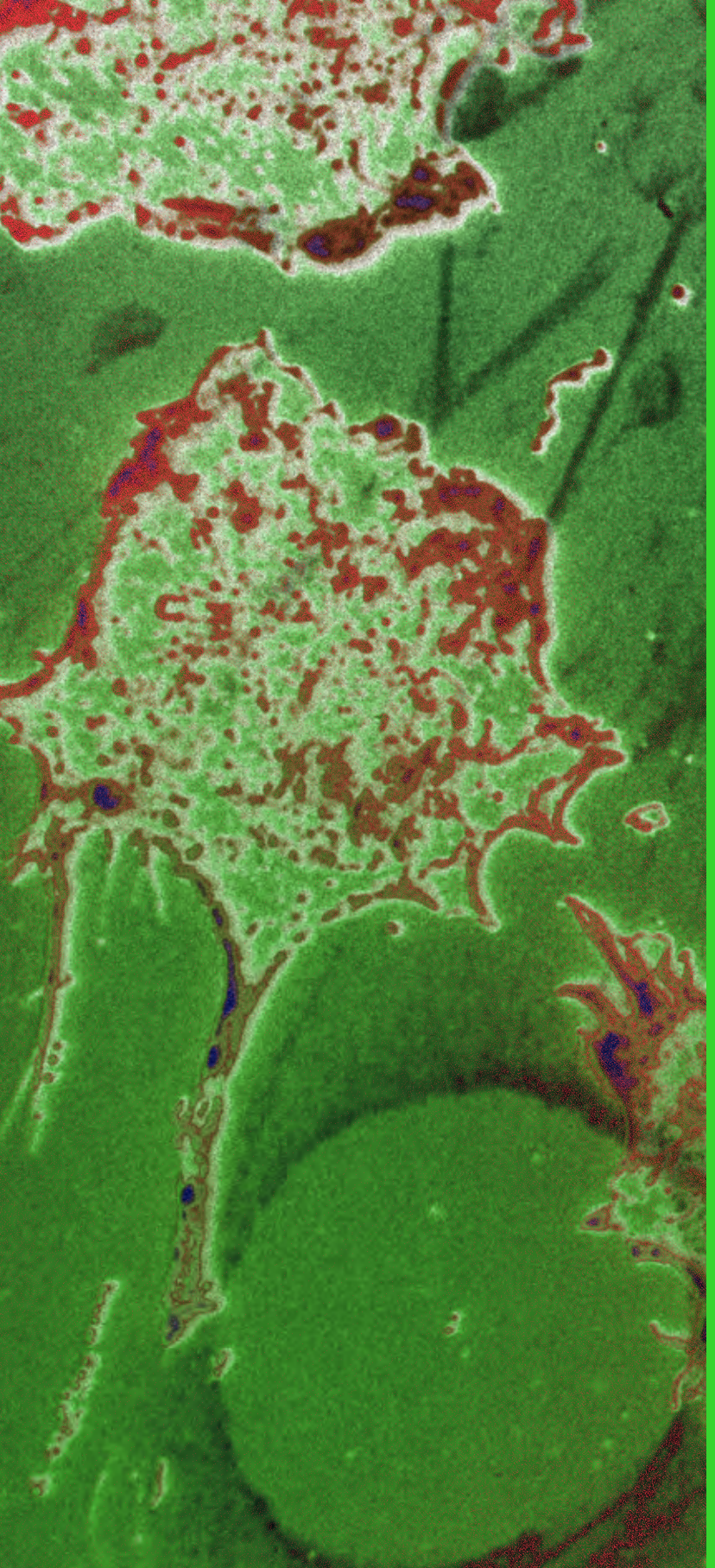
Future Experiences:

Precision Medicine and the Future of Cancer Care

INNOVATION SCHOOL
THE GLASGOW SCHOOL OF ART



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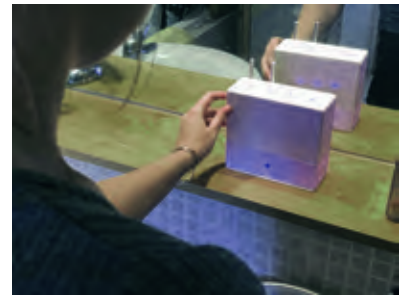
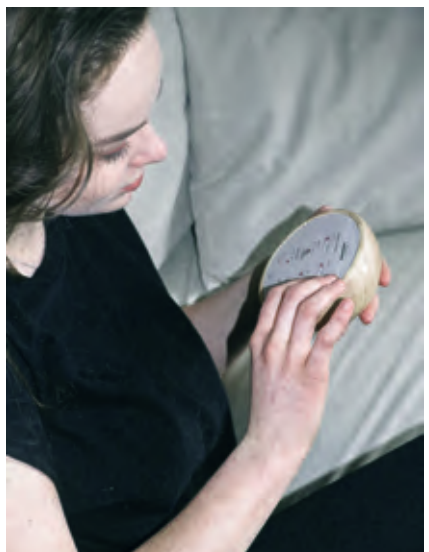
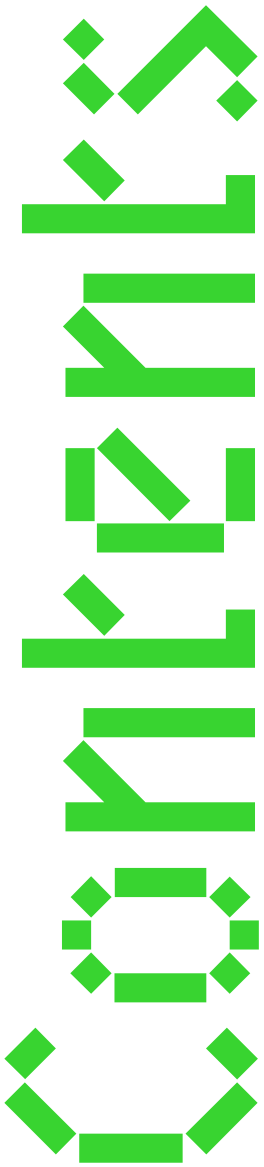
MRS SALLY JONES






external
factors



Introduction

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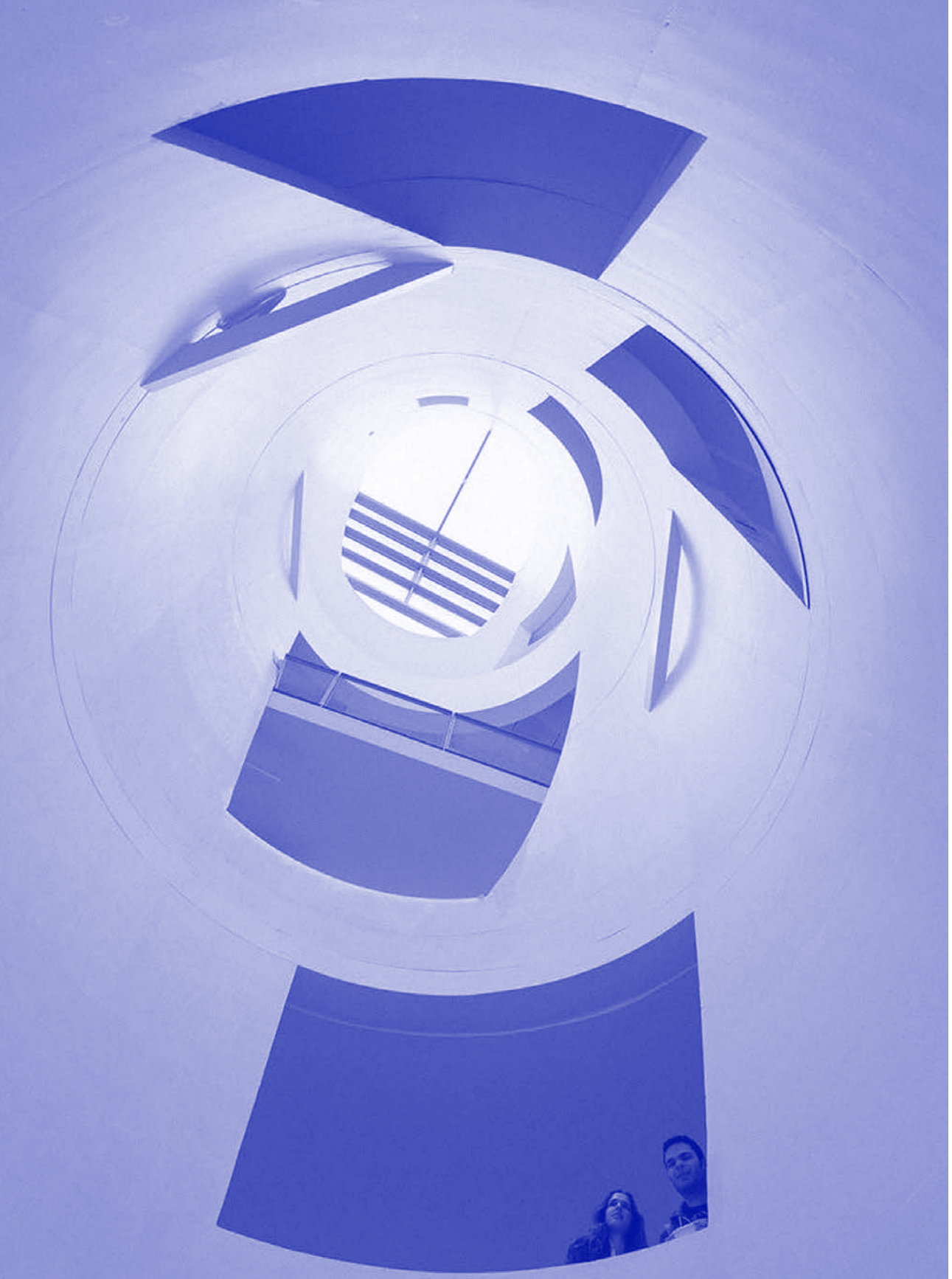


PREFACE

GSA and The Politics of Creative Engagement: “for the common good”

As the Glasgow School of Art prepares to celebrate its 175th anniversary, in 2020, we can reflect upon the relationship the Institution has had with the city of Glasgow, Scotland and the UK, our European neighbours and an increasingly inter-connected global audience for the work produced by students and faculty. Founded in 1845 as a Government School of Design and building upon our origins in the Foulis Academy and the Scottish Enlightenment, GSA has pioneered advances in the creative disciplines and contributions to aesthetic exploration. With the recent addition of both the School of Simulation & Visualisation and The Innovation School to the historic Schools of Fine Art, Architecture, and Design, this proud tradition continues.

The expansion of the intellectual and aesthetic repertoire facilitated by new academic Schools and the emergence of novel disciplines ensures the translation of proud tradition into contemporary relevance. GSA continues to honour its past as it engages with the present and imagines our future(s), and it does so in the spirit of “the common good,” of greatest benefit for all, students, teachers and citizens. This is the ethos that underpins the *Precision Medicine* project described in these pages, a collaboration between Product Design bachelor students at the GSA’s Innovation School and the scientists and clinicians of the University of Glasgow’s Institute of Cancer Sciences, born of the synthesis of creative exploration and scientific expertise.

The Glasgow School of Art’s pursuit of creative engagement with others, with the users and stakeholders of the design process, our fellow citizens, our academic colleagues at the University of Glasgow and their world class expertise, lies at the core of this project. It is the combination of cutting edge science with the intellectual exploration

of designers that gives birth to the innovative products, services, interactions and experiences detailed here. This publication seeks to capture the possibilities of tomorrow and offer them up for scrutiny, today. In this sense *creative engagement* is an invitation to all, to enter a debate regarding our shared future, an opportunity for designers and innovators to make available to citizens the chance to say how we might wish to live, and to care for others. This is the tradition, of innovation *open to all*, that the Glasgow School of Art embodies and seeks to share.

Dr Gordon Hush
Head of The Innovation School
The Glasgow School of Art

PROJECT OVERVIEW AND CONTEXT

Future Experiences: Precision Medicine

Precision medicine is currently leading a healthcare revolution that places citizens at the centre of a discussion about their own care and wellbeing. This pioneering Future Experiences project by the Innovation School's graduating BDes students examines how cancer care, in particular, can be tailored to meet the specific needs of individual patients. It explores the evolving landscape of cancer treatment and proposes alternative futures that are innovative, credible, practical and provocative.

The students were asked to develop visions of a future world in which advances in information technologies, artificial intelligence and genetic profiling have ushered in a new era of personalised health. Their projects explore the potential implications of precision medicine on stakeholders ranging from patients and their families, to policy makers, medical professionals and pharmaceutical firms. Key areas of focus include the shifting relationship between patients and healthcare providers, the pros and cons of increased access to our genomic information, and how personal health data should be safely stored and shared.

A collaboration with the University of Glasgow's Institute of Cancer Sciences provided direct access to patients and experts embedded in the current world of precision medicine and cancer care. The students employed a variety of techniques and methodologies in order to gather information and develop solutions to real-world issues that arose from their research. The diverse range of products, services and experiences they proposed highlights unforeseen opportunities to revolutionise the future of cancer treatment and care in relation to precision medicine.

About The Innovation School

The Innovation School at The Glasgow School of Art is a leading centre for design teaching that focuses on the key issues impacting contemporary society. Rather than concentrating on the more conventional interpretation of design in an industrial context, students learn how to generate innovative solutions that foreground the user experience. This post-disciplinary approach to Product Design encourages students to consider the needs of the end user and other stakeholders when developing proposals for building a better world.

