Design Specks
Connecting People with Speckled Computing

Edited by
DK Arvind
and Polly Duplock

The Centre for Speckled Computing
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Acknowledgements

Such a collaborative project naturally involved the willingness, commitment and support of numerous people. Many of these are prominent in the pages of this book; some of the others are listed here.

THE PROJECT
The Centre for Design Informatics at The University of Edinburgh, and particularly Alan Murray, Prof Jon Oberlander and Prof Chris Speed, for their commitment and financial backing of the project.

Prof Irene McAra McWilliam at Glasgow School of Art (GSA), Prof Tom Inns at Duncan of Jordanstone College of Art and Design at the University of Dundee (DJCAD), and Prof Paul Harris at Gray’s School of Art at Robert Gordon University, Aberdeen (Gray’s School of Art) for contributing to the initial discussions around making the project happen.

Andrew Bates and Janek Mann at The Centre for Speckled Computing for their technical and programming support. Charmaine Leitch at The Centre for Speckled Computing for keeping everyone organised and up-to-date throughout the project.

The numerous academic and technical staff, at the four art colleges, who were involved in both setting up and facilitating the workshops as well as giving inspiring talks.

THE BOOK
Victoria Hale at Project Stuff for her energy, organisational skills and aesthetic judgement in pulling together the book. The photographer Malcolm Finnie (DJCAD) for his numerous road trips to capture images of the products in development, final product shots and portraits. Dr Andrew Cook and Graham Pullin (DJCAD) who acted as font gurus and for their guidance on layouts. Kathleen Brown at Triwords for her attention to detail and her patience in copyediting. Jane Macdonald, the Research Projects Coordinator at Design Informatics, for her support in the final stages of the book.

THE EXHIBITION
Mark Daniels at Inspace for hosting and curating the final exhibition of the projects.
Design Specks was conceived as an experiment in bringing together design students and computer scientists working in tandem to design with the data and computation enabled by Speckled Computing. The idea was to nurture a hybrid approach to Speckled Computing, combining product design with data and computation, and realising physical, functioning prototypes using Specks. This book describes the design process and is a practical demonstration of, and reflection on, this approach.

The proposal for Design Specks was first presented to the Research Group of the Centre for Design Informatics at The University of Edinburgh, chaired by Prof Jon Oberlander, in February 2012. We next approached the Heads of School at four Scottish institutions – Alan Murray at Edinburgh College of Art at The University of Edinburgh (ECA), Prof Irene McAra McWilliam at Glasgow School of Art (GSA), Prof Tom Inns at Duncan of Jordanstone College of Art and Design at the University of Dundee (DJCAD), and Prof Paul Harris at Gray's School of Art at Robert Gordon University, Aberdeen (Gray's School of Art). The proposal was enthusiastically received and they gave us their encouragement and full support.

Three preparatory meetings were held in April, June and August 2012 attended by lead academics from the four design schools – Arno Verhoeven (ECA), Mil Stricevic (GSA), Polly Duplock (DJCAD) and Sue Fairburn (Gray's School of Art) – Prof Jon Oberlander (Centre for Design Informatics) and chaired by Prof DK Arvind (The Centre for Speckled Computing). The discussions helped us align the aims, structure, themes and timings of four workshops held during the academic year 2012–13 and the final exhibition in June 2013.

The success of Design Specks is to a large measure due to the ownership taken by the four leads in setting the agenda and the tone of their respective workshops, and their collegiate style of working together. The students were inspired and rose to the challenge enthusiastically. Researchers Andrew Bates and Janek Mann at the The Centre for Speckled Computing were appointed in September 2012 and designed new Speck hardware and programmed applications to translate the design concepts into functional prototypes.

Design Specks was ultimately made possible thanks to the generous financial contributions from the Centre for Design Informatics at The University of Edinburgh. Design Specks was conceived in a moment of madness but they had the vision to see its potential and back the venture.
INTRODUCTION
Designing for a particular technology is not easy, even for the seasoned designer. Do you focus on the potential of the technology at the outset? Or put it to the back of your mind and first consider the people you are interested in designing for? Or is there an approach somewhere between these two extremes? You will find as you delve into this book that the different students working on Design Specks have adopted all of these strategies. I run a programme at the University of Dundee entitled ‘Social Digital’ where the underlying thread running through everything we do is that students should be thinking about people, digital technology and design together, most of the time. So I have a pretty good understanding of how technology and design can come together – but what Design Specks has taught me is that there are further nuances to the challenge of meaningfully designing with technology.

