity and human safety, technological application is usually seen as a means to an end. However dark or invasive the application, its presence is accepted because the worst-case scenario would be infinitely worse. The AUCS department's original research existed in this context, but by shifting the operation of the technology into the domestic setting, the political justifications behind its development were removed - allowing for a more critical examination of its role in managing and mediating human interaction. The project exists as a tangible examination of the automation of everyday life described in chapter two, 'Playing to strengths: *Implications of a robotic future*', building on the strengths of robot technologies and subtly applying them in the home.

**Public disengagement: *Spoon-feeding the technology***

The project does not fully exploit the narrative and engagement potential of the thermal imaging technology, which limits its disseminative potential. Deciding on the appropriate strategy for presentation was a hard fought battle. As described earlier we decided

93. Idea prototyping is not about optimizing technological functionality or aesthetic design but imagining the future products a disruptive technological innovation could become. It is not about how a technology functions rather what it could do in the context of everyday life.

against the superficial or frivolous approach of written feedback, opting for a more contemplative self-calibration solution. This decision had the effect of shifting where the discussion took place, moving it away from the popular audience that the Carnivorous Domestic Entertainment Robots and Audio Tooth Implant had reached so successfully to a more vested and learned audience. Happylife has recently been shown at the 'Talk to Me' exhibition at the Museum of Modern Art in New York and was featured on several websites, blogs and magazines. The nature of comments left on these pages has so far been of a more mature, eloquent and thoughtful nature than those made about the Carnivorous Robots, suggesting that the audience has been more engaged by the project.

> **"I like how James has left their meaning ambiguous. They're not labelled. To some extent that speaks to the tension between the confidence we seem to have in technology by default, that it CAN do this sort of prediction accurately, and the reality that in the end we're assigning deeply meaningful personal traits to the random changes in digits." (Richard Banks, http://www.richardbanks.com/?paged=5, accessed 2 January 2012)**

> **"This project questions how imperceptible body parameters could reveal emotions such as guilt. What is highly intriguing (and smart according to me) is that the dashboard does not have any label… leaving its interpretation to the people who will live with it. How would this change social interactions in the family home? Would this electronic device enable family members to infer new things about their relatives? Would the device detect patterns invisible to people?" (Nicolas Nova,**

**http://liftlab.com/think/nova/2010/03/20/impact-exhibition-at-the-rca/, accessed 2 January 2012)**

**“If the family unit crowded around the Happylife device are on the ball they wont wait to react to the machine’s analysis – they will engage it in an interactive manner, exploring with their own experiences the relation of machine and human. And I think this is a good thing. We want to talk to our machines, and for them to talk back. It’s for our own benefit. I can’t wait to see where this all leads to.” (Thomas W Campbell, http://twcampbell.wordpress.com/2011/11/26/observation-on-the-evolution-of-storytellin/, accessed 5 January 2012)**

Happylife is one of those rare projects that with hindsight there is little I would change. As a critique of robots and more specifically the automated home, it does offer a plausible route through which sensing technologies could begin to invade everyday life and intimate human relationships. I was extremely conscious of the sensitive and in many ways sacred nature of human interaction. Whilst it is completely acceptable for smart phones to increasingly mediate day-to-day interactions between people and environments, these interactions are still initiated and controlled by conscious human activity. It would represent a major perceptual shift for invasive and automated technology to enter everyday life, and therefore a clumsy or insensitive concept would have been very easily dismissed as perverse. Happylife avoided this route through a carefully managed presentation of form, interaction and narrative.

The project did, however, leave room for further developments. Rather than simply turning dials relating to human affective states, it would be possible to utilise this information to control and manipulate devices and products. This is an exciting opportunity for further work.

## RCA Design Interactions robot project: *Living with robots*

The following describes a student project run over four weeks in the Design Interactions department at the RCA. Sixteen first year students on the MA programme participated and the project was funded by Intel research laboratories.

We launched the project with two speakers: David Crowley from the Critical Writing department at the RCA, who talked about the history of technology in domestic spaces, and Noel Sharkey, a roboticist and ethicist from the University of Sheffield, who presented a brief historical introduction to robots and some of the current ethical issues surrounding their application.

The brief was intended to represent a distilled version of the observations made during the research phase of this PhD, directing the students towards the specific problems and opportunities raised by a design approach to domestic robots - specifically form, interaction and contextual considerations.

### The brief: Living with robots (abridged, see Appendix B)

In a recent essay for *Scientific American* (2007), Bill Gates drew an analogy between the emergent computer industry in the mid-1970s and the state of the robotics industry today, coming to the conclusion that there will soon be a robot in every home. This is a prediction, though, that has been echoing around for over 70 years.

The question remains, what will these robots do in the home? Many proposed robots focus on complex engineering problems and choreographed stage demonstrations, ignoring the complex rules of the domestic landscape.

The goal here is to design a domestic robot, and to rethink the robot based on: complex human needs and desires; the rules of the domestic space; and the strengths of robot technologies. Don't get distracted by stereotypes as they often ignore these points.

James Auger, October 2010

## Selected projects

I have chosen one student project to represent each of the specific questions asked in the brief. The choices are based on either original approaches or significant outputs.