Through collaborations, such as this one with the University of Glasgow, our students apply their creative skills and knowledge to real-world scenarios. By adopting a participatory approach that involves various stakeholders throughout the process, they are able to devise human-centred solutions that could play a genuinely positive and disruptive role in the future of our rapidly evolving society.

Precision Medicine: a personalised approach to healthcare

This Future Experiences project focuses on the emerging field of precision medicine and examines its potential to revolutionise how certain diseases are diagnosed and treated. Precision medicine aims to match treatments to individual patients by taking into account their genetic make up, medical history, test results and other distinctive biological and biographical characteristics. This tailored approach to healthcare puts the patient at the centre of a discussion about their own care and wellbeing. Technological advances are enabling data including genetic information to form the basis for personalised treatments or lifestyle choices that could profoundly affect the future relationship between the public and healthcare providers.

Advances in genomic medicine are having a particularly significant impact on contemporary medical practice, as faster and more affordable genetic sequencing technologies facilitate more widespread use of genomic information in the realm of clinical care. The Human Genome project, which began in 1990 and succeeded in mapping the entire sequence of human DNA, has far-reaching implications for a future in which genetic information is used to treat patients in a very specific manner, or to preempt certain conditions and encourage a more preventative approach to treatment. In this context, the traditional relationship between doctor and patient is being transformed, with patients assuming far greater control and commercial enterprises offering gene-profiling services that could support self-diagnosis, and even treatment.

Other technological advances are also affecting the way we approach healthcare, with online services, digital health trackers, apps and wearables allowing users to generate data about their personal health. This data holds great value for companies developing new drugs, as well as for clinicians performing trials or looking for ways to tackle diseases such as cancer.

Against this backdrop of unprecedented scientific and technological progress, the Innovation School's students focused on the human issues arising from the evolution of precision medicine. They examined the various stakeholders involved and the ways in which emerging technologies will affect patients, healthcare providers, researchers, policy makers and commercial organisations. The era of personalised medicine will require collaboration between all of these stakeholders, and the Future Experiences project provides a range of visionary concepts for uniting people in the pursuit of a common goal.

Why Precision Medicine?

The aim of the Future Experiences project is to confront students with a live subject that tests their ability to examine and respond to important contemporary issues. It provides an opportunity for them to demonstrate how advanced research and design methodologies can be used to develop a vision for an enhanced future world.

Precision medicine is evolving at a staggering speed, and has the potential to radically alter how healthcare is provided in the coming years. In his 2015 State of the Union address, President Barack Obama launched the Precision Medicine Initiative, claiming that the ability to match a cancer cure to a patient's genetic code could soon become as standard as performing a blood transfusion based on a person's blood type. He repeated a popular

definition of precision medicine that outlined its potential to deliver “the right treatments, at the right time, every time to the right person”. Obama’s speech helped to put precision medicine in the public spotlight, and it continues to make the news as businesses, scientists and healthcare providers seek to exploit its enormous potential.

The implications of adopting a more personal approach to healthcare are profound and varied. The students were asked to respond to the theme of “Personalised Health in a Consumer Age” and to imagine how the cancer landscape will look ten years from now. The numerous technical, ethical and social considerations arising from this issue formed an appropriate foundation for a future-focused design project that examines the needs and aspirations of specific groups of users or stakeholders. The brief provided opportunities for the students to conduct detailed desk and field research, which informed the development of socially driven experiences that are enabled or afforded by precision medicine.

The Innovation School regularly works with the NHS and other organisations on health-based projects, so the students are part of a hub for research and innovation relating to medical practice. Glasgow is also a world-leading centre for precision medicine, with the University of Glasgow pioneering a multidisciplinary approach that promotes collaboration between academia, industry and the NHS. Through our partnership with the university, the students benefited from input from researchers, academics and industry professionals at the front line of precision medicine. The access to experts and physical sites where work on precision medicine is taking place provided exceptional opportunities for a speculative project that is rooted in a real-world context.

Project scope

The main goal of this academic project was to encourage design students to engage with an important topic confronting society, and present proposals for a highly resolved design experience. The students were afforded an opportunity to demonstrate the skills, methods and approaches used to engage with, design for and envision the future in relation to the theme of Personalised Heath. This experience mirrors the sorts of analytical and strategic skills valued by the design industry and organisations involved with setting the future agenda for areas such as policy making, finance and healthcare. They were assessed based on their group research and individual outcomes, with the grades contributing to their final degree mark.

Alongside its primary academic scope, the Future Experiences project exemplifies the Innovation School’s commitment to partnering with businesses and institutions on projects that have significant mutual benefits. This project involved working closely with scientists, clinicians, patients and academic professionals from the University of Glasgow, staff at Queen Elizabeth Hospital’s Clinical Innovation Zone, and staff from Beatson West of Scotland Cancer Centre, as well as patient representatives and external design experts to ensure all stakeholder needs were explored. This collaboration enables our project partners to gain a new perspective on their own practice and an appreciation for the way design can be used to help identify new ideas and alternative ways of working. The project culminated in a final presentation that was attended by members of the public, as well as the media and peers of our various project partners. Insights generated during the process and the final outcomes were also compiled by the University of Glasgow as a dataset that can be accessed using the following Digital Object Identifier (DOI): 10.5525/gla.researchdata.843

INTERVIEW 01

Kirsty Ross

—Design academic and lecturer in the Innovation School

Kirsty teaches across the Product Design undergraduate programme at the Innovation School and is responsible for the coordination of the final year curriculum for both the BDes and MEDes pathways. As lead tutor on the Future Experiences project, she was responsible for setting the brief and oversaw the project from start to finish.

What is the main aim of the Future Experiences project?

We try to identify a future context that is linked to a significant technological or scientific advancement. Challenging the students to explore a topic that's future focused and emerging in society gives them a chance to add something to their portfolio that is really contemporary or ahead of industry.

Why did you choose personalised health as the area of focus for this project?

Health is becoming a huge area for design and we have a lot of graduates working within that field. Having an undergraduate project examine that area complements the research being conducted elsewhere in the Innovation School and helps to form a cluster of knowledge.

How did the brief you devised provide a framework for the students to demonstrate different human-centred design methods and techniques?

From a methodology point of view I'm very interested in future-focused design practice, and this project utilises a lot of the methods and approaches we teach across the undergraduate programme. Consolidating these ideas as a project framework that introduces a coherent future-focused design process allows the students to apply these methods along with their own skills and experience.

You commissioned design professionals to run workshops that focused on methods for effectively communicating research. Why did you feel this was important for the project?

The translation and interpretation of the research into a physical materialisation of a future world was really exciting. It asks them to communicate and describe their findings using semantics and making. It's about making the research and knowledge tangible by creating something that can be experienced and understood by other people. It uses the power of making in a slightly different way than in traditional product design.

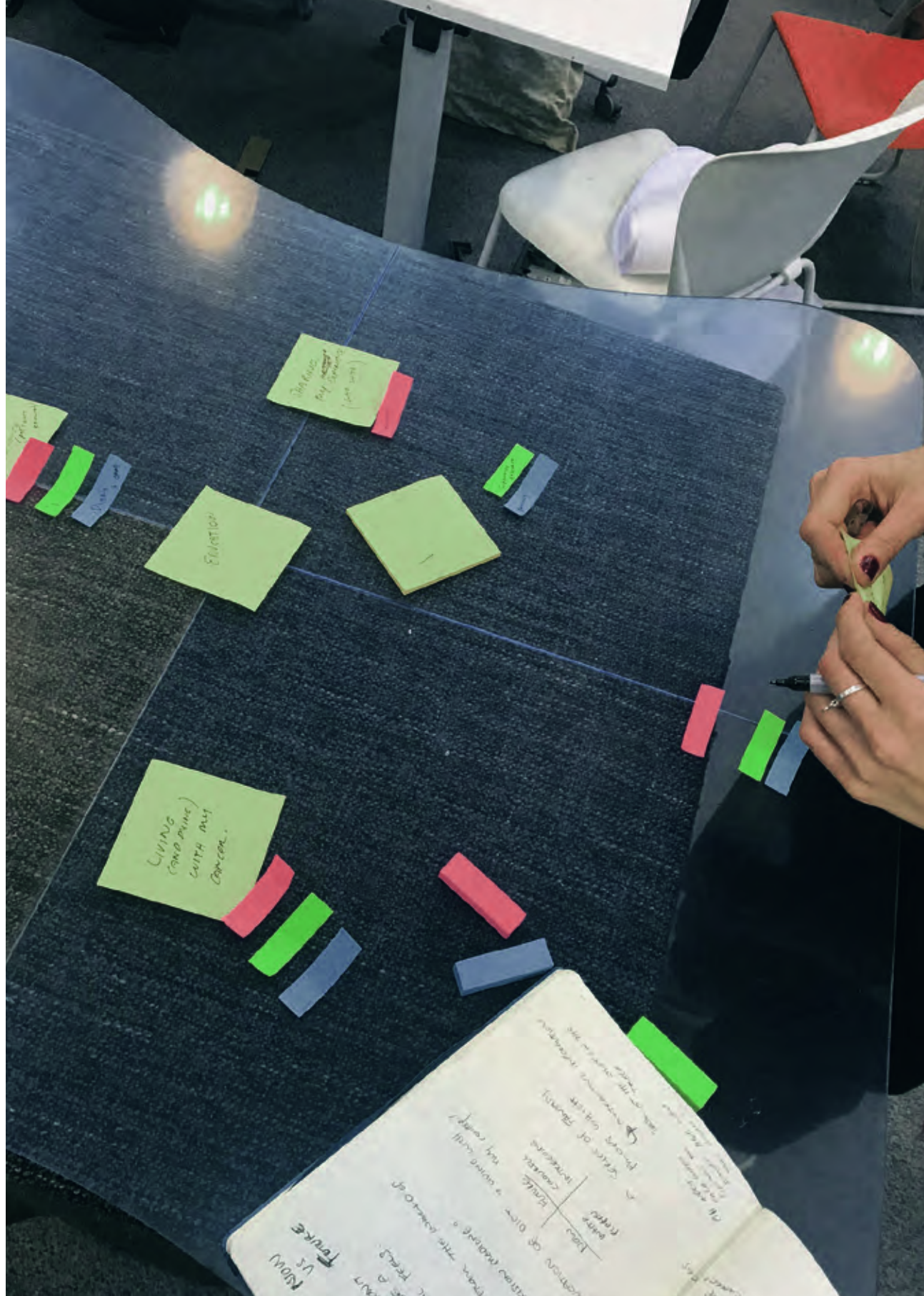
What skills and expertise have the students been able to showcase throughout this project?

The students have demonstrated the skills, methods and approaches used to engage with, design for and envision the future in relation to a thematic future context. As an exploration of health, medicine and

design, the project required the students to embrace a level of intellectual and creative mobility and flexibility of approach. Through this they gained real experience of the professional practice involved in inter-disciplinary design, and developed the awareness and ability to learn and work collaboratively across teams, disciplines and platforms – a mindset and approach that is of great value within the design industry and contemporary design practice.

What are your thoughts on the proposals and how they respond to the real-world implications of precision medicine and the future of cancer care?

As the creator of the project and the academic lead, one of the most rewarding aspects is seeing how the students bring the project to life. They exceeded my expectations in this respect. They embraced the challenge of understanding an emerging scientific area, interrogated the complex context of cancer care and treatment, gave it meaning and definition, and delivered provocative design responses. The outcomes are impressive in terms of their creative extrapolation of the research – a diverse range of credible and challenging design propositions that range from future systems, to services and connected products.



Process

02

DESK AND FIELD RESEARCH

At the Innovation School, our students conduct meaningful, targeted desk research in order to gain a thorough understanding of the topic they are addressing. In the case of this Future Experiences project, the first phase of the research was conducted in groups over an intensive three-week period. The aim of this process was to gather information and generate a detailed overview of how the evolution of precision medicine is affecting current practices within cancer care. The groups then presented their research in the form of a Future Vision that placed their findings in a speculative real-life context.

The research process was structured around the STEEEPLE cards methodology developed by lead tutor Kirsty Ross and previous student cohorts, which allowed the cohort to examine a wide range of factors that are relevant to the field of precision medicine. Each of the eight groups was given a specific area of focus and tasked with gathering information in a way that could be easily communicated to their peers. By researching the social, technological, economic, ethical, educational, political, legal and ecological implications of precision medicine, the groups were able to collaboratively compile insight and uncover areas of opportunity that helped to guide the design phase. The STEEEPLE cards provided a way to capture, analyse and activate the desk research. Each student was tasked with generating approximately ten cards, which were then clustered into different arrangements to help map societal shifts and identify key themes.

STEEEPLE cards are a very interesting method for capturing research. Giving eight groups a single dimension to focus on worked as a way to distinguish each group and bring their research together for collective review. The cards are a prompt to facilitate discussion between the groups, as well as enabling them to distill their research, commit to it and make decisions about what it means. It's an effective way to create collective knowledge for the whole cohort.
Kirsty Ross

As part of this initial research phase, some of the students also undertook field research to gather more in-depth insight into specific factors relevant to their group's theme. Students from the economic group attended a meeting of the In-House Trials Advisory Board (IHTAB) at the Beatson West of Scotland Cancer Centre, which makes decisions about clinical trial resource. Other students visited the Pathology Department at the Queen Elizabeth University Hospital to witness how pathology specimens are run. This field research enabled the students to observe and analyse key relationships and interactions between different stakeholders. They were able to question the various experts they met with

to deepen their understanding of real-world scenarios and gained a personal perspective that informed their future proposals.