*Design Specks: Connecting People with Speckled Computing* documents a year-long project between technology and design initiated by Prof DK Arvind at The Centre for Speckled Computing, part of the School of Informatics at The University of Edinburgh.

Researchers from the Centre have collaborated with students from the four main art colleges in Scotland: ECA, GSA, DJCAD and Gray’s School of Art. The year-long collaboration was framed by a series of four two-day workshops hosted by each of the participating art colleges.

Design students were given a brief that included exploiting Speckled Computing within a design. The dominant design discipline involved in *Design Specks* has been product design, though students from the disciplines of textile design, visual communication and jewellery have also been involved. Each art college has had a lead academic member of staff associated with *Design Specks* who has been involved in the planning of the project and workshops as well as mentoring the students through their design processes. Bringing together four art colleges has highlighted that design comes in many flavours and the diversity of student project outcomes are testament to this.
TOWARDS ‘SOFT MACHINES’ AND FUTURE WAYS OF LIVING

PROF DK ARVIND
AND PROF RAYMOND OLIVER
Specks provide three main functions: the means to sense the real world, the computational power to process this data and extract information, and the wireless connectivity to share this information and act on decisions.

Your task is to examine situations in everyday life and to discover concerns, needs and opportunities that could benefit from Speckled Computing technology.

You should imagine solutions that improve the situation, and should define your concept through dialogue with relevant stakeholders.

You should rigorously question the functionality of the products or services that you develop, keeping in mind the affordances of the technology.

You should deliver your design as a functioning prototype in collaboration with researchers at The Centre for Speckled Computing.

‘As technology merges into our walls, floors and clothes, then we no longer “consume” technology, but live with it side-by-side as it supports and facilitates our daily living, an invisible helper at the ready.’

Josephine Green

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THE TECHNOLOGY

PROF DK ARVIND
The term Speckled Computing was coined in 2002. It imagined a world in which tiny devices (Specks) on the person and in the environment could sense and extract information. Specks would process this sensed data in situ, which could then be shared wirelessly with other Specks and the rest of the Internet, for collaborative action. Speckled Computing links the real world of sensory data with the virtual world of digital information, and affords new modes of tangible interactions in which the physical world is the primary site of interaction.

The RESpeck and Prospeckz-6 are examples of Speck devices which have been used to realise, as functioning artefacts, the design concepts developed during the Design Specks project. Both these devices share the same processor (Cortex-M3 from ARM Ltd) and two radios: a low energy Bluetooth 4.0 radio for communication with the Internet via a phone, tablet or a PC; and a proprietary 2.4GHz radio for wireless networking between a number of Speck devices, which consumes even lower energy than the Bluetooth radio. The similarity ends there as the two Speck devices have been designed with quite different purposes in mind.
The Prospeckz-6 contains a number of sensors (3-axis accelerometer and magnetometer, and temperature sensor) with four general-purpose input-output ports for connecting additional sensors, and provision of high current channels for external actuators such as motors and solenoids, and specialised amplifiers and digital-to-analogue converters for driving external speakers. Although the RESpeck has the accelerometer and temperature sensor in common, the only actuation it can perform is to turn on a light emitting diode (LED). It has none of the switches or USB ports for serial communication and for charging the batteries that the Prospeckz has. These two Speck devices are a study in contrast: one burgeoning with sensors and actuators and profligate in its power consumption to require a rechargeable battery, whereas the other frugal in its design, which can run for months on a primary cell, quietly sensing, processing and storing data in its generous 16Mb of Flash memory, and occasionally flashing its LED.
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The Workshops - Overview
Polly Duplock

One of the cornerstones to Design Specks has been four workshops spread across the nine-month design challenge. One workshop has been hosted by each of the participating art schools as summarised below:

1. ECA: 11th and 12th October 2012
2. GSA: 29th and 30th November 2012
3. DJCAD: 23rd and 24th January 2013
4. Gray’s School of Art: 6th and 7th March 2013

These two-day events acted as an opportunity for both students and staff to meet, share ideas and working methods and, most importantly, develop the projects.

