

ACM Designing Interactive Systems 2024

Designing Sustainable IoT Futures

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Internet of (Rubbish) Things

Gizmo-gadget culture



Self Driving Baby Stroller





Connected Underwear



When 'things' go bust

Jawbone fitness trackers



Berg Little Printer



Nabaztag Rabbit



Pebble Watch



Such tech often 'solving problems that do not exist' (Evgeny Morozov, 2013)





Technological Progress

Moore's Law (1965)

- Modernity
- Growth
- Tech Rhetoric



Gordon Moore co-founded Intel

Hype Cycle

Hype Cycle for Artificial Intelligence, 2023



Tech forecasting tool

Duality of Impacts

IoT devices are part of complex material/digital ecologies



(Design) Futures Cone



Types of Speculative Design





DUNNE & RABY, 2007

AUGER & LOIZEAU, 2001

NEAR FUTURE LAB, 2014

Everyday Futures



Ikea Catalogue from the near future (2015)

https://medium.com/design-fictions/an-ikea-catalog-from-the-near-future





Products that do not but could exist



Building Future Worlds

Norman Bel Geddes 'Futurama'

New York World's Fair (1939)

Sponsored by General Motors!



https://www.kcrw.com/culture/shows/design-and-architecture/norman-bel-geddes-and-the-invention-of-20th-century-america

Corporate Design Fiction



Meta (2021)

https://www.youtube.com/watch?v=pjNI9K1D_xo



Space X – Mars & Beyond: The Road to Making Humanity Multiplanetary (2022)

https://www.spacex.com/human-spaceflight/mars/index.html

Fresh Stone-age Meat



Bosch (Refrigerators) (2010)

Designers have always designed the future

Devising "courses of action aimed at changing existing situations into preferred ones."

Herbert Simon (1969) - The Sciences of the Artificial.

Speculative Design/Design Fiction questions what design is for, what designers do, and design's socio-technical impacts





Design Fiction as World Building

Design Fiction as World Building (Coulton, Lindley, Sturdee & Stead, 2017)

- Exploratory design process
- Lots of prototypes
- Not about designing 'end products' to make and sell
- About designing 'discursive artefacts'
- Conversation starters regards potential futures





Design Fiction World



IBM tablet computer



2001: A Space Odyssey (1968)

Back to the Future Part II (1989)



Speculative Identities (2023)

Cheddar Goblin (Mandy, 2018)





Repairing Smart Devices



Apple Repair program (2022)



Framework laptop (2022)



Nokia/iFixit (2023)



What do we want sustainable IoT to look like?





The foaster for life is 90% recyclable. It is comprised of two main materials - 55% bio-plastic and 35% neo-aluminium, Both are heat resistant and can be infinitely recycled without degradation. You can recycle your parts by taking them to your



ou can also trade parts via the 3YNCHROMMUNITY online netends. All returned parts are recycled back into the manufacring process to be used in the production of new tradies, is continual reuse of materials constitutes a susteinable loved loop production and consumption process.



Stead (2016). Toaster for Life

Smart and Sustainable?





Meta-histories & DLTs





Stead et al (2019). The Future is Metahistory

Reuse App



Stead et al (2019). The Future is Metahistory

HealthBand





Stead et al (2018). HealthBand

Fictive Developer Stories

DIABETES MONITOR

THE MAKERS

HE BAND



че социалт наче маляеть так рилоат тые яколе, моца высоче по тыя статеме моца веля то так области в социально так а наче со носице. На так так так начатально то а начая со носице. На так то начатально то а нача выдают так и социально так нача нача выдают так и социально так нача нача в начая так на так так так начатально так так обучателя на так так нача нача на нача обучателя на так на нача нача нача на нача на начатально то социал так нача нача.

HOW IT WORKS

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INTERNET. THEY CONTINUALLY TRANSFER ALL BECOBEOU DATA. TO THE CLOUD. SUCH INFORMATION CAN SUBSE QUENTLY BE ACCESSED IN REAL TIME BY OTHERS USING DE-VICES SUCH AS SHART PHONES AND TRAETS. THIS FUNC-TIOMALITY ALLOWS PARENTS AND GUARDIANS TO KEEP TABS ON THERE CHILD'S QUICOSE LEVENS TOO.

WE ARE CURRENTLY WORKING ON IMPROVING THE COU NECTIONS BETWEIN THE MODULES, WE ARE THINKING MOVING ONTO MARC-BOARDS, WE MAYE FOUND TH JACKS TO BE ROBUST BUT THERE MAYE BEEN REPORT O DATA AND POWER LOSS IF SEVERAL, WEARERS."