Throughout this research phase, several areas of overlap between the different STEEEPLE topics were identified. These helped to generate key themes that formed the basis for further exploration and more targeted conversations with stakeholders. The research also prompted the students to identify a range of important, human-centred provocations based on the hopes, fears and opportunities outlined by the different collaborators. Several of these issues were addressed directly by students in the design phase, providing a launchpad for examining the potential consequences of any interventions on various stakeholders. These sorts of provocations exemplify the ability of the Innovation School's students to translate research into areas of exploration that can have a real-world impact on an imagined future.

Some provocations arising from the desk research

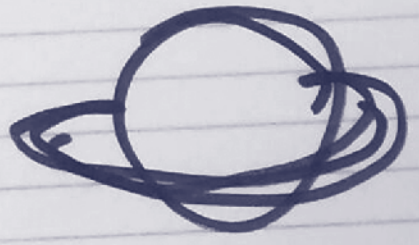
- How does the accurate information precision medicine provides alter patients' perceptions of their treatment options?
- In ten years' time, will people make key lifestyle/relationship decisions based on genomic information?
- Under what circumstances might corporations be given access to an individual's health data, and how should they be allowed to use it?
- Might removing the stigma associated with cancer lead to changes in attitudes and behaviours?
- What role will artificial intelligence play in the future of diagnosis and prescribing treatments?
- If precision medicine is prohibitively expensive, how should this be balanced against more accessible care for the majority?

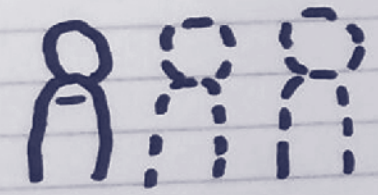

Far 2035 Eth
To Become Human Gods!
Insight
Machines can be faster and more efficient in work. An algorithm, for example, can work continuously and can be used by many people simultaneously. This makes healthcare available to more people, faster. This also means that technology has access to rural areas.
Indicators
"Analytics, artificial intelligence, and deep learning are put into play by analyzing medical images and reports on different pathological conditions, and then coming up with different models and sources of treatment from studies of thousands of patients in China's urban hospitals."
Links
Now Eth
given to more patients
Selling a Campaign
Increasing of Campaigns, selling hope
Now 2018
Commercial
Buying a better
Indicators
Machines get biased because the training data they're fed may not be fully representative of what you're trying to teach them," says IBM Chief Science Officer for Cognitive Computing Guru Banavar."
Links
Google
as a Commodity
knowledge and how do they profit?
Now 2018
Insight
Precision medicine, gene testing and health tracking, could lead to an increased awareness of our health and cultural shifts towards generally healthier lifestyles and a more open culture when speaking about health.
Indicators
1. Fit-Bit, a health tracking device, valued at £3.8 billion on the NY Stock Exchange in 2015
2. Apple IOS 11.3 update allows users to access their health records on their phone as part of the 'Health' App
Links
heartfit
Taking Care of
A more open culture of h
Insight
What are we doing if we don't know something? We Google it. Instant 1000000000 results we just have to choose the good ones. Or these websites are shared by our social media friends and popping up on our dashboard. It is the same with health blogs, if we want to improve our life or self meditate, there is an opportunity for it, we just have to choose wisely. Click baits, revolutionary solutions are covering the whole screen. The Internet is a free platform so we can't control its content.
Indicators
"Of the 20 most-shared articles on Facebook in 2016 with the word "cancer" in the headline."
Links
'I want to believe'
Fake health blogs
Creating S
Could we end up w
Insight
Thanks to new technologies, patients get more control over their health. Services like GP at hand created by Babylon allow patients to talk to a chat robot and quickly get a diagnosis. Patients can schedule an appointment and discuss health via the phone. The features of a lifestyle app are now merged into one with professional healthcare.
Indicators
1. Self-healthcheck and consultation with a doctor are offered as one service
Insight
The act of taking a test to arguably determine your future is a scary concept, however if this became part of our life, the start of our life? Would that alleviate the pressure and anxiety around such test. As a society we do not discuss illness, death or our health. By introducing a compulsory test at a young age, could this address this? Allow you and your family to grow with your genetically predisposed conditions in mind?
Indicators
In recent years we have become much more open to the concept of Amniocentesis testing, allowing parents to make decisions and prepare for the future depending on the outcome. Although a test done pre-birth, the benefits translate to a Precition Medicine screenings.
Links
Now Eth
Insight
Indicators
Links
Screening
Can the scr
Insight
Cancer is pretty equal, not selecting people according their social status, so it's pretty common that even celebrities we adore, respect or follow are fighting with cancer. With raising awareness, they have higher impact on people, especially because the extra opportunity of showing up in tv talks, advertisements et c. And this is useful. On the other hand, they are using their cancer to advertise themselves, trying to become more famous through it. Even with books publicized by cancer survivals, there is a big amount of business included, sometimes the profit is overtaking the original aim.
Indicators
"45+ Celebrities Who Survived Cancer"
Links
Now 2018 Eth
CANCER
Cancer Is Not a Disease
Insight
Hospitals accross the Uk have different resources and specialisms. Depending on the region that you live in certain therapies may be unavailable or you may have to travel to recieve them. With this in mind some areas may be disadvantaged in comparison with others and therefore see less benefits.
Indicators
1. 'while 97% of urban households lie within 8km of a hospital, the figure for rural households is just 55%.'
2. 'rural areas often lack of public transport, while poor broadband and mobile phone network availability hinders communication and access to online health services'
PEOPLE'S POSTCODE LOTTERY
Near 2020 Eth
erment

Student work: Organising and communicating experience

Student work: Collating and visualising complexity

INVEST IN SPACE INDUSTRY

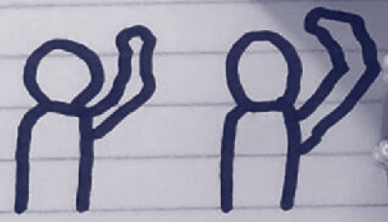




FAMILY CLONING

multiplying children

JOB RECRUITMENT BASED ON GENOMIC ID CARD



human-being. clone mix-up

who is real?

work allocated on genomic data instead of enthusiasm & experience

PM UTOPIANISM

TOO MANY PEOPLE STUDYING PM.

CLINICAL INNOVATION ZONE VISIT

As part of their research into the real-life implications of precision medicine, the cohort visited The University of Glasgow's Clinical Innovation Zone (CIZ) at the new Queen Elizabeth Hospital campus. The building accommodates high-specification units intended to promote innovation and provide access to world-leading clinical academics, research facilities and industry partners all on one site. As a home to companies specialising in precision medicine, imaging and diagnostics, the Clinical Innovation Zone is one of the best places in the world to learn about the people pioneering future applications in this emerging field.

The CIZ champions a 'Triple Helix' partnership with industry and the NHS to accelerate the implementation of precision medicine – an innovative approach bringing benefits to patients, savings to the NHS and creating an exemplar life-sciences cluster to drive economic growth in Glasgow. The visiting students learned about co-located partners, ranging from start-ups and spinouts to major corporate partners, and actively engaged with the development process for diagnostics and the roles that industry, academia and NHS play.

During the visit to the Collaboration Zone within the university's Imaging Centre of Excellence (ICE), the students were met by experts based at the facility, who explained their roles and showed them around the building. Jonathan Scott, ICE and Strategic Projects Manager, and Dr Ruth McLaughlin from the Glasgow Molecular Pathology Node of The University of Glasgow both discussed their work and described the advantages of being based at a major centre for multidisciplinary research, innovation and commercialisation in precision medicine.

The students were interested in the role that innovation and the CIZ are playing in a much wider innovation-led investment strategy planned across the city of Glasgow, which will further drive economic and physical regeneration and bring an increased connectivity, physically embodied in a new bridge spanning the River Clyde.
Jonathan Scott, ICE and Strategic Projects Manager

The group also met with Harper VanSteenhouse, the General Director of personalised diagnostics company BioClavis Ltd, who relocated from the USA to Glasgow to benefit from the opportunities provided by being part of the community at the Clinical Innovation Zone.

From our visit to the Clinical Innovation Zone I observed the importance of access to key hubs of activities involved within research topics. I was able to form relationships that saw me invited back to the hub to re-engage with artefacts and assumptions that helped to validate and challenge my project direction.
Alex Lister, graduating student

This field research was vital to the Future Experiences project, as it allowed the cohort to visualise the sort of environment where groundbreaking research and clinical trials are currently being conducted. It also provided them with access to some of the stakeholders who may benefit from their proposals and enabled them to consider the wider context surrounding their designs. A key takeaway from the visit was the importance of collaboration and the mutual benefit of co-location that the various practitioners pointed out. The Clinical Innovation Zone manifests the concept of knowledge exchange and co-creation. This informed the work of many students who chose to focus on joining the dots between different stakeholders working within precision medicine.

EXPERT INSIGHT

Throughout the research process, the students had opportunities to engage with industry experts from a range of specialisms, including medical oncologists, pathologists and researchers, as well as professors in molecular oncology and genetic medicine from the University of Glasgow.

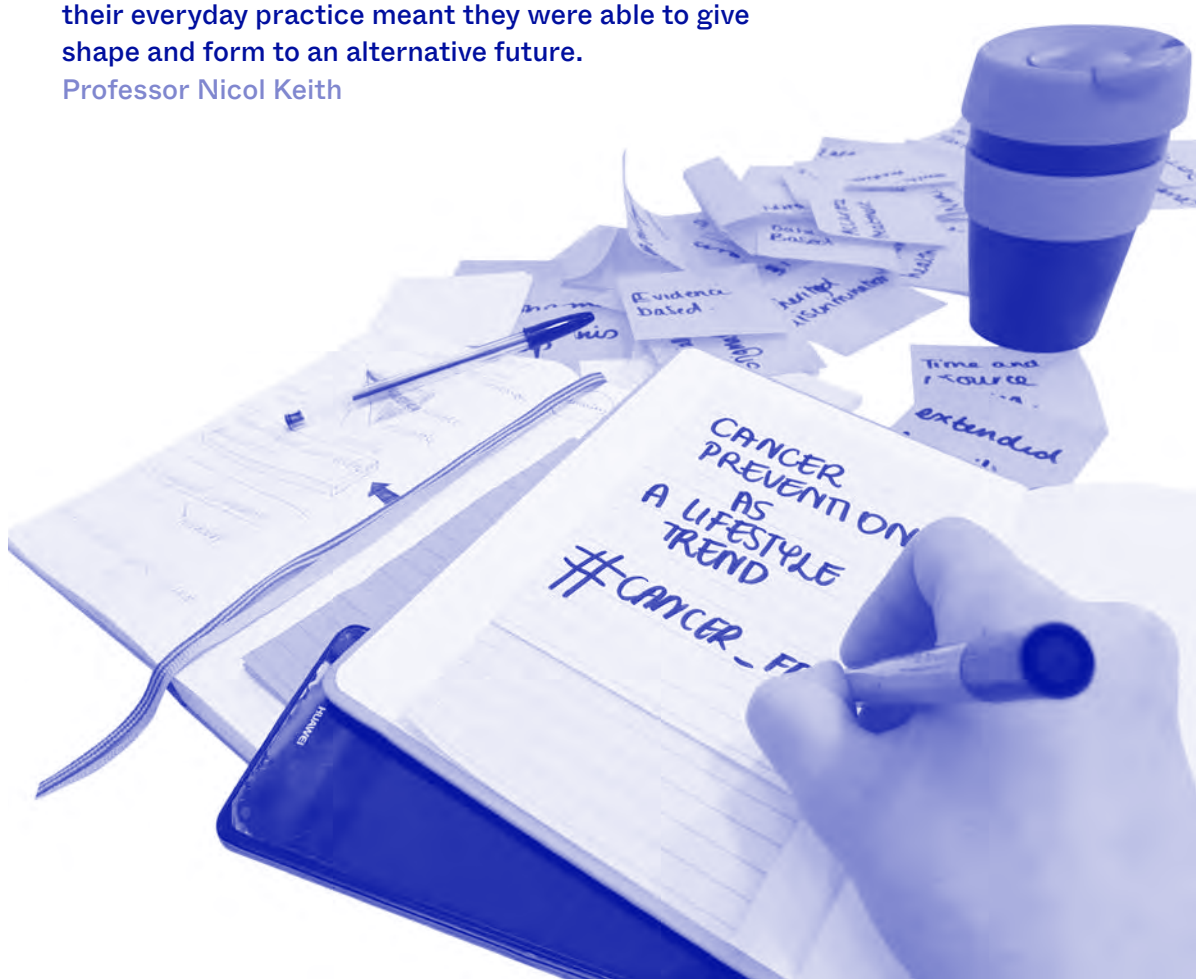
The experts were invited to join the students in their studio at the Innovation School, where they sat down with each group to discuss their STEEEPLE topic. As a cohort, the students identified the need to include the patient's perspective in these informal workshop sessions. This viewpoint was provided in later workshops by Elspeth Banks, a cancer patient who represents patients on various committees, as well as contributing to several research and advisory groups.

For the students, having access to such experienced professionals and experts provided essential context and a level of personal insight to their research. They were able to ask targeted questions and learn about the everyday reality of working with cancer patients or living with the disease. They also gathered detailed information about the impact precision medicine is having on research, clinical trials, consultancy and logistics.