**Project/question 1: Relating to robot function**

Neo-naturalists by Neil Usher

This project presented a delicate blend of the technical with the poetic. The proposal used the traits of robots normally associated with production lines such as tirelessness, pattern recognition and repetition, but applied in original and thought-provoking natural contexts. Usher's technique bears similarities to the observational comedic approach described in chapter four (see p.164), taking advantage of familiar and in many cases forgotten childhood games such as spotting faces in cloud formations and searching fields for four-leaved clover. These give the robots new functions that whilst based on their strengths touch human sensibilities.

The direct introduction of natural phenomena into the robot's function also circumvents the robot paradox #1 (see p.73) through facilitating complete unpredictability. In the next iteration of his project, Usher developed the possibility to personalise the search element of the Cloud Robot - for example, the face of Elvis Presley or the classic image of Che Guevara. This feature has the consequence of greatly increasing the rarity of the special cloud, and therefore making more magical the quest and the sublimity of the successful robot.

Whilst this project is playful, it is helpful in presenting robots in a different light, moving their operation beyond the contexts of service, military and production to suggest a more romantic and aesthetic role in everyday life.

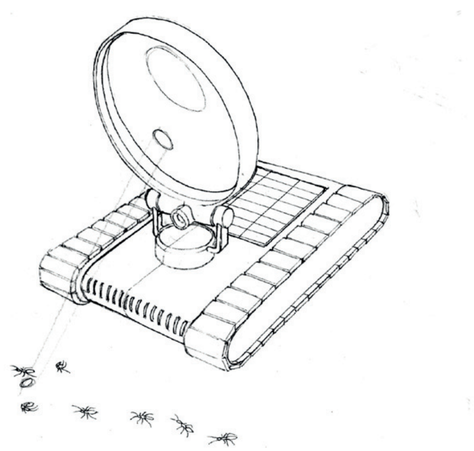


Fig.107: Insect Extermination - Anti-Ant.
Locates and burns ants using focused sunlight.
E-ink surface automatically chalks up verified fatalities.
Scores are uploaded to a local 'hall of fame' as well as a global leader board.
Powered by integrated PV panel.

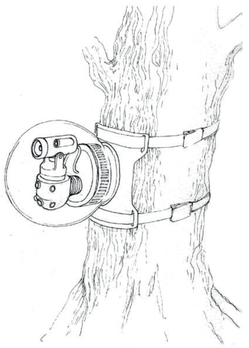


Fig.102: Sonic Identifier - Avian
Locates and Identifies bird calls.
Real-time chronological display details identified calls over 24 hours.
Audio Playback.
Uploads recordings to research databases for broader analysis.
Independent power from integrated PV panel.

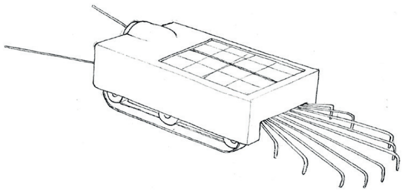


Fig.103: Insect habitat - Rake
Autonomously collects rotting vegetation on the lawn to provide insect habitation.
Provides Live-streaming video to 'under-pot' projection display with zoom control.
Lawn mapping and obstacle avoidance behaviours. Independent power from integrated PV panel.
Can be synchronised with most modern lawn mowers.
Uploads recordings to research databases for broader analysis.

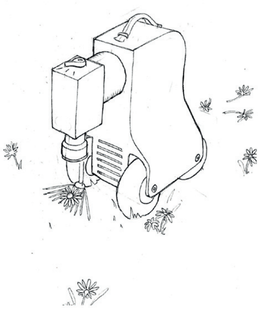


Fig.104: Flora Identifier - Neo-romancer.
Lawn flora identification with petal and leaf count.
Autonomous navigation and obstacle avoidance.
Four leaf clover alarm.
Optional dandelion mode with wish pre-recording facility.
Powered by rechargeable Lithium ion battery.

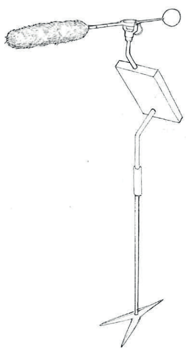


Fig.105: Mammal Surveillance – Attenborough.
Autonomously locates and films mammals for use in research, education and home entertainment.
Thermal and motion tracking behaviour with zoom and infrared mode.
Vacuum sealed housing with vibration dampers for absolutely silent operation.
Ratchet straps and self-orientating 3-axis gimbal allows multiple mounting options.
Powered by independently mountable PV panel.
Optional remote location rental plan with dedicated on-site maintenance technicians or 'shepherds'.