The overall structure of the four workshops was set around the Design Council’s ‘Double Diamond’ model where the design process is ‘divided into four distinct phases, Discover, Define, Develop and Deliver’, and ‘maps how the design process passes from points where thinking and possibilities are as broad as possible to situations where they are deliberately narrowed down and focused precisely on distinct objectives’. The process is further described below.

The staff who organised each workshop took these descriptions as starting points and then developed a bespoke programme of activity across two days. These workshops were high energy, intense experiences crammed full of activities, which ran into the evening and involved thinking, talking, playing, working and eating together. They served as great opportunities for participants to single-mindedly focus on Design Specks.

* http://www.designcouncil.org.uk/about-design/what-design-is-and-why-it-matters
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1. TELL US A LITTLE BIT ABOUT YOUR BACKGROUND.

I studied for an undergraduate degree in Furniture Design in China at the College of Furniture and Industrial Design, Nanjing Forestry University. The course focuses on materials, particularly wooden materials and craftsmanship. I mainly designed new Chinese furniture, which referenced our cultural history. So working with technology this year on Design Specks has been totally new.
1. TELL US A LITTLE BIT ABOUT YOUR BACKGROUND.

Hannah: I grew up in Glasgow and enjoyed a range of subjects at school, so when I left I wasn’t sure what direction to take. I chose to study civil engineering with architecture, taught jointly between the University of Glasgow and GSA. I found that I far preferred the design projects and the environment at GSA. So I took another year out and did a portfolio course to apply for Product Design at GSA.

Ole: I grew up in Norway, in a small fishing town on the south coast. I studied arts and crafts in secondary school and after graduating spent two years working for a pro-bono missionary organisation in Norway involving shorter stays in India and South Africa. I then moved to Oslo and worked for a year in a street café for drug addicts. This experience meant that I really wanted to work both with people and design and that led me to Product Design at GSA.

2. WHAT SKILLS DO YOU FEEL YOU BROUGHT TO THE DESIGN SPECKS PROJECT FROM YOUR CURRENT STUDIES?

I think our experience at GSA meant that we were not afraid to be very explorative with ideas. We also tried hard throughout the design process to focus on finding opportunities based on user research rather than designing from the technology.

3. WHAT IS YOUR PRODUCT CALLED AND CAN YOU EXPLAIN IN ONE SENTENCE WHAT IT DOES?

Our product is called ‘Light Support’ and it aims to extend the support experienced within eating disorder help groups into the homes of the sufferers.
Josefine: I am from Chemnitz in Germany. After graduating from secondary school I took a gap year and travelled to five different countries around the world. Subsequently I worked as a nanny in London for a while. My interest in working with people and my passion for art led me to apply to Product Design at GSA. I was really happy when I got in, as I think GSA has a different perspective on Product Design compared to many other schools. Now I have decided to study ‘Synth Ensemble’, left and right

A central audio hub – somewhere between a radio, synthesiser and mixing desk – brings together user-generated audio streams from the various members of each network and outputs these via a number of individual speakers. One per person, the aesthetic characteristic of each speaker is designed to visually represent the person to whom it is attributed, and can be moved from place to place within the home so that the user can arrange, tune and edit the sound of their chosen ‘sound company’.

These abstract sounds might be listened to in isolation or played simultaneously to create an immersive, sonic symphony whose nature and quality will, by the nature of their ‘real-time’ composition, never be the same twice.
1. TELL US A LITTLE BIT ABOUT YOUR BACKGROUND.
Rebecca: I’m from Inverurie and I came straight from school onto the General Foundation course at Duncan of Jordanstone College of Art and Design. I originally wanted to do Graphic Design, which turned into Illustration, which finally became Textile Design. I’m particularly interested in printed textiles and there is a strong illustrative thread that runs through all my work.