The experts shared with us their first-hand experiences and thoughts about precision medicine. They outlined key issues and provided honest insight that led to outstanding design opportunities. The experts also explained the broader ecosystem and the role each particular expert plays within an oncology and cancer care team.
Monika Kantor, graduating student

The collaboration with The University of Glasgow and the contacts provided by project partner, Professor Nicol Keith, in particular, were invaluable in ensuring that the students received input from a broad spectrum of stakeholders affected by precision medicine. This expert insight supplemented the desk research, informing the responses to the STEEEPLE cards and raising many additional questions about the likely impact of precision medicine on the entire ecosystem surrounding cancer care.

Too often we put ourselves in the position of others and speculate about what industry, patients or the NHS might want or need. It's much better to collate a sample group of people who are invested in the future of precision medicine, and who have opinions, skills and knowledge that could inform what's actually required. Getting those people to think about the future in a way that frees them from the constraints of their everyday practice meant they were able to give shape and form to an alternative future.
Professor Nicol Keith



Interrogating the experts: workshops
in the Haldane Building, GSA

Experts help turn insight into
experience prototypes

Collaborative creativity:
Expertise driving innovation

For the experts, themselves, the workshops at the Innovation School represented a novel opportunity to discuss and re-examine their own practice in a creative context. The students were also able to probe aspects of their workflow and relationship with other stakeholders in ways that foregrounded efficiency and the needs of the various users.

I was struck by the preparedness, motivation and enthusiasm of the students I worked with. They had prepared questions linked to their specific topic and it was clear that much thought had gone into this aspect of their work. The students are in a unique position to contribute blue-sky thinking to the project. They arrived with no baggage or preconceived ideas and it was refreshing to witness how they developed these original thoughts.
Elspeth Banks, Patient Representative

The expert workshops are an example of the approach the Innovation School adopts to ensure projects focus on everyday experiences and improving people's lives through targeted interventions. Following these sessions in the studio, several of the students followed up individually with experts working in an area that held particular interest or relevance for their chosen direction. These interactions lent a richness and depth of knowledge to their research presentations and are evidenced in the project outcomes.

SPECIALIST WORKSHOPS

Workshop 1: Mapping a Future Vision

The Innovation School's extensive network of industry professionals, many of whom are alumni, enables it to organise practical teaching sessions that utilise the broad-ranging skills and experience of these expert practitioners. For the Future Experiences project, two workshops were arranged to help the students as they sought to translate their desk research into a tangible future vision. Lead tutor, Kirsty Ross, collaborated with the visiting designers to ensure the students received the right sort of information at the right time to benefit the flow of the project.

The first workshop run by Santini Basra of design strategy studio Andthen focused on techniques for analysing the STEEEPLE research and extracting key information related to the evolving cancer landscape. Andthen specialises in combining design research with futures thinking, and Basra demonstrated how the research could be used to map the potential future impact of precision medicine on various stakeholders.

The research was translated into a range of speculative consequences, which generated further opportunities that become exponentially more visionary. In this way, the groups were able to focus on moments in the user journey that provided opportunities for innovation. This process challenged them to think beyond the obvious evolutionary steps for precision medicine and cancer care, and instead devise more radical outcomes that are beyond the realm of current thinking.

Often when you do desk research on topics like precision medicine you encounter the same sorts of consequences being discussed. These exercises pushed their thinking and helped them understand that everything exists within a bigger system where one change will lead to changes elsewhere.
Santini Basra, Studio Andthen

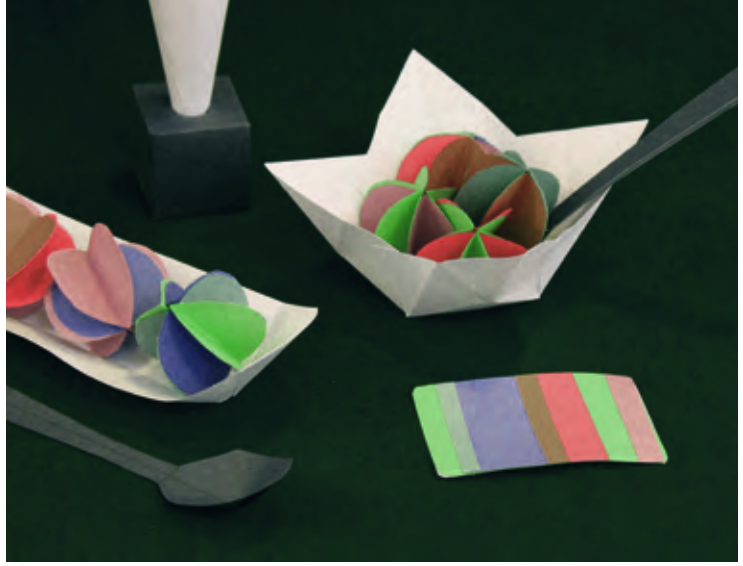
The final part of the workshop was a *post mortem* aimed at disposing of any opportunities that were either unfeasible, uninteresting, or not closely aligned with the goals of the project. At this point, the students were able to identify a specific area of interest for more targeted exploration.

Workshop 2: Creating a Future World

The second workshop led by designer and branding specialist Brian Proudfoot of Glasgow studio GOODD explored ways of manifesting the future world visions in visual and material form. The prototyping session focused on the production of physical communication artefacts that express ideas and tell a compelling story. The groups were encouraged to consider how the artefacts they created might relate to people, processes and practice. The outcomes could be anything from tools for collecting genomic data, to a vision for improvements in the way patients and consultants interact. Rather than creating refined prototypes, the intention was to help the groups solidify their thinking and generate a physical representation of their ideas.

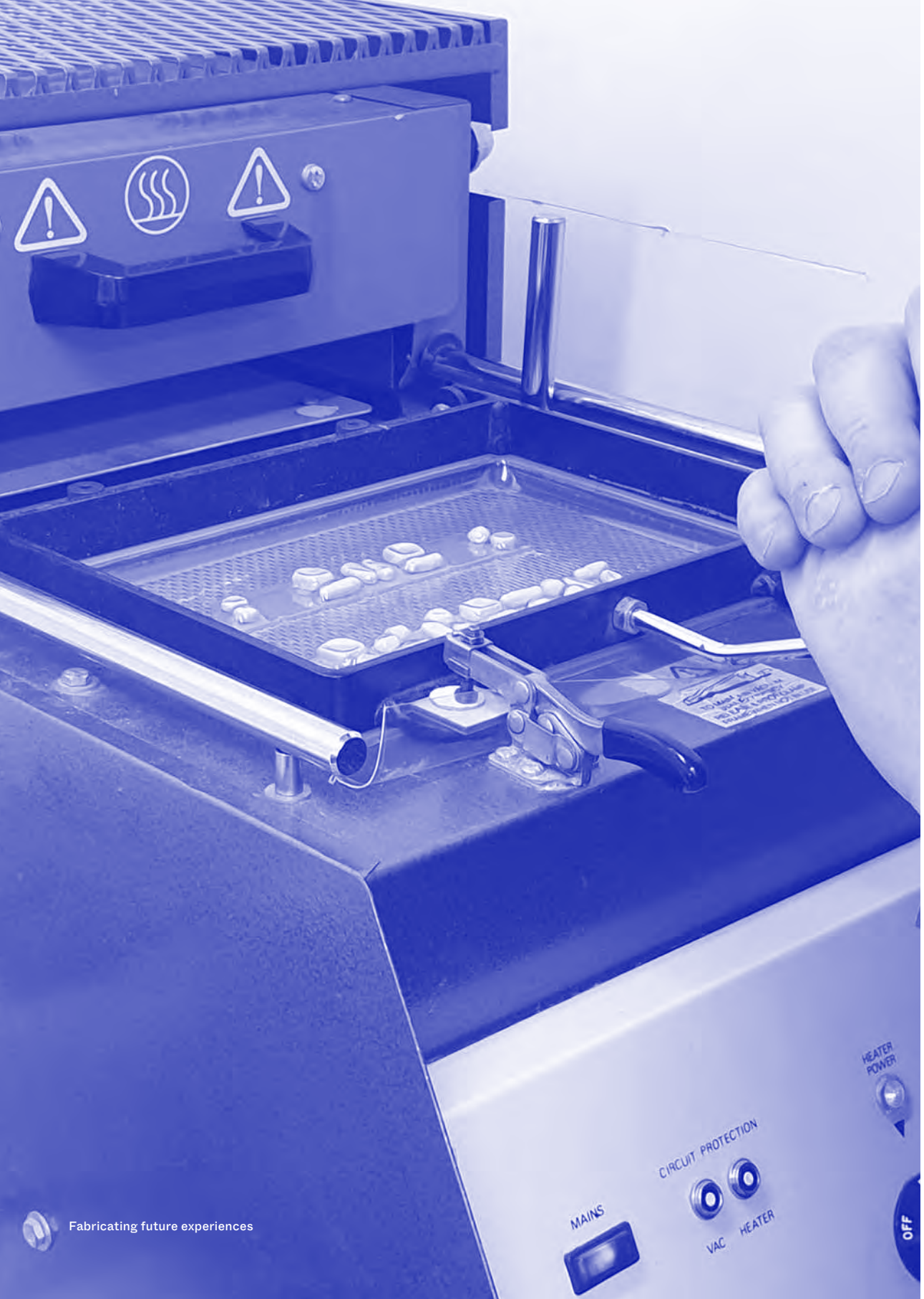
The first stage of this workshop looked at creating value propositions that brought the research to life in the form of materials or images. These were applied to a grid that displayed the current and future landscape of each group's dedicated STEEEPLE topic. The aim was to demonstrate that a future proposition could have a more approachable, understandable and integrated look and feel than the present.

The students then developed experience maps based on the narrative journey of a particular user or user group. They were asked to quickly manifest a tangible exhibit based on the user journey using basic materials or items found around the studio. These interactive exhibits helped to tell a cohesive story that was easy to share with the rest of the cohort. Using found objects with existing associations helped to place the exhibits in a real-life context and made it simpler for anyone not immersed in the project to comprehend their purpose and meaning.



Making ideas tangible and testable

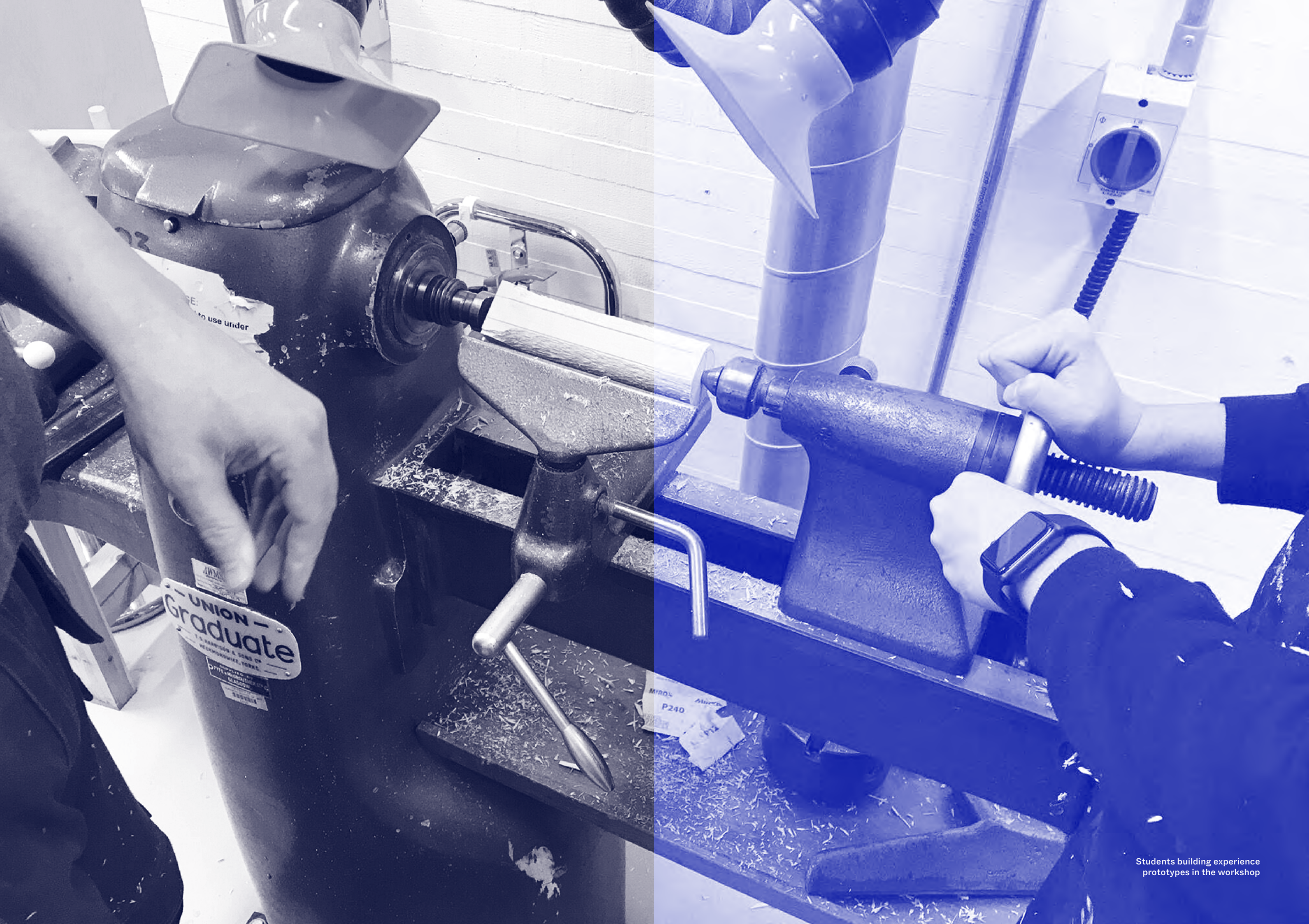
Rapid prototyping with experiences



Thinking through making is a really good way of working. You can easily get caught up in paper and online research, but having to stop and make something is actually a great way to bring your thoughts together quickly. The workshop offered scope to determine the best way of communicating research in ways that encourage interaction and make it easier to understand.
Brian Proudfoot

Some of the exhibits focused on representations of a familiar context, such as a bathroom cabinet that was adapted to contain futuristic artefacts used for harvesting physical samples or collecting data from users. Others chose a more abstract approach, such as using a see-through box with a DNA helix spiralling through it to represent the need for more transparency about who can access a patient's genetic data.