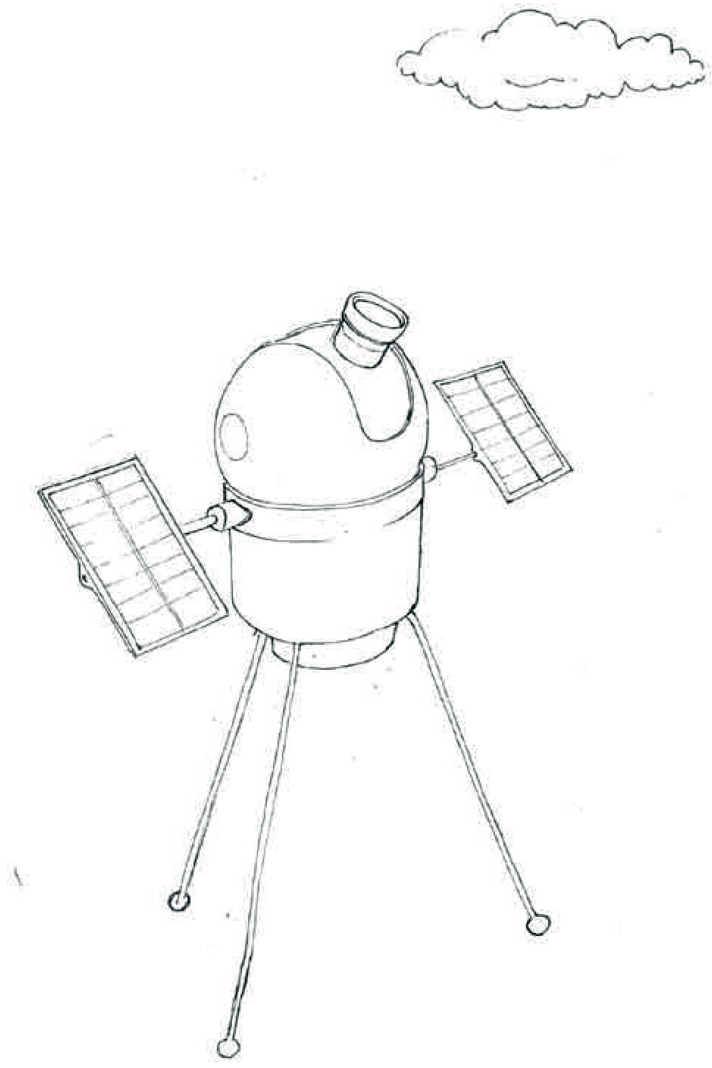


Fig.106: Face Recognition - Nimbus
Surveys the sky and attempts to locate cloud formations that resemble human faces.
Images are collected and stored by a remote display device.
Specific faces can be set as search criteria Powered
by integrated PV panel.

**Project/question 2: Adapting the home to accommodate robot needs**

With Robots by Diego Trujillo

Diego Trujillo's project presents an interesting depiction of the robotic home not as the classic shiny white seamless vision of the future, but a version not too dissimilar to our own. Look closely at the images and slight anomalies begin to appear, subtle compromises that make a normal home more hospitable for robots. The favourite justification for the humanoid robot is no longer relevant in this space and robots can develop in ways that would be more appropriate to technological limitations and mechanical design. The choice of media and the content of the images encourages the viewer to draw their own conclusions as to why things are slightly uncanny: the dinner plate rotated 90° out of position; the cupboard with drawers clumsily removed and cups with odd handles; the aestheticised optical tags on the sheet; the perfectly sliced slab of meat. These suggest the presence of something robotic in the house and although we never see it, we are drawn into the fiction in subtle and intelligent ways, encouraging our imagination to take over and fill in the gaps.

As with H G Wells' Martian, the project is an example of careful handling of habitat. Here Trujillo operates more in the second stage of the domestication process described in chapter three: domestication of the *product*, specifically the objectification stage, exploring how the robot could become situated in the aesthetic environment. He describes realistically how the domestic landscape would inevitably undergo subtle changes during the incorporation of the robot. The aesthetic treatment of the project and its original approach to domestic robots has led to With Robots being featured on several popular websites and blogs such as *Wired* (2011), *BLDGBLOG* (2011) and *Dezeen* (2011).