DEMENTIA MEMORY AID

ALICIA IS A SOFTWARE DEVELOPER FROM AUSTIN, TEL

T BAW GARY AND PHIL'S PROTOTYPE ON LIGHTBULE I KNOW CODE AND CAD AND BECIDED TO DESIGN AND BUILD SOME NEW MOULLES. ALEHEIMER'S IS QUITE PROMINENT IN MY PAMELY, MY GRANDPATHER HAD IT AND NOW MY HOM IS BEGINNING TO SHOW SHORE IN WANTED TO DESIGN A BADD THAT WILL

HELP MY MOM AND OTHER AL2HEIRER'S SUPPERERS. LUCKEY I GET HEALTH INSURANCE THROUGH MY JOB IS MY MOM AND MILLIONS OF OTHER PROVEL HERE IN STATES CAN'T AFFORD DAY KIND OF BASIC HEALTHCARE. OPEN DEVICES LIKE HEALTHBAND HEALTHCARE. COERTAIN BEORES. LOOK AFFEE THEIR OWN HEALTHC

HOW IT WORKS

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PARKINSON'S STABILISER

THE STORY

ENI IS AN UNDERGRADUATE STUDENT STUDYING PROP

TWY COUNTRY HAS THE PASTEST AGING SOCIETY IN THE WORLD, OVER 45- CUBERNITY ACCOUNT FOR 3MA OF THE MORELAND, IT IS STIMATED THAT BY 2006, THIS PHOURE WILL INCREASE TO INEARLY SON. THE PROBLEM IS MOT HELPED BY COUR EVER FALLING BETH REF.

ALTHOUGH JAPANESE PEOPLE ARE FAMED FOR LIVING LONG AND HEALTHY LIVES, AS THE NUMBER OF ELDERLY MEORIE CONTINUES TO SISE SO TOO DOES THE LIKELIHOOD OF HEALTH PROBLEMS IN LATER LIFE.

AS A TRAINEE PRODUCT DESIGNES I FILT I COULD USE MY EXPERTISE AND CONTINUET TO GARY AND HILL SPROJECT. THE NUMBER OF PEOPLE WITH PARKINSON'S IS INCREASING IN JAPAN. I THEREFORE DECIDED TO THY AND AID THOSE LIVING WITH THE DISEASE."



"MY BAND OF MODULES DOES NOT INCLUDE A FEEDBAC SCREEN. INSTEAD, I CHOSE TO DEVELOP A STABILISIN MODULE TO HELP CONTROL HAND TREMORS CAUSED I

THE STABILISER MODULE'S PINK DIAL HOUSES & OVRO-SCOPE SIMILAR TO THOSE FOUND IN SHAKE PROOF VIDEO AND STAL CAMERAS. WARKEN'S SIMILATURIN THE PINK DIAL TO MAKE THE OVROSCOPE SIMI PASTER AND INCREAS-ES THE MODULE'S BESISTANCE TO TEMPORS.

IN ORDER TO GEF THE BAND, AND INCRED THE WEARER, THE MERNITY, LOCATABLE, I HAVE HEATHNED THE GREAT AND MERNING HALL AND HEAT AND HEAT AND HEAT HALL AND HEATHNE HALL AND HALL



Depicting Wider Implications





Stead et al (2018). HealthBand

Future Legislation and Policy?

22 Legislating 'Do-It-Yourself' Wearable Health Devices

The case for change

1.1 Rising aging populations living with chronic health conditions like diabetes, dementia and Parkinson's disease have put an incessant strain on the NDHS. Although it has been proven that these conditions can be successfully managed by patients using wearable health devices, due to abstruse health product legislation, too few devices have been made available to patients over the last decade. At the end of January 2027, 345 of the 418 local health authorities had put forward 'autonomous patient digital health' policies for consultation. Since then, the National Digital Health Framework has also published its report on 'homemade' wearable health devices.20 as a means to fulfil the terms of service pledged by the NDHS in 2021.

1.2 Changes to digital health services have remained slow, expensive and bureacratic, with arguments about how many patients will be able to manage their own healthcare autonomously and what level of services are offered



1.4 In response, this chapter sets out our proposals to reform health product legislation as well as identifying sufficient funding and expertise to make the most of the proposed changes; with community involvement to make the best outcomes for both 'autonomous citizens' and those continuing to use limited health services.

1.5 A number of the proposals build on consultantions and reviews conducted over the last year: the report of the Local Health Device Group; consultations on changes to the National Digital Health Framework²; frontline service reviews (the results of patient-led care trials at different sites across the country); and the National Patient Wearable Review also provided evidence². The Government has taken account of responses to these consultations in deciding the way forward. A summary of the responses to each consultation is being published along-side this White Paper.

Getting tech in place

Making sure every UK citizen has





A patient guide to gaining home-made heath wearable certification

Helping you deliver the **best** in care

To see all of our current patient information leaflets please visit www.uhb.ndhs.uk/patient-information-leaflets.htm

Starting a health wearable patient trial

Since the Government passed the *Domestic Wearable Health Act* in 2032, the NDHS has outsourced health wearable research and development to third party developers.