The syllabus at the Innovation School teaches different methods for communicating complex ideas in an intuitive way. We work with partners ranging from financial institutions to healthcare providers and social enterprises, so it is vital that our students can document processes, experiences and interactions using appropriate techniques. This level of communication goes well beyond what is typical in other fields and is different to the methods our partners may be used to. In the case of this project, the visiting medical experts and academics said they were impressed with the ability of the students to present complex ideas in a visual or physical format that made it possible to understand these concepts in a real-world context.

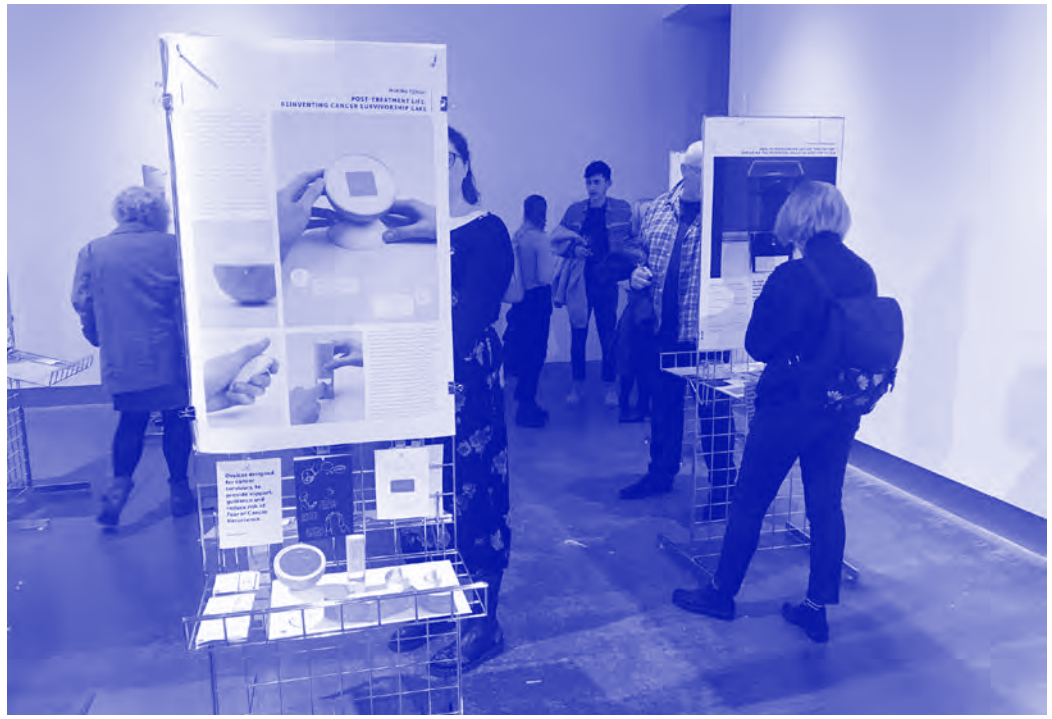


Students building experience prototypes in the workshop

RESEARCH PRESENTATION

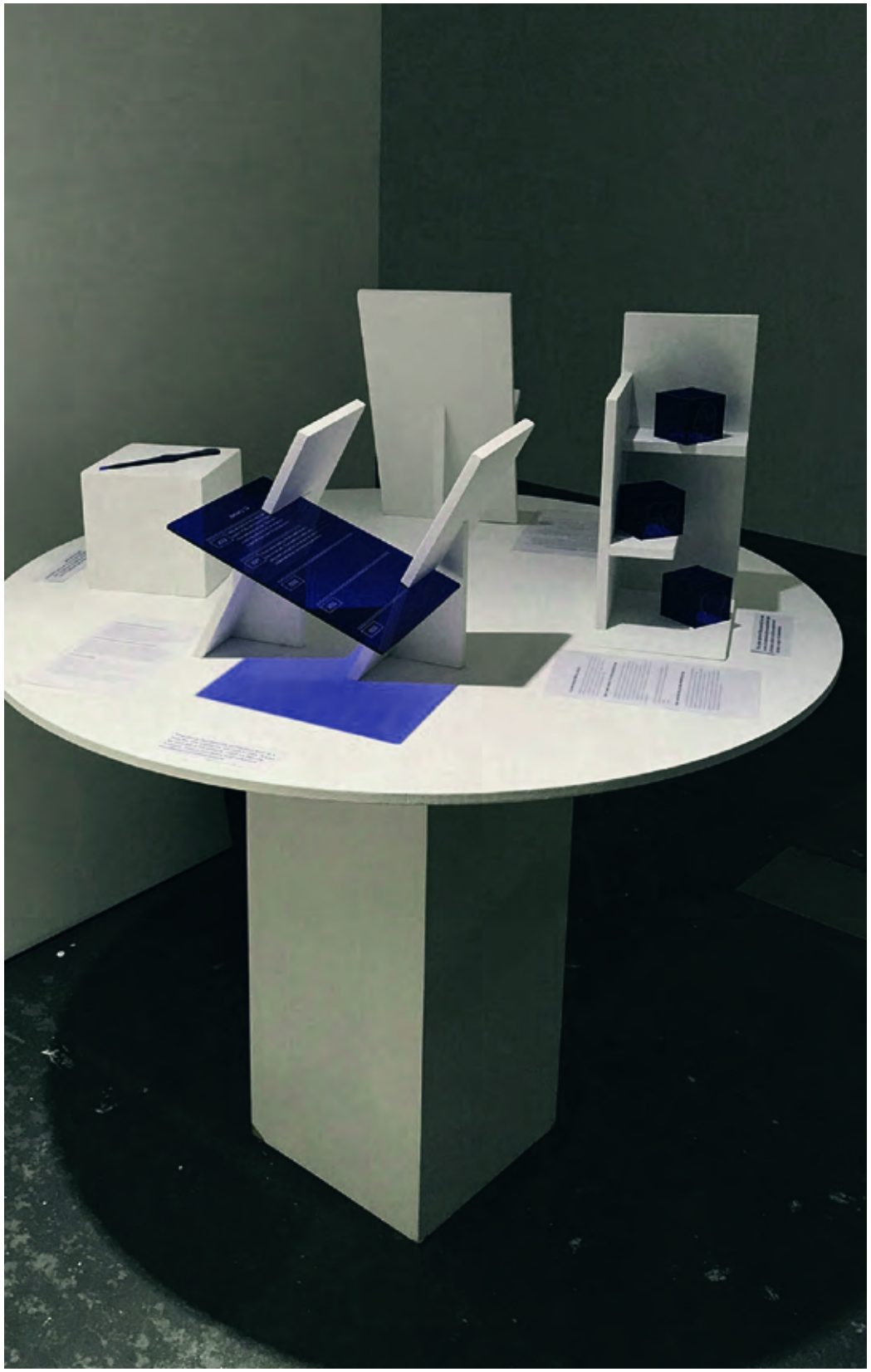
The desk research culminated in a presentation of future visions developed by each of the eight groups in response to their designated topic. The format for the presentation saw the groups physically manifest the most significant research outcomes as part of a ‘future world’ scenario. The brief called for the creation of an experiential prototype that allowed the research to be accessed, understood and discussed by peers, staff and the public. Using a variety of prototyping methods and media to bring their visions to life, the teams demonstrated a range of potential implications of precision medicine on key areas within the cancer landscape.

Several of the groups developed personas based on their findings, which they used to depict real-life scenarios that could be affected by the adoption of genomic treatments. The Technology group, for example, presented a futuristic room set incorporating devices that unobtrusively gather health and lifestyle data from a patient – transforming them from a passive subject to an active participant in the research process. By volunteering to submit this data to the Community Health Index, for use by researchers and clinicians working on new applications for precision medicine, the patient may be prioritised when it comes to participating in a clinical trial. The presentation raised questions around the implications of technology’s future role as a discreet but powerful tool that is present in the home and is capable of altering the dynamic between patients, doctors and other organisations in need of this precious data.



Other groups produced interactive exhibits that sought to immerse the viewer in different aspects of their future world. The Economics team created a series of artefacts to demonstrate how precision medicine might impact future fiscal approaches of businesses, consumers and policy makers across a range of scales. From the micro scale of a washbasin that gathers genomic data and rewards the user, to the macro scale of funding data centres capable of processing huge amounts of information, the exhibit employed simple models to facilitate interaction and a more intuitive appreciation for the issues arising from the research.

The future visions helped to communicate vital information gathered throughout the research process to the other students, as well as the Innovation School faculty and visiting experts. In addition to providing insight into specific factors that affect the many stakeholders impacted by precision medicine, the group exhibition formed the basis for each student to identify a relevant area of focus for their individual project.



Research data was turned into conceptual products and prototypes

Monika Kantor

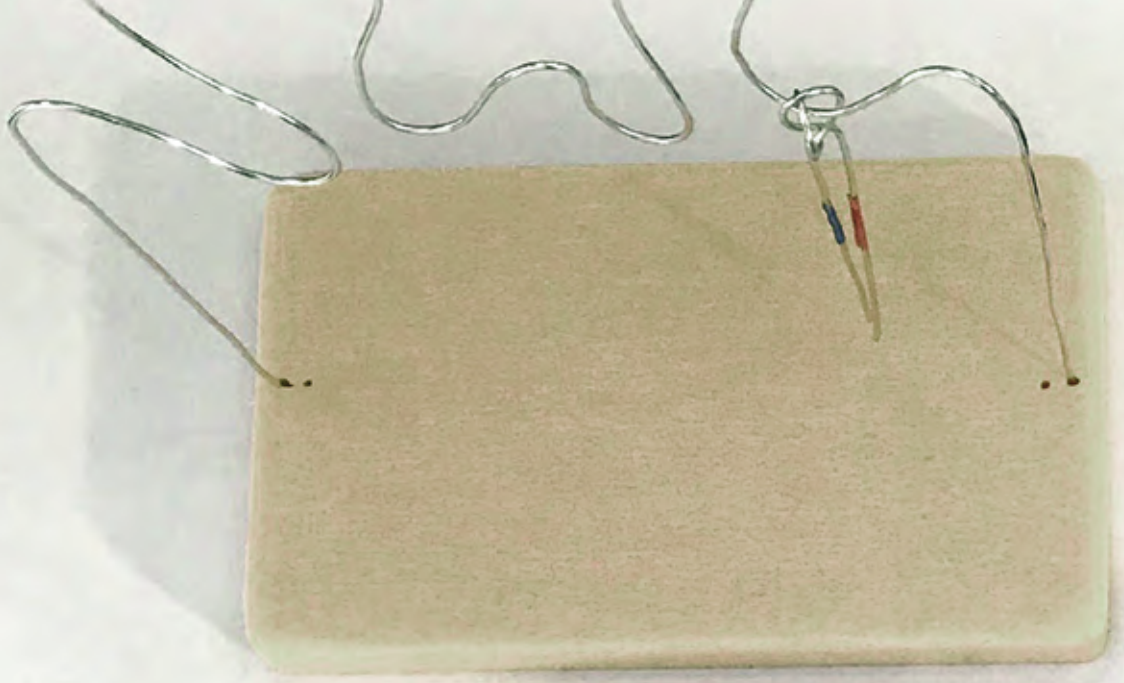
Maia at home

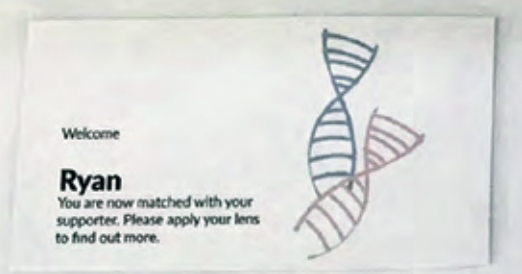
Maia at home is a personal server-, voice-controlled smart device and digital journal that provides visual and voice feedback. It allows a conversational experience, delivers guidance and recommendations and it is linked with the rest of the devices. For the cancer survivors a simple headache or fatigue might trigger the fear, anxiety and thoughts that cancer is back. It is important to understand and analyze unknown symptoms and worrying side effects during their post-cancer life.

There are 3 key functions: journal (calendar and plan of cancer care), results, alarms, side, emotional monitoring, health insights (sugg... plan how to be healt... avoid secondary cancers), home entertainment and... provider, music, cale... etc).

The Health Suggestions mode analyses health data of Laura, lifestyle patterns, identifies potential sources of stress and fear, analyses external factors, and delivers post-treatment, lifestyle suggestions to avoid RSI and to maintain healthy lifestyle. The user can ask any questions about her/his condition and add any information to the journal at anytime, regardless it's nature.