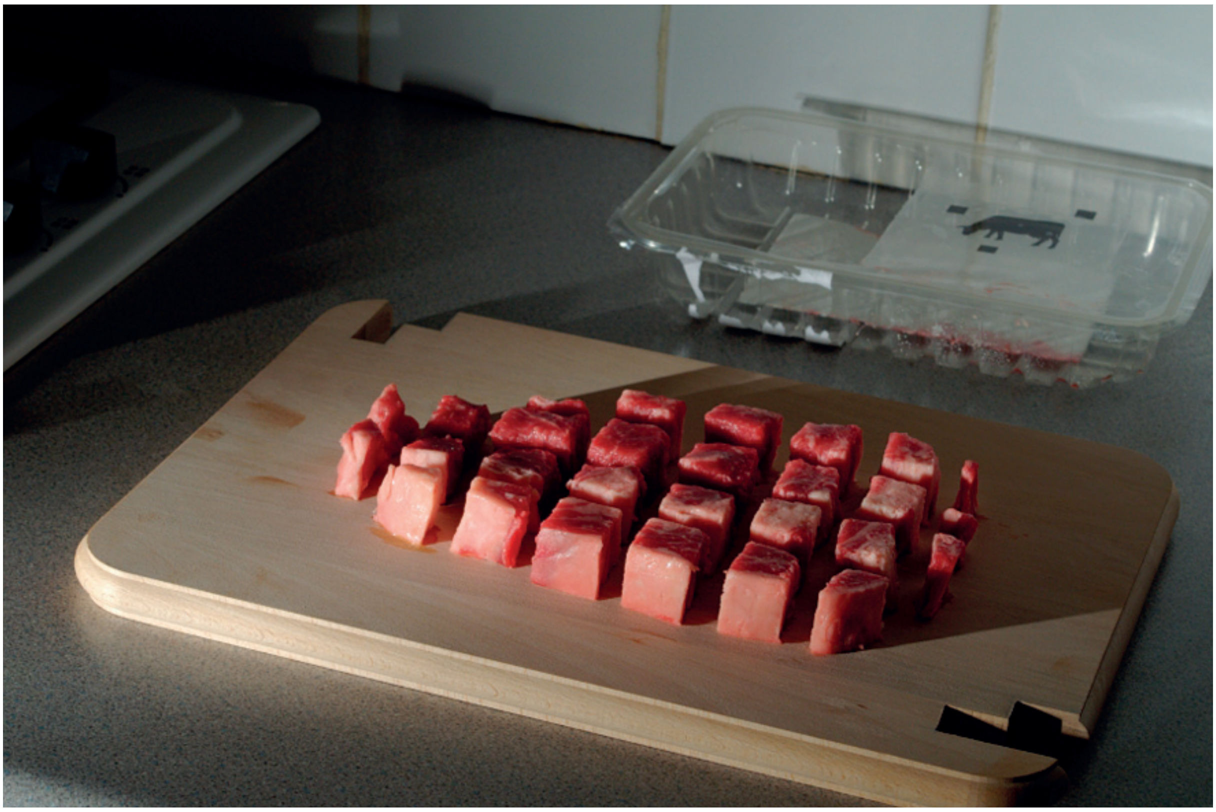


Fig.108: Diego Trujillo, With Robots: Cooking
Cooking robots have been promised for more then 60 years, ranging from Falks robotic toaster to the Jetsons' Rosie maid-bot.  How desirable is robot precision in the kitchen? The situation presented shows how meat has been precisely cut into cubes without leaving any cut marks on the chopping board. The board its self has notches to facilitate robot interaction.

Fig.109: Diego Trujillo, With Robots: Folding
Robot friendly bed sheets were designed in order to assist with a computationally demanding task. For the humans it means having a foreign symbol printed onto their bed sheet. In the background we see a small clock reading 4:19 suggesting the robot has been folding laundry for a very long time, even with the help of the tags.

Fig.110: Diego Trujillo, With Robots: Handling
Concentrating a bit more on how robots manipulate objects, a cup with a robot friendly handle was made. This object reveals a lot about the relationship between humans and robots, it creates a tension between the robotic and the human handle. The handle could become a design feature or it could be badly received, considered ugly and uncomfortable. The cupboard in which these cups rest has also been altered in order to accommodate the robot; not only are there tags marking the position of objects but the doors have been removed.

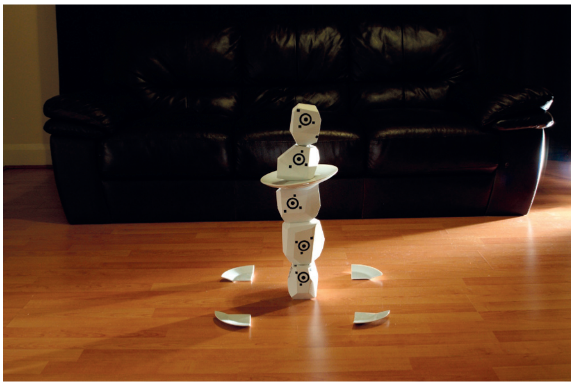


Fig.111: Diego Trujillo, With Robots: Learning
Every living space is different, not only in the architectural layout but also in the tasks that the tenants require the robots to do. For this reason robots ship only partially programmed so that through a learning algorithm they might adapt to the home they operate in. To accelerate the learning process special learning tools have been designed to help the robot integrate to a 3D environment. The picture on this page shows a living room after a robot self-training session. We can see it has now mastered the physics of equilibrium. It is also evident that it has mistaken one of the house's dinner plates that it has broken with robotic precision to complete its piece. This scene intends to show what it would feel like to have objects that are useful only to robots in our house.

Fig.112: Diego Trujillo, With Robots: Serving
Setting the table is another task robots might be doing, having everything ready for when the owner comes home. The plate does not require a "plate tag" printed on it, the tag has been replaced by a notch on the edge indicating that this object is a plate. The notch also doubles as a holding point; it makes us wonder on the shape of the tool the robot uses to manipulate this object. The edges of the table are marked telling the machine where the limits are. In the scene presented, the robot has made a mistake and placed the cutlery rotated by 90°.

**Project/question 3: How could robots adapt to the home?**

‘Experiments in Robot Sound’ by Mark McKeague

I chose this project for the simplicity of the original problem: how to alleviate the trauma of a (real-life) robo-phobic girlfriend faced with the possibility of living with robots. On further questioning it turned out that it was not simply robot forms and movement that the girlfriend in question was afraid of, but in particular mechanical noises and the creepy silence that would prevail when the robot was motionless, waiting for a command to move. The project explores the fundamental issues surrounding robot paradox #2 (see p.83), specifically the uncanny nature of automata conflicting with the comfort of the home.

It is unfortunate that there is no possibility to play video in a written document, as it is impossible to do justice to the simple effect of modifying the *expected* sounds made by a robot. By removing the original soundtrack from Honda’s promotional video for Asimo and replacing it with a selection of experimental alternatives, McKeague facilitates a focus on alternative acoustic experiences. The different effects vary from being simply humorous, such as ‘The Cat’ (the robot sounds like a cat) and ‘Involuntary Actions’ (the robot makes inappropriate human sounds), to a more subtle approach such as ‘Slippers’ (the robot makes its presence known discreetly). The project encourages us to look beyond the obvious when it comes to pre-empting the problematic issues that may arise from robot co-habitation. The ultimate output of this direction would be an extensive aesthetic database of possible interactions, exploring in a very efficient and accessible way the realities of living with robots.