James: I’m from Linlithgow and left school to do Architectural Engineering at the University of Strathclyde. I dropped out a month later as I hated it and worked in IT for a year, until I decided what I wanted to do. I came to the DJCAD open day and realised I wanted to study Product Design.

2. WHAT SKILLS DO YOU FEEL YOU BROUGHT TO THE DESIGN SPECKS PROJECT FROM YOUR CURRENT STUDIES?
Rebecca: I design for interiors and this way of thinking is well suited to this project.

James: Our understanding of the iterative process of prototyping and having a good working knowledge of different materials.

3. WHAT IS YOUR PRODUCT CALLED AND CAN YOU EXPLAIN IN ONE SENTENCE WHAT IT DOES?
Our product is called ‘Tea?’ and is a tea set that creates a subtle invitation for people within a house to join each other for a chat.

4. WHAT WAS THE BACKGROUND TO YOUR CONCEPT?
We focused on the kitchen, which tied in with DJCAD’s overall theme of ‘Everyday Rituals’ in the home. We interviewed seven people within their kitchens and asked them how they used it as a social space. We also asked people to take photos of a favourite object in their kitchen and send them to a hashtag. Of the twelve responses eleven were either a coffee machine or tea-making equipment. From this we started to do a
REFLECTIONS

POLLY DUPLOCK, SUE FAIRBURN, MIL STRICEVIC AND ARNO VERHOEVEN
The students, left to right
Hannah Smith
Ole Tørresen
Josefine Leonhardt
Robert Kaysen
Peter Eastwood
Sean McHarg
Mil Stricevic
Lecturer, BDes/MEDes Product Design,
GSA

Mil Stricevic trained in product design following a career in the music business and holds an MA from the Royal College of Art in London where he studied under Ron Arad, Tony Dunne and Durrell Bishop. In his part-time position at GSA, Mil runs the core programme with colleague Elio Caccavale, delivers brand experience projects to third year students and teaches across all final year projects for the fourth and fifth years. His professional résumé includes brand strategy, experience and new product development for an international clientele across the commercial, cultural and civic sectors. His work has been worn on the feet of Italian footballers, drunk across the USA, featured as a question on ‘University Challenge’ and spent time in prison!

An approved supplier of ‘surprise and delight’ to the National Trust, Mil is a founding partner in Buro Design Thinking and, within the Design Innovation Studio at GSA, has recently been working with a diverse range of Scottish companies to explore the value design thinking can add to business development, delivered through a mix of participatory workshops and one-to-one support.
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The students at DJCAD have been exploring the potential of Speckled Computing through a collaboration between the Product Design and Textile Design courses. This collaboration has been framed by a new module running within the school entitled ‘Textile Futures’ which pays homage to the Textile Futures masters programme at Central Saint Martins College of Art and Design.

Textile Futures at DJCAD aims to give students the opportunity to understand and push the boundaries of what textiles are. Students begin to extend the limits of where these new materials may be used, by exploring applications beyond those traditionally perceived to be the domain of textile materials. It also aims to encourage students to work in small cross-disciplinary teams forcing them to question their normal ways of working and develop new insights/ideas throughout the project.

Throughout the Design Specks project students have drawn on the philosophies, thinking and methods of both the Product Design and Textile Design courses.
Designing for a particular technology is not easy, even for the seasoned designer. Do you focus on the potential of the technology at the outset? Or put it to the back of your mind and first consider the people you are interested in designing for? Or is there an approach somewhere between these two extremes? You will find as you delve into this book that the different students working on *Design Specks* have adopted all of these strategies.

*Design Specks: Connecting People with Speckled Computing* documents a year-long project between technology and design initiated by Prof DK Arvind at The Centre for Speckled Computing, part of the School of Informatics at The University of Edinburgh. Researchers from The Centre have collaborated with students from the four main art colleges in Scotland: Edinburgh College of Art at the University of Edinburgh, Glasgow School of Art, Duncan of Jordanstone College of Art and Design at the University of Dundee, and Gray’s School of Art at Robert Gordon University, Aberdeen.