The exhibition of research allowed a wider public to engage, discuss and contribute





Students sought to engage and include participants, the public and expert stakeholders through exhibition artefacts


Can I ?
Will I be able to?
Could Be Useful Sources...
Macmillans Cancer Care and Support
Maggies Cancer
NICE
NHS Inform
Indian Journal of
Cancer Si
Sally Jenkins
GID Number: 8765
Treatment Number: 22nd/3r
Print Date: 27/05/2028
Cancer: Breast Cancer


2028
My Holistic Info
Reflect on your needs...
Emotional
Spiritual
Financial
Practical
This diary belongs to
SALLY JENKINS
If lost please call
07451322117

INTERVIEW 02

Nicol Keith

—Professor of Molecular Oncology at The University of Glasgow

Nicol is Professor of Molecular Oncology and the Director of Research Impact at the Institute of Cancer Sciences. His research activities focus on translational cancer research including biomarker development, clinical trials and cancer cell immortality. He was the lead project partner on behalf of The University of Glasgow.

How did you get involved with this project and what appealed to you about working alongside the Innovation School?

I had met with representatives from The Glasgow School of Art to talk about how they approach health and we quickly realised there was potential to work together on projects combining health and innovation. We looked at a few areas that might be worth exploring with the BDes students and settled on precision medicine because it felt really topical and matched the Innovation School's intended learning outcomes. Also, Glasgow is a hub for this kind of work so there is a strong local interest in the future of precision medicine here.

What were your hopes and expectations for the project and what the students might come up with?

What I wasn't interested in was business as usual. Based on evidence that is already available I can see obvious benefits of precision medicine, but what's interesting is to look at what this means if it becomes normal in the future. What impact does it have on patients, the healthcare system, the companies involved, the researchers? What does the whole ecosystem around it look like? Cancer precision medicine is still a nascent field so there was a great opportunity here to examine what's missing by getting a different perspective.

What did you make of the way the students approached this subject and the outcomes they presented?

It impressed me how quickly they reached a very high level of understanding about precision medicine, which is a very complex field. They exceeded my expectations with the way they picked up on the critical elements and what needed to be done.
What I realised from the information the students presented was that there is more research to be done on precision medicine than I ever thought possible. My view of precision medicine was focused on finding another set of genes and seeing if we can target those with a drug. This process made me realise that we need to start acting on a wider range of projects associated with precision medicine so that in the future we are ready to ensure precision medicine is implemented in ways that genuinely enhance peoples' lives.

What was the real value of this project and how might the ideas you've witnessed make a difference to the future of precision medicine?

The project catalysed a thought process that showed how cancer research or precision medicine is not limited to finding a new drug to target a certain set of mutations; it's

far more than that because if we get that right there are many other things we need to have in place. That's where the real value is for me. It opened up a way of finding real-world research questions that need to be addressed. I actually think a number of things they came up with are good prototypes that have real value and could be built upon.

Outcomes

03

INDIVIDUAL PROJECTS

The group research phase resulted in a range of future-world scenarios that provided a foundation for individual projects. The students were asked to design artefacts, services and experiences for the people inhabiting these future worlds. Each designer explored a range of concepts before choosing to focus on a specific aspect of precision medicine and its potential impact on their chosen future user.

Further workshops with Studio Andthen, as well as the Innovation School's faculty, helped the students to clearly define the personality and needs of their intended users. The sorts of people identified as future users ranged from young patients learning to deal with the lifelong implications of a cancer diagnosis, to medical professionals requiring a more seamless way to incorporate new precision medicine procedures into their normal workflow.

The design process involved a rigorous development and testing phase, with multiple ideas explored and refined before reaching a final outcome. Throughout this phase, the students narrowed their scope of thinking and ideas towards a targeted solution to a specific problem or issue. They visualised objects and experiences through sketching or model making to enable them to refine their proposals. This process was documented through a printed personal process journal that helped both the students and tutors to reflect on the work undertaken throughout the project.

The aim of the design phase was to deliver a compelling narrative, along with examples of innovative products and services that relate strongly to the needs of the intended user and a specific scenario of use or experience. The final outcomes were expected to be highly resolved in terms of aesthetics, interactions and experiences. The completed proposals were presented for assessment in the form of a poster and short film or animation explaining their value and appeal. The students were also required to present a storyboard outlining the user journey and usage scenario in a clearly comprehensible way.

REID GALLERY WORK-IN-PROGRESS EXHIBITION

The eight-week project culminated in a work-in-progress exhibition at Glasgow School of Art's Reid Gallery, where the students presented their proposals to the public. Each of the groups exhibited the future visions they generated in the initial phase of the project. The individual outcomes were presented using a consistent format comprising a simple exhibition stand with space for an explanatory poster and additional models or other supporting materials.

The Reid Gallery exhibition was visited by many of the medical academics and healthcare professionals who contributed to the project, as well as industry professionals, media and friends and family. The students used a variety of techniques to communicate their concepts, from films depicting products or digital interfaces in use, to three-dimensional models and speculative branding materials that demonstrated intelligent uses of form, colour, tactility and interaction. The exhibition enabled the students to gather valuable input that informed final refinements before the work was presented again at the end-of-year graduation show in June 2019.

The WIP show was a fantastic test run in preparation for the final degree show. Exhibiting to the public at this stage helped me better understand how to clearly communicate my proposition and take into consideration how a first-time viewer is interpreting my work.
Victoria Hamilton, graduating student

The work-in-progress exhibition was the first time we had seen the project in its entirety. Despite being involved in this project from its inception I was not prepared for the transformation taking place. The future experiences, whilst at times provocative, were justified and grounded in real-world relevance.
Nicol Keith, Professor of Molecular Oncology

DEGREE SHOW

At the end of the academic year, the graduating students presented their work to the public at the annual Glasgow School of Art Degree Show. Each student was given a dedicated area to exhibit their research and final outcome in the form of an explanatory poster, together with concept models and accompanying documentation.

As with the mid-year work-in-progress exhibition, the Degree Show was attended by members of the public and many of the experts who were involved throughout the project. It gave the students an opportunity to present themselves professionally to various interested parties including the media, visiting designers, academics and industry professionals. The feedback from this event was overwhelmingly positive, with both patients and medical experts suggesting that the outcomes provided a realistic vision for the future of precision medicine and cancer care.

This project was a living ecosystem, constantly evolving in real time. There was a fearless originality to the work and a sense of ownership and social responsibility for the future of cancer care was inescapable. The range and diversity of vision, artefacts, outputs and in particular solutions, was beyond expectation and a disruption of my perception of what cancer research is and can be.
Professor Nicol Keith

INTERVIEW 03

Robert Jones

—Professor of Clinical Cancer Research at The University of Glasgow and Director of the Cancer Research UK Glasgow Trials Unit

Robert combines his academic work with his role as a busy clinician helping cancer patients to make informed treatment decisions. He contributed to the creation of the brief for the Future Experiences project and provided his unique perspective on the real-world implications of precision medicine and its potential benefits for future cancer patients.

Based on your experience working across molecular biology and clinical research, what are the key issues you hoped this Future Experiences project might be able to address?

The pace of progress in molecular biology has been massively fast and has been driven by technological, knowledge and economic changes. However, there are a still lots of barriers to how we actually use that knowledge to improve outcomes for patients. A lot of hypotheses that seem obvious from a scientific point of view turn out to be much more complex when you actually sit down with a patient. I was hoping the students might approach this topic from a more user-centred point of view.

How do you feel design might be able to help ensure precision medicine is applied in ways that are ethical, practical and genuinely beneficial to cancer patients?

Precision medicine is clearly the way things are moving now in oncology, but the rate of scientific knowledge development has outpaced our ability to translate it into meaningful therapeutic changes for patients. I'm interested in asking what makes precision medicine therapy something that a patient would choose? People make assumptions that because a test predicts an outcome, therefore a patient would want to have the test. One of the prospects of this project was that it would identify and highlight the barriers to implementation, access and impact of precision medicine.

You attended expert workshops organised by the students to gather information from medical professionals, academics, clinicians and patients. What did you make of these sessions?

I was very impressed by the students' ability to understand what it is that scientists are trying to sell here because these are quite complex concepts. One of the things that really pleased me was the engagement of my fellow clinical and scientific colleagues. They were clearly enjoying and benefiting from their interactions with the students.

What do you think is the value of this sort of project? What real-world consequences might it have on the future evolution of precision medicine?

The science community is currently being encouraged to consider and demonstrate how we address the impact of research. This is a great opportunity to explore impact in a novel way that goes beyond how scientists currently think about it. If the project causes the clinical science group to think more broadly about things then that in itself is an achievement. If it further enables us to highlight and

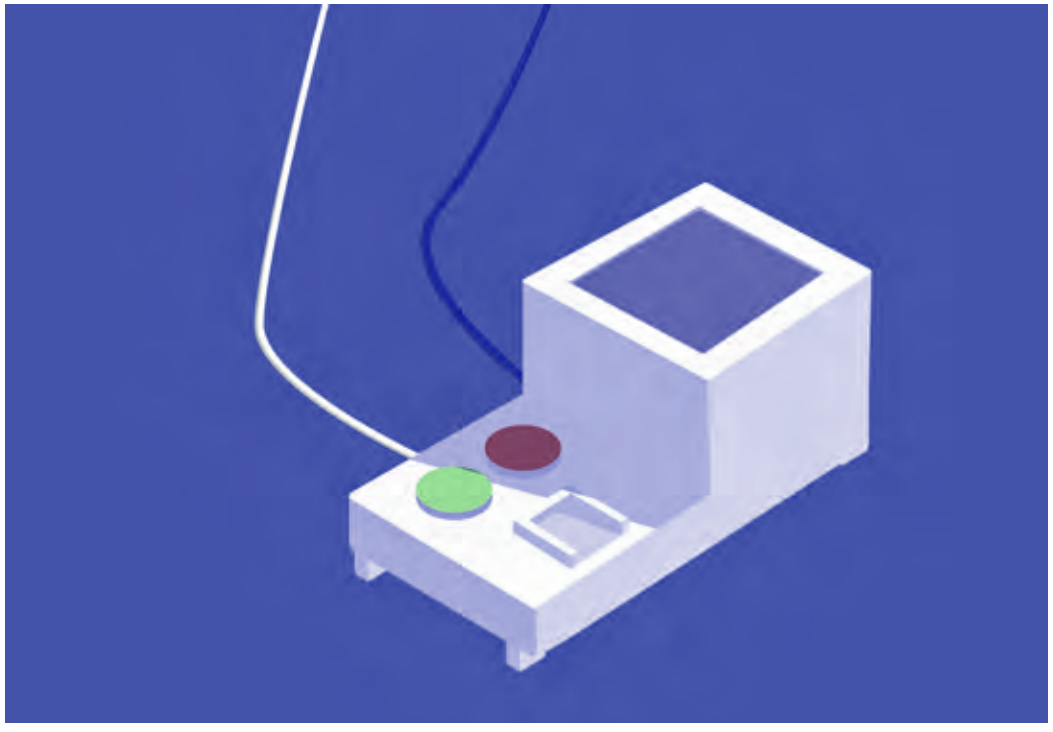
identify areas where more work needs to be done, or to garner more interest in identifying and influencing areas of policy that need to be changed, then that's a really good thing.

Case Studies

04

Alexander Lister
—Panoptic Choice

The Panoptic Choicagraph project imagines that in the year 2028 pharmaceutical companies will genetically engineer chickens to develop cancer-fighting proteins for use in the development of personalised medicines. In this future scenario, recently diagnosed cancer patients enrol in an experimental trial for biosimilar drugs that can be engineered to suit a group of people with specific genetic mutations. Cells taken from the user would be inoculated via a process of embryonic transgenesis into eggs so that the hatched chicken would carry proteins to be used as part of their future treatment. The Panoptic Choicagraph device would be used during an initial consultation with the manager of a clinical trial and would allow the patient to choose their level of involvement and transparency at each stage of the medical trial.



Benjamin Laing
—Capsule

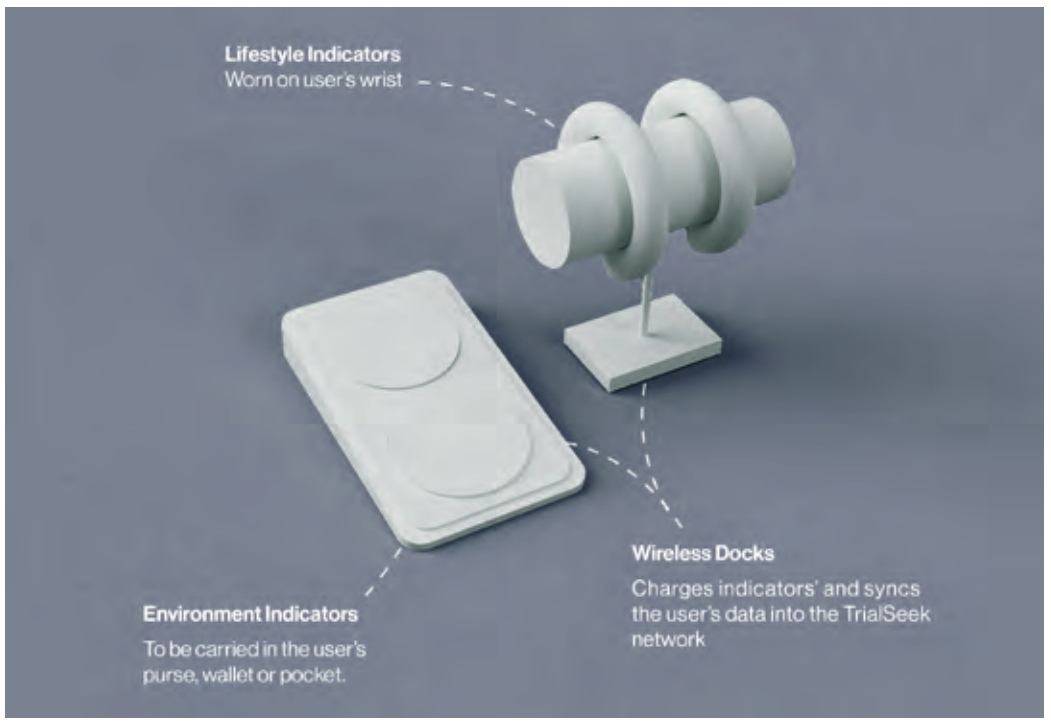
Capsule is a new pharmaceutical-focused lifestyle brand that seeks to disrupt the current conceptual model associated with courses of cancer medication. Capsule aims to embed itself discreetly within the patient's daily lifestyle and allow them to live their life emotionally separated from their illness. The target demographic for this project is young adults who are determined not to be defined by their illness. The refillable water bottle features a lid that conceals the pills in a special capsule chamber, allowing the user to load and swallow their medication discreetly. Capsule also helps its users to manage, track and record their recovery and share this information with medical professionals at the push of a button.