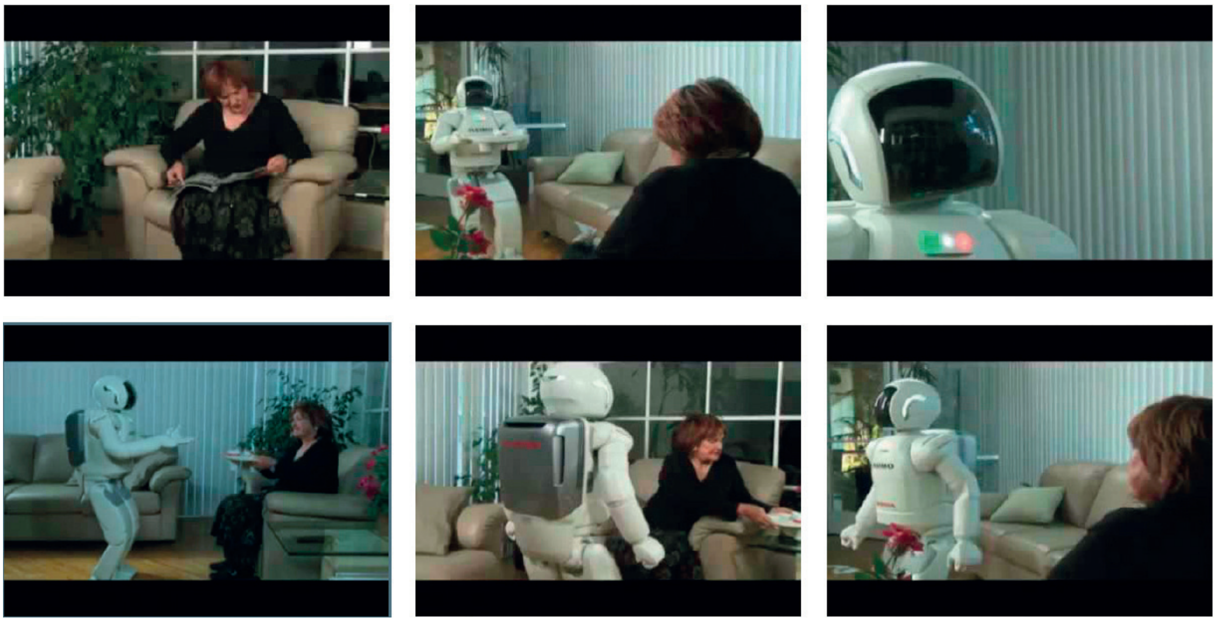


Fig.113: Mark McKeague, Experiments in Robot Sound, digital video, version 1: Buzzing.

**Project/question 4: The implications of domestic robots**

'When the Home Stops' by Joseph Popper

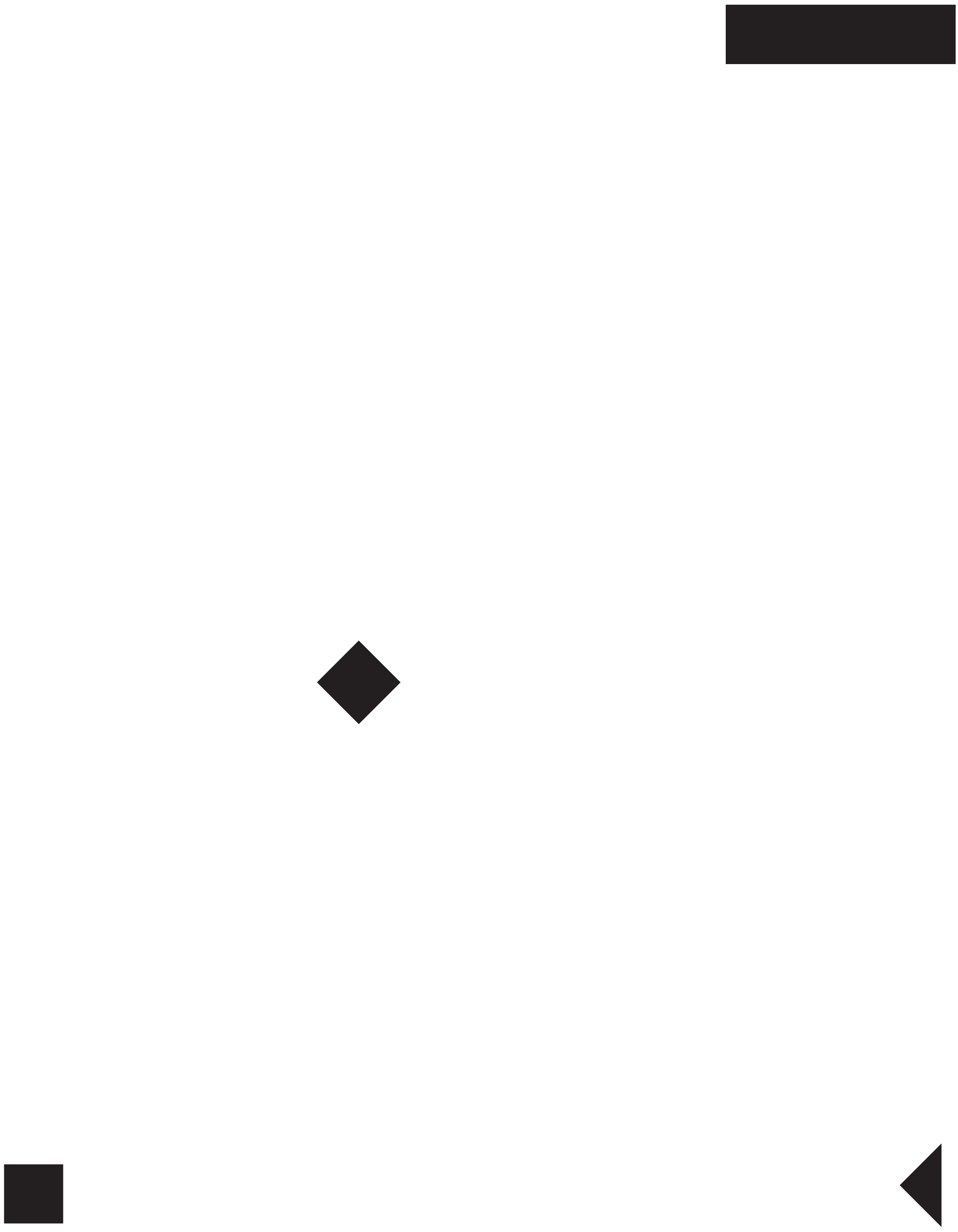
Here in the familiar setting of the home the protagonist has surrendered even the most sensitive and delicate tasks to a machine. Joseph Popper's automated home is the antithesis of Ray Bradbury's post-apocalyptic house featured in the short story 'There Will Come Soft Rains', (Bradbury, 2008). Here, rather than continuing to operate long after the departure of its human inhabitants, the automated system is failing and the human, now completely reliant on his machines, is left helpless and distraught. As Popper describes, the project explores what can happen if our trust and dependence on the domestic robot goes too far. When the Home Stops echoes the genuine pre-millennium fear we experienced in 1999 as countless reports described the potential catastrophic consequences of the breakdown of global computer systems. Here the breakdown is transferred into the traditional safe-haven of the home, creating a thought-provoking parody of automation and the dream of the smart home.