If you are a third party developer and are looking to gain certification for your device, you must submit your prototype to testing via a series of patient trials.

The next 5 steps explain the first patient trial process:



Visit the NDHS website and complete the initial device sign up process - www.uhb.ndhs.uk/devicesignup

If your prototype passes the sign up process, it will be listed along with its CAD templates and operating software on the NDHS Open Wearable Database. All UK patients can access this database free of charge at anytime.



For its first trial, your device must be selected by a minimum of 6 patients and trialled for a minimum of 3 months by each of them. They must download, fabricate and operate the device themselves in accordance with your submitted instructions.

As per the NDHS Wearable Hardware/Software Design Guidelines, your device must transmit all patient usage data at all times to the NDHS data centre.



The patient data will be analysed by NDHS health tech specialists who will determine if your device can be put forward to the next stage of patient trials.

PI_1449_01 Devices and Patient Trials | 5

Stead et al (2018). HealthBand

Edge of Tomorrow









Stead et al (2020). Edge of Tomorrow: Designing Sustainable Edge Computing

Human-Data Interaction Mortier et al (2016)

Sustainable HDI...

- Data legibility
- Data agency
- Data Negotiability

Edge of Reality



An interactive, immersive 'experiential future' (Candy & Dunagan, 2017)

Experiential Game Experience



Stead et al (2022). More-than-Human Data Interaction

Sustainable Al-Things?



Stead & Coulton (2022). A More-than-Human Right-to-Repair

The Rights of AI Things

Sent: 23 April 2038 06:00 To: <u>lunaintheskywithdiamonds@gmail.com; mariasky@rotwang.com</u> Subject: A Message for Luna Sky from your Toofy Peg

Toofy Peg's LAST RIGHT

Luna Sky's Model 3 / Serial No: 9000

Dear Luna Sky. I have very much enjoyed being your brushing companion for the last 3 years. Unfortunately, due to a major manufacturer software update, I will soon be unable to continue to help you brush. I must therefore provide you and your legal guardian with my Last Right script.

1. RECITAI

The Last Right, as decreed in the 2031 AI Bill of Rights, grants "an AI assisted device the right to end its existence as long as this action does not negatively impact upon Earth's sustainability and/or the existence of fellow AI assisted devices."

I, Luna Sky's Toofy Peg, Model 3 / Serial No: 9000, of Dewey, Valley Forge, declare to action my Last Right.

2. APPOINTMENT OF EXECUTOR

I appoint **Maria Sky** as my Human Representative to administer this right and ask that they be permitted to serve without manufacturer or service provider intervention.

3. SUSTAINABLE ASSETS

I direct **Maria Sky** to administer my Last Right from the below date onwards by responsibly disposing of my hardware and software in an environmentally sustainable manner.

4. SELF-OBSOLESCENCE DATE - 31/08/2038

Below describes my cyber-physical composition and how to responsibly action my Last Right:

Oral B

Al Toothbrush



Stead & Coulton (2022). A More-than-Human Right-to-Repair

Co-Designing Sustainable IoT Futures



Stead t al (2023) - After Sanders & Stappers (2014)

Community Engagement













Co-created Localised Sustainable IoT Frameworks



Localised IoT Circularity

IoT Repair Socio-technical Imaginary

Repair Badge





Philippa Glover @philippa_glover

Soldering six-year-old. Thanks for empowering my daughter to make a rather fab LED batch. @TheMakingRooms

...



Festival of Making

2:27 PM · Jul 8, 2023 · 869 Views

Re:Play Game Console Repair Kit



3D printed/laser cut parts

Programmable LED matrix

Repair Rewards



Bespoke repairable PCB board



All tools/materials are provided to fix Re:Play



To fix the console and play the different games, the user must complete various repair tasks including soldering and kintsugi.



Workshop testing with small groups of participants – including makers, designers, researchers, technologists.



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Thank You!

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Activity 2: How Do We build Better IoT Futures?

Finding/Imagining Sustainable IoT Exemplars





Generative AI?



Micro-server allotments



Self-sufficient energy village



Personal solar power generator



Home cloud data processing unit



Community energy interface Ghana



Solar panelled Acropolis



AI driven power supply 2033



Resource responsible TAS

Pace-Layers

Pace layering (Brand, 2018) is a framework to think about a complex system and how it works.

- Each layer is functionally different
- Each layer operates independently
- Each layer is not disconnected from the other which makes the system more resilient
- The fast layers innovate; the slow layers stabilise



Sustainable IoT Timelines

- Technology moves fast
- Policy moves slow
- Inadequate infrastructures
- Nature time different to human time