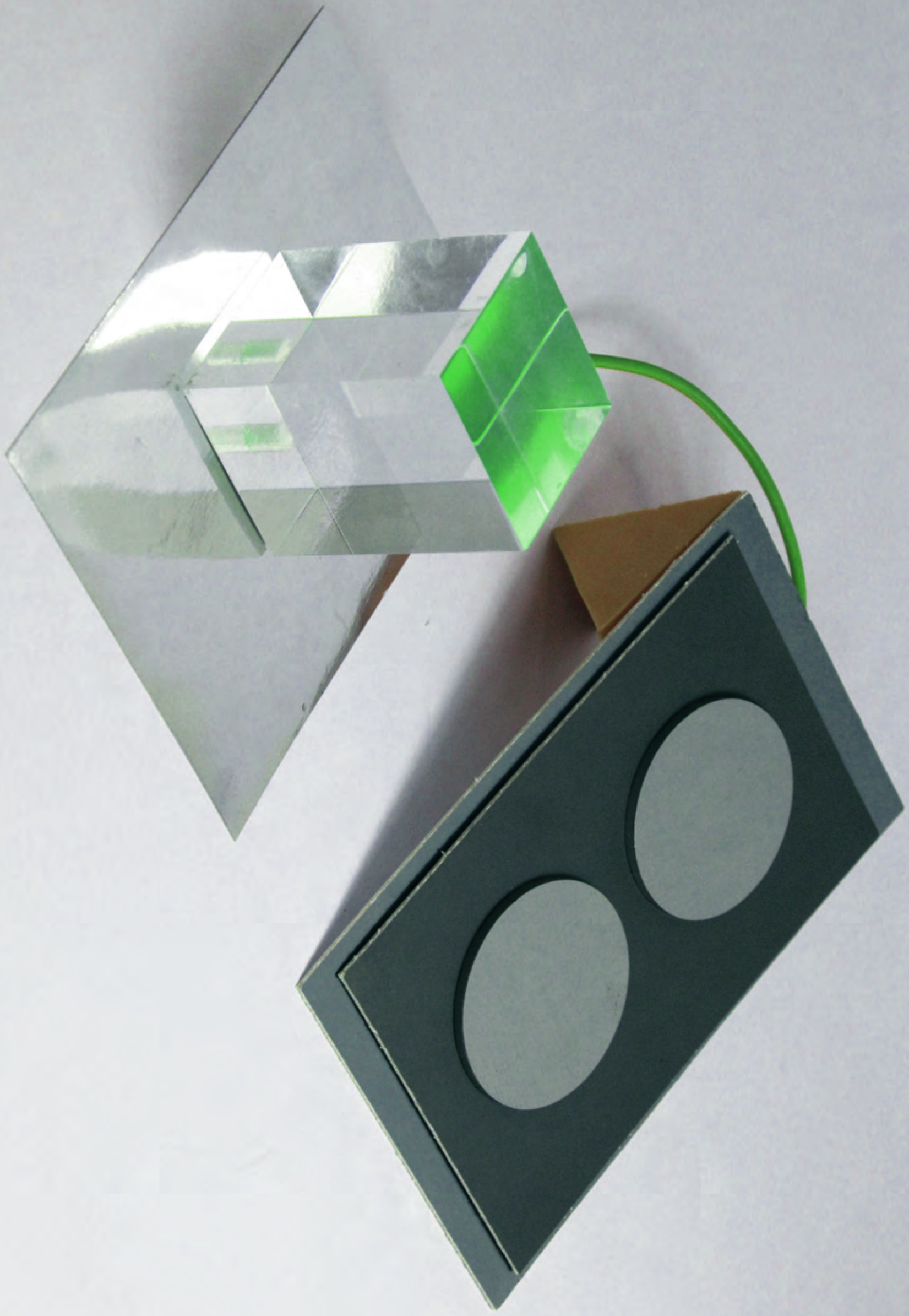
Charles Painter
—A New Perspective

Perspective helps future cancer patents collaborate with their oncologist and clinical nurse to identify a suitable course of precision medicine. The service provides information about the experiences of previous patients with similar genetic profiles in visual, audible and tactile formats. Patients would be invited to speak with their oncologist and clinical nurse about aspects of their life and future ambitions that might affect the type of precision medicine they are prescribed. They would then be presented with 3D graphs depicting the emotional and physical journeys of previous patients, which they can feel to compare the various highs and lows. An augmented-reality lens provides layers of additional information as well as video testimonials from patients at different points in their journey.

Erlend Prendergast —TrialSeek

This project explores the future relationship between artificial intelligence and clinical research – with a specific focus on how third-party lifestyle and environment data could be used to facilitate a more effective selection process for clinical trials. TrialSeek is a service which gathers and analyses an individual's lifestyle and environment data in order to match them with a suitable trial. It comprises a wearable device that tracks the user's activity and a portable sensor that gathers environmental data. This information is transferred to the TrialSeek network through wireless docks used to charge the devices. The data is used alongside other medical and lifestyle records to help the oncologist match the patient with a suitable course of precision medicine treatment.





Monika Kantor
—MAIA

MAIA is a voice-controlled digital health journal. The system is designed to alleviate the fear of cancer recurrence by providing guidance and support to survivors and their chosen loved ones in the form of visual and vocal feedback. Data gathered from a home blood test is analysed by medical professionals and sent to a main device that shares the results with the user. Care teams can communicate with the patient through the device to provide new instructions or schedule an appointment. A portable device tracks the user's emotions and heart rate throughout the day, looking for worrying levels of stress. If it detects any concerning data, or the user manually enters abnormally negative feedback, Maia can alert the doctor and chosen family members.

Victoria Hamilton —Collective Care

This project envisions a new internal collective within the NHS to help staff keep up with the rapid pace of change affecting treatments, products and services. The organisation called Collective Care (CC) challenges stakeholders to review the future implications of precision medicine and how staff will use it to deliver better prospects for patients. The service bridges the gap between design and healthcare, with the ultimate aim of creating a more interdisciplinary system and developing innovative new management structures. A specially developed toolkit would be provided for use in multidisciplinary meetings held to determine a patient's treatment, helping to sidestep multilayered procedures to achieve quicker and more efficient outputs.

Directory of Student Work

05

Adrianna Mozel
—MOOT

MOOT is a brand that tackles the cancer taboo by creating tangible representations of tumours that are unique to each patient. By providing a patient with a physical model of their own mutation, MOOT aims to change how people relate to their disease. The objects can function as tools to enable conversations between family members and even strangers. The modular design can also be further customised depending on the treatment progress. The brand takes into consideration the understanding that some cancers remain terminal and generates empathy through the objects' semantics.

Aleksandra Kaleta-Pyrek
—Biosence, 2029

The efficacy of precision medicine is reliant on the availability of data relating to a patient's genes, lifestyle and environment. Recent advances in epidemiology and geomedicine have contributed to more thorough health records and a better understanding of the complex relationships between the environment and human health. Biosence is a healthcare system that uses sensors incorporated into a wearable device to gather data about the environment we live in, including the food we eat, the water we drink and the air we breathe. The research from this programme, gathered by users all around the world, could contribute to increased awareness of key environmental factors affecting the evolution of precision medicine and cancer prevention.

Alexander Lister
—Panoptic Choice

The Panoptic Choicagraph project imagines that in the year 2028 pharmaceutical companies will genetically engineer chickens to develop cancer-fighting proteins for use in the development of personalised medicines.

Alison Erridge
—Parlour

By 2028, healthcare will be more seamlessly integrated into everyday life and routines. For this project, I was interested in the ways in which we consume medicines. As precision medicine evolves, it will allow treatments to be more targeted and have less severe side effects. With this in mind, can we transform treatment into a positive experience? Parlour provides cancer treatment in the form of ice cream. Using patients' genetic data, collected via at-home testing, the parlour creates the perfect precision medicines within the perfect ice cream, tailored specifically to the way you experience flavour.

Antonis Charalambous
—Decision Maker

This project is based on a dystopian vision of a future in which precision medicine influences how people are viewed in society. In the envisioned scenario, increased cancer rates have prompted the introduction of mandatory health-monitoring devices. These implants use artificial intelligence to monitor the user's diet, lifestyle and physical activity, which enables healthcare providers to prioritise treatments to those most in need. The role of the AI is to constantly analyse and feed back to the user on their personal device or smart devices in the home. The enforced use of the implant has caused a distinct divide in society between those diagnosed with a higher likelihood of developing cancer and those with more favourable data. Incorporated into the system is a tool called the Decision Maker that uses lifestyle choices, external factors and luck to place the user within either of the societal groups.

Benjamin Laing
—Capsule

Capsule is a new pharmaceutical-focused lifestyle brand that seeks to disrupt the current conceptual model associated with courses of cancer medication.

Charles Painter
—Perspective

Perspective helps future cancer patents collaborate with their oncologist and clinical nurse to identify a suitable course of precision medicine. The service provides information about the experiences of previous patients with similar genetic profiles in visual, audible and tactile formats.

Charlotte Smith
—Bloc Care

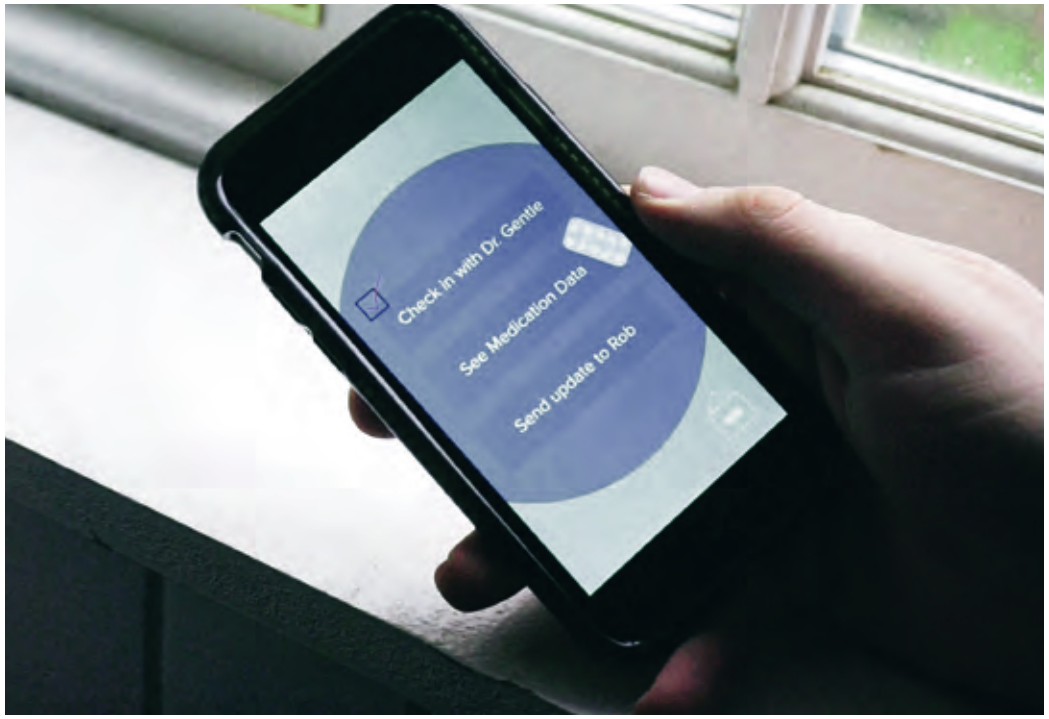
Bloc Care is a service connecting data from patients' monitoring devices with the expertise of a clinician to improve the management of cancer treatment for all involved. Bloc Care is a mixture of digital application and physical tool kit. Bloc tools replace traditional offline apparatus such as the stethoscope. The application is accessible on a tablet. When Blocs are placed on the tablet they display data sets from the patient. Stacking Blocs overlays the data sets. This allows for early detection and treatment of symptoms, whilst contributing data to the precision medicine research pool.