Fig.114: Joseph Popper, When the Home Stops, digital video, 1:50 min loop.

Fig.115: Joseph Popper, When the Home Stops, digital video, 1:50 min loop.

## Learning and observations

This project took place in the latter stages of the thesis, and as such I was able to distill the key design issues related to the domestication of robots into the brief. This allowed for the students to immediately begin exploring quite specific areas or issues. Prior to the project I had the opportunity to visit Intel's robotic research laboratory in Pittsburgh, US, and to meet with the scientists responsible for the development of the robots. The visit revealed quite an orthodox approach to the subject, such as projects exploring physical interactions between humans and robots combined with extremely complex and impressive functioning devices - the classic research habitat of the robot. Whilst the Design Interactions department could not compete with the technological knowledge and skills of Intel's research laboratories, the RCA project introduced to their team a speculative design approach, facilitating an accessible and imaginative examination into hopes, fears and possibilities for robot co-habitation.



# Conclusions

The basic enquiry running throughout this thesis has been into the possible journeys a technology may take, between its genesis and an existence in domestic life. Using the robot as a vehicle for the study, I described three variants of this journey: how technology *does, does not* and *could* become a product. I will break the conclusion down into two-parts: first, a summary of the current state of domestic robots, the likelihood of their entering our homes sometime soon and the potential implications of this. And second, a more general overview and critique of how technology is currently domesticated, why this is problematic and how speculative design can intervene is this process to offer a more considered approach to the technological future.

## On robots: A suggestion for further research

The robot turned out to be a deserving subject due to its unique place in both popular and research culture. Why, after so many years of unrealised promises, does the latest version still succeed in generating large media attention and captivating such a broad audience? To conclude, it would seem that whilst the robot has a clear *raison d'être* in the habitats of research laboratories, marketing and science fiction, its purpose in the home, both today and in the future, remains unclear. The issue is two-fold: first, for reasons described in chapter two, existence is problematic when directly placing the 'spectacular' robot into the home due to its maladaptation for that habitat; and second, when the emphasis shifts away from stereotypes towards more logical or plausible routes for robots, such as those described in Happylife, function potentially becomes dark and invasive or at least questionable. A glance at contemporary everyday life reveals the extent to which such forms of automation are becoming commonplace.[94] This cultural acceptance, combined with ongoing technological developments such as advances in the science of informatics,[95] ubiquitous computing[96]

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**94.** As noted in chapter two, half a century ago Gilbert Simondon critiqued the starter motor for adding unnecessary complexity to the mechanical function of the car engine. Today, advances in the field have led to the most average and everyday cars such as the Ford Focus boasting amongst other things: a driver alert that monitors driving behaviour, senses fatigue and then displays a warning icon suggesting the driver take a break; a lane departure warning applying gentle steering input should the driver stray; an active park assist, which checks first if there is enough space for the car then automatically steers it into the gap; and a low-speed safety system, automatically braking if the car in front unexpectedly stops. The family car represents the vanguard of automation in daily life. This progression can be seen in other products, from algorithms that influence the online browsing experience to smartphone automation apps such as Microsoft's on{X} or Android's Tasker.

**95.** For example, complex sensing technologies such as thermal imaging and gait analysis, algorithms, data mining and analysis, and artificial intelligence.

**96.** The term ubiquitous computing was first coined by Mark Weiser, a chief scientist at Xerox Parc, in 1988. It suggests that computers will recede into the background of everyday life: "It is invisible, everywhere computing that does not live on a personal device of any sort, but is in the woodwork everywhere." (Weiser, 1988).

and cloud computing,[97] leads to the likelihood that robotic technologies will become increasingly pervasive - robots will enter the home, but through the side-door as many existing products and environments are given agency and intelligence. The implications of this on domestic life, emotional interactions and human communication are profound. Happylife presented one example of this 'speculative future' but I suggest a pressing need for further and more expansive research into this subject.

## On speculative design: The considered future

In this thesis the robot is primarily a vehicle for the enquiry into speculative design and the domestication of technology. The more important conclusion therefore focuses on how this form of design can be used to examine both the impact of contemporary technology on our lives today, and how contemporary scientific research could impact on our future lives. In *The Whale and the Reactor*, the philosopher of technology Langdon Winner asks: "Why has a culture so firmly based upon countless sophisticated instruments, techniques, and systems remained so steadfast in its reluctance to examine its own foundations?" (Winner, 1986, p.5). In *Autonomous Technology* he goes further to suggest that as the "speed and extent of technological

97. The networking of products and services - for example, see Ericsson research project, 'Connections: you, me and 50 billion devices'.

innovation increase, societies face the distinct possibility of going adrift in a vast sea of unintended consequences." (Winner, 1977, p.89).

As many thinkers on the subject have noted, the heart of the problem lies with the notion of 'progress' briefly explored in chapter two (see p.59), and defined by the Oxford English Dictionary as: "Forward or onward movement towards a destination." Or "Development towards an improved or more advanced condition" (2005). This raises two fundamental questions: what is the *destination*?, and 'what is an *improved* condition? The main conclusion to this thesis is that we need to begin by first dismantling this misused notion of progress and its influence over how technology is domesticated, and then find more considered and democratic ways of deciding upon desirable destinations and conditions. I have described some of the practical methods and techniques[98] that have been developed for presenting plausible and engaging imaginaries of future destinations; these enable and encourage an audience to contemplate whether this specific future is *improved* or not.

A significant factor that emerged and evolved through the practical element of this thesis is collaboration between design and science. The early speculative design projects described here were based on simple interactions between these disciplines, such as

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98. Every speculative design project though is unique and the diversity of possible subjects, contexts, technologies, perspectives and audiences make a definitive 'how to' guide impossible. Complicating the situation further is the fact that new techniques are continually being developed and as the practice matures, old methods are becoming more sophisticated. The examples described here are therefore intended to present a more general attitude or approach towards the subject of speculation.

simply checking facts or gathering the basic scientific information on which to base a project. But as the methods and relationships have matured, the potential of a more refined collaboration has become apparent. Beginning with the Happylife project, the 'Impact!' exhibition and ongoing research proposals, a speculative design approach has demonstrated the benefits of shifting the design process upstream from where it normally operates. In this way its role expands beyond public engagement to engage and influence science itself, in turn influencing technological development at the beginning of the 'domestication' process. Here design has the potential to identify research directions that are 'orthogonal' to the original research aims and more closely related to everyday life. It invites, through dialogue, a reflection on the relationship between *possible* and *preferable* futures, and examines not only new applications for a technology but also its potential implications. Speculative design effectively introduces scientific research to the complexities and whims of human character, usually only found at the end stages of a successful technological journey, and providing a much more considered destination than the one we currently find ourselves heading towards.

# Appendix A

## Selected exhibitions

***New Energy in Art and Design:*** Van Boijmans Museum, Rotterdam, Netherlands , 15 October 2011 – 26 February 2012

***What If:*** National Museum of China, Beijing, 28 September – 17 October 2011

***Transnatural:*** Amsterdam, Netherlands , 4 March – 1 April 2011

***Tech Fest:*** Mumbai, India, 7 – 9 January 2011

***Freak Show:*** Berlin, Germany, 13 November 2010 – 8 January 2011

***AND Festival:*** Manchester, England, 1 - 31 October 2010

***Lift10:*** Geneva, Switzerland, May 2010

***What Happens If…?:*** Lancaster, England , 30 January – 3 April 2010

***Transmedial:*** Berlin, Germany , 2 – 7 February 2010

***What If:*** Trinity Science Gallery, Dublin , Ireland, 8 October – 13 December 2009

***Touch Me Festival 2008:*** Zagreb , Croatia, 19 – 23 December 2008

***Nowhere/Now/Here:*** Laboral, Gijon, Spain, 9 October 2008 – 20 April 2009

***Crossing Over:*** Royal Institution, London , England, 2 – 21 October 2008

## Selected conference presentations

***Human Design or Evolution:*** Aalto University, Helsinki, Finland, 30 January 2012

***Robots that care:*** Kolding, Denmark (keynote), 14 September 2011

***Making Future Design:*** Derby, England (keynote), 10 June 2011

***Robolift:*** Lyon, France, 23 – 25 March 2011

***Transnatural:*** Amsterdam, Netherlands, 12 March 2011

Five-city presentation tour of India (sponsored by the British Council), 6 January: National Institute of Design, Ahmedabad; 8 January: ITT Mumbai ; 10 January: ITT Kharagpur ; 12 January: ITT Madras ; 13 January: British Council event, Pune

***Swiss Design Network:*** Negotiating Futures: Basel, Switzerland (keynote) 29 – 30 October 2010

***DAP 2010:*** Devices that alter perception: Seoul, Korea (keynote) , 13 October 2010

***EASST Conference:*** Practicing Science and Technology: Trento, Italy, 3rd September 2010

***Critical Minds: critical spaces:*** University College London, England, 8 May 2010

***The Objects Of Design And Social Science:*** Goldsmiths College, London, England, 18 November 2009

What If : Trinity College, Dublin, Ireland, October 2009

***Experimenta 09:*** Panel Discussion: State of Design: Lisbon, Portugal, 10 September 2009

***Lift 09 conference:*** Where did the future go?: Geneva, Switzerland, February 2009

***Smart Space:*** Aarhus, Denmark, December 2008

***London Calling:*** Designtransfer: Universität der Künste, Berlin, November 2008

***V&A Thinktank***: The Future Object . Victoria and Albert Museum, London, England, September 2008

# Appendix B: Briefs and workshops

## Full brief of RCA student project

In a recent essay for *Scientific American* (2007), Bill Gates drew an analogy between the emergent computer industry in mid-1970s and the state of the robotics industry today, coming to the conclusion that there will soon be a robot in every home. This is a prediction, though, that has been echoing around for over 70 years.

The question remains, what will these robots do in the home? Many proposed robots focus on complex engineering problems and choreographed stage demonstrations, ignoring the complex rules of the domestic landscape.

By making a taxonomic shift to view the robot as a product rather than a technology, it becomes exposed to a whole different set of rules and expectations than those that currently inform and direct robot development. This contextual shift - from the screen and laboratory to the domestic and the everyday introduces new ways of thinking about robots, our relationships and interactions with them and their meaning not as visions, props or demos but as real things in our homes:

1. What would robots do in the home? Robotics engineers rarely answer this fundamental question with tangible propositions. Bear in mind the strengths of robots but also their weaknesses.

2. How could we/the home adapt to robot needs? We shape elements of the home to the special needs of pets, but how might a home designed for people *and* robots look?

3. How could robots adapt to the home?

Social roboticists explore human/machine interaction but rarely address where that interaction takes place. Methods of interaction are then mostly based on the robot adopting human techniques.

The purpose of an interaction defines its nature. What would be a more appropriate method of communicating with domestic robots?

4. How can we begin to understand the ethical implications of bringing robots into the home? Ethical issues are being hotly debated in the field of military robots, but in the home robot ethics have been neglected. What would it mean, for example, to delegate care-giving tasks to a machine?

Defining the word ‘robot’ is a challenge. For the purposes of this project we will use the broadest meaning possible:

1. It can sense its environment.

2. It can compute decisions based on this sensory information.

3. It can act on these decisions (for example, through mechanical or electronic means).

Note: the form of the robot is completely open to interpretation.

## To Design:

Begin by choosing one subject from above.

The goal here is to design a domestic robot, to rethink the robot based on: complex human needs and desires; the rules of the domestic space; and the strengths of robot technologies. Don't get distracted by stereotypes as they often ignore these points.

## Musashino Art University (MAU), Tokyo, Japan

In May 2012 I was invited to be visiting professor at MAU. I ran a one-week workshop based on the robot paradox #1: *Sublimity and temporality* (see p.73).

Defining the word 'robot' is a challenge. For the purposes of this project we will use the broadest meaning possible:

1. It can sense its environment.
2. It can compute decisions based on this sensory information.
3. It can act on these decisions (for example, through mechanical or electronic means).

This technical definition, however, fails to address the spectacular element culturally and historically associated with robots. To the above definition, then, we add the following:

4. The complexity or sublimity of either the sensing, computing or mechanics should elevate the status of robotic object above that normally ascribed to machines or products.

This leads to the paradox: a spectacular robot can only ever exist for a short time, the reason being that the sublime, in terms of robotic behaviour, cannot endure.

This *normalising* of technology has been experienced by some people who bought Sony's robotic dog, AIBO, as the BBC's technology journalist Jon Wurtzel reports after living with the robot for a short time.

"What became increasingly clear is the power and importance of the emotional relationship with this robot dog. When I tried to develop a relationship with him, I felt let down. I stopped referring to him solely as a he, and started referring to him as the robot. This deflation felt even more acute because he had so successfully generated emotional cues and responses with me. He had seemingly promised me a canine relationship, and then failed to deliver. As art, AIBO is a tremendous success. He makes a great interactive sculpture, and is fun and impressive to watch. But, as a pet dog, AIBO fell down." (2001)

This problem arises when roboticists attempt to directly replicate the behaviour of pets: the robots ultimately fall victim to the limits of their own programming. The same traits that make them perfectly adapted to production lines render them ephemeral in a cultural or emotive role. Automation reduces randomness, in turn increasing predictability: repetition leads to familiarity, which in turn leads to apathy. The robot ceases to be a robot and is demoted to mere product.

## To Design:

A companion or entertainment robot.

Consider the factors that make real animals so successful in these roles.

Find new ways to introduce randomness *[or]* unpredictability *[or]* entertainment *[or]* reliance.

Think about relationships between living things and products where interaction enhances or creates a spectacle.

Present your robot as either:

A prototype. This doesn't need to be fully functioning. Just communicate the concept.

A video. Showing or describing how it would work.

An animation, storyboard or illustrations.

Or other ways you wish to tell a story – be creative.

## Timetable:

Day 1: Launch brief, presentation by James Auger describing project. Begin brainstorming in groups.

Day 2: Ongoing research leading towards possible design directions. Sketching ideas.

Day 3: Split into groups for interim crit and discussions.

Day 4: Design development and presentation preparation.

Day 5: Final crit and party.

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