Clarisse Chapal
—Educ-cell

Educ Cell is an interactive platform for creating and storing physical models that manifest a patient's healthcare data in a comprehensible format. The system creates a living 3D databank over time in order to help people learn collaboratively through the use of tangible objects. It can be difficult for doctors to announce a diagnosis to their patients, and patients sometimes struggle to understand their diagnosis because of the complexity of the information they are presented with. In order for designers to visualise complex scientific data they also need to educate themselves and know more about healthcare before designing for it. The Educ Cell platform is designed to help improve collaboration and communication between medical experts, their patients and designers, whether they are interacting face to face or remotely.

Eddie Allbutt
—NHS Homecare

NHS Homecare is a future service framework provided by the Scottish Healthcare System; specifically designed to cater for patients in unusual, remote locations. The service is based on the idea that in the future, healthcare will be more integrated into our home lives. NHS Homecare would be built into the patient's treatment process following a significant event like chemotherapy or radiotherapy, when the patient is recovering alone at home. The patient would be provided with a collection of artefacts that would enable a dedicated treatment plan to be delivered and monitored remotely by the healthcare provider.



Emma Strain
—Symbiotic Community

Symbiotic Community responds to a societal shift that has seen more people providing companies and organisations with sensitive personal data. Advances in precision medicine are reliant on patients sharing data and Symbiotic Community aims to help bridge the gap between citizens and medical institutions, while ensuring patients are aware of what their data is being used for. A campaign across Glasgow linking together the creative industries, local councils and healthcare professionals creates a system to engage and inform individuals in unexpected and joyful ways. Artistic interventions designed to raise awareness of how precision medicine utilises personal genetic information would be placed in strategic locations across the city. Users approaching the artworks would find information to help them understand the need for data and encourage them to contribute to a wider research programme.

Erlend Prendergast
—Trialseek

This project explores the future relationship between artificial intelligence and clinical research – with a specific focus on how third-party lifestyle and environment data could be used to facilitate a more effective selection process for clinical trials.

Eve Mccann
—Alli

Alli – Connected Emotional Care, is a connected suite of devices which aims to provide older cancer patients with a more tailored healthcare plan. The three devices manage data collected from the user's digital interactions to detect changes in mood. Unusual activity is flagged in the nurse practitioner's web portal. Through analysing and monitoring the patient's digital behaviours, the nurse practitioner verifies whether these mood changes are medically related. The patient receives a notification on their self-reflective app and a domestic light-signalling tool glows brightly to alert the patient and other family members of the change in behaviour. The user then answers a series of questions through the app that are reviewed by the nurse practitioner.

Gabriela Karolak
—T•Care Precision Care

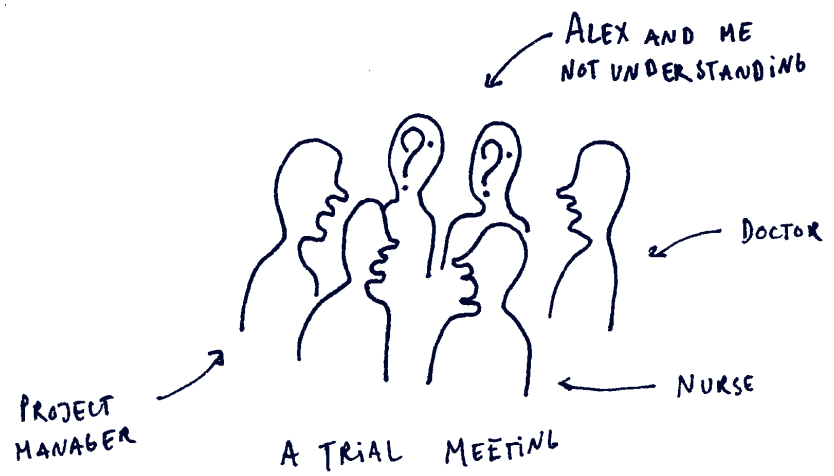
T•CARE is an artificial intelligence personal care assistant for future post-cancer patients. With more people anticipated to survive cancer in the future, the disease will likely be perceived as something more akin to a chronic illness than a terminal condition. Survivors will require dedicated care to adjust to life after cancer. AI technology offers an opportunity to provide tailored support during the remission stage, as a follow up to their course of precision medicine. T•CARE provides everyday support required to fulfil the patient's medical, emotional or practical needs. The personal care assistant can be fully customised to resemble a loved one and can be accessed through devices such as a bracelet which allows a post-cancer patient to be accompanied by their hologram Care Manager wherever they go.

Hanlin Zhang
—2028 Pjc System

The patient journey coordinator (PJC) system provides a new way to store a cancer patient's documentation. Each PJC provides independent and specific directional services relating to an individual's unique course of precision medicine treatment. In collaboration with professional doctors and a network of other staff offering tailored emotional support, the documentation detailing a patient's entire hospital journey will be improved. The data files relating to each patient will be being refined, eventually forming a medical manual belonging to the patient.

Lisa Kalt
—Collaborative Research Facilitator

Collaborative Research Facilitators are former patients who act as a bridge of communication between drug trial participants and researchers. The concept builds upon the existing role of the patient representative (PPI). In its current form the PPI service struggles with diversity and insufficient numbers of candidates as it has a number of barriers for most people who want to get involved. For example, it is unpaid and it requires candidates to bring transferrable skills with them. Taking advantage of the existing ties between hospital, university and art school, the facilitator would receive training provided by the different institution. This form of apprenticeship would allow them to become fluent in each stakeholder's way of communicating and enable them to act as a translator between patient and researcher to enable enhanced collaboration.



Marie Fremin-Besombes
—Trial Engagement

Clinical trials are essential to help develop treatments targeted at rare forms of cancer. Trial Engagement is a service that seeks to de-stigmatise clinical trials and encourage patients to participate using a pair of engaging artefacts. An augmented-reality app allows the patient to visualise the extent of their cancer and compare their medical records with those of other patients to find the most appropriate clinical trial. A children's book incorporating aspects of augmented reality helps parents to explain their cancer to their children. The service aims to make the patient a more active participant in the process of identifying clinical trials and supports them through their treatment.

Monika Kantor
—MAIA

MAIA is a voice-controlled digital health journal. The system is designed to alleviate the fear of cancer recurrence by providing guidance and support to survivors and their chosen loved ones in the form of visual and vocal feedback.

Morrighan Humpleby
—PreciseMe

By 2028, precision medicine will have drastically improved cancer survival rates and many more people will be living and coping with cancer as a long-term illness. This scenario will lead to limited availability of space in hospitals and more patients will receive their treatment at home. PreciseMe is a modular care system for administering at-home treatment. Its modularity enables the system to adapt to a patient's specific needs. The system of four main sections has over 80 combinations that can vary depending on medical factors such as what medical and diagnosis information the patient requires, the amount of toxic drugs within their treatment plan, but also the level of physical/verbal contact the patient would like with their doctor.

Olga Mrozek
—Perfect Us

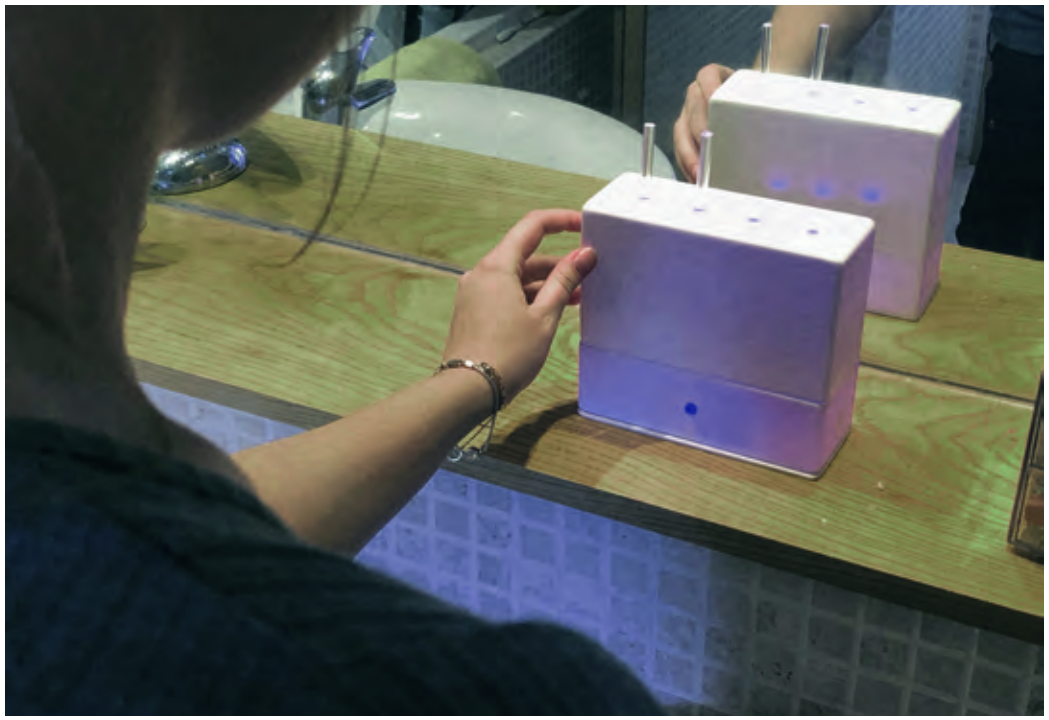
Perfect Us helps users to find a partner that is compatible on a genetic level, which can result in longer lasting and stronger relationships. Moreover, it offers an opportunity to find the perfect person for reproduction, making sure that the baby is just the way we want it to be: healthy, beautiful and cancer free. With help from precision medicine specialists, Perfect Us can minimise the likelihood of cancer occurring. The system uses a wearable device to analyse the air and identify particles of saliva normally found in human breath to find the perfect genomic match. When compatible saliva particles are detected the chip vibrates to guide the user towards their match. The Perfect Us app provides detailed descriptions about compatibility and possible reproductive information.

Sara Safrany
—Boost

While precision medicine generates amazing results, the medicine is so precisely developed for certain cancers and specific mutations that it creates a hierarchy between patients the medicine is suitable for and those with a different genetic make up. BOOST is a service dedicated to filling the gaps between different patients by introducing them to clinical trials and boosting the development of different precision medicines. The system employs a wearable device that is capable of performing a small liquid biopsy. The data collected can be submitted to clinical trials around the world and the wearer is rewarded in return with monetary credits. The main aim is to make it easier for patients to gather and submit personal data that will facilitate new clinical trials and the development of precision medicine.

Sophia Klinck
—Biseq

The microbiome serves immunological, structural and metabolic functions. Disturbances in the normal, balanced state of healthful microbial communities known as dysbiosis, is significant in patients with colorectal cancer. Whether the gut microbiota maintains health or promotes colorectal cancer ultimately depends on the composition of the gut microbiome, and the balance within the microbial community of protective and detrimental bacteria populations. BiSeq is a device designed for patients with colorectal cancer to monitor the balance of their gut microbiota, and make changes to improve their metabolism and response to medication. The patient's microbial data and reaction to drug therapies can be shared digitally with oncologists and other relevant medical professionals. This not only ensures that the patient is receiving the best treatment, but also drives further research in the development of better, more precise immunotherapies.



Teresa Raina
—Informed Consent for the Genomic Era

This project focuses on the issue of consent and how patients control the ways in which their private data is used. At a time of exponential growth in medical research, the role of consent has increased significance. The project looks at how we can make people more willing to contribute their personal genomic information to research, whilst increasing the population's "genomic literacy", enhancing engagement and ensuring transparency. The proposed system would see all citizens receive a package on their 21st birthday containing activities aimed at promoting conversations around the issue of genomic consent. The outcomes would be analysed by a counsellor and used to set consent preferences linked to the patient's data. Patients would then have access to a dynamic consent platform where they could view how their data is being used and update their preferences.

Victoria Hamilton
—Collective Care

This project envisions a new internal collective within the NHS to help staff keep up with the rapid pace of change affecting treatments, products and services. The organisation called Collective Care (CC) challenges stakeholders to review the future implications of precision medicine and how staff will use it to deliver better prospects for patients.

Zahra Merchant
—Qube

Qube was developed in collaboration with researchers at the Beatson Cancer Centre in Glasgow, and aims to make the clinical trial process more efficient, paperless and more transparent. The user-centred interface creates a shared network for supporting clinical trials related to cancer treatments. Qube utilises Blockchain technology, which allows data to be stored securely on a transparent and easily accessible platform. The service comprises the user interface and a biometric identity card that grants exclusive access to each stakeholder on the clinical trial network. The project's main objective is to facilitate easier access to medical data and promote collaboration between researchers to advance the evolution of precision medicine.

Conclusion

CONCLUSION

The Future Experiences project is exemplary of the Innovation School's unique approach to confronting key contemporary issues through innovative collaborative practice. Working alongside the University of Glasgow's Institute of Cancer Sciences provided opportunities to gain first-hand insight into the emerging topic of precision medicine and its implications for the future of cancer care. The input of various academics, experts and patient representatives also contributed to outcomes that are grounded in reality, responding to problems and concerns that were raised during the intensive research phase.

During the project, the students adopted various methodologies for organising and directing their research, including the use of STEEEPLE cards that enabled them to cover a wide range of subtopics through group work and share their findings with the rest of the cohort. The inclusion of targeted workshops at key stages throughout the programme helped the students to identify unforeseen opportunities by imagining the future consequences of precision medicine, as well as teaching them methods for creating quick prototypes that allowed them to present their concepts in a clear and understandable way. The students described these workshops as "incredibly valuable" and "integral to our creative process".

The intensive eight-week project culminated in a collection of sophisticated and considered outcomes that translated the group research into viable real-world proposals. The wide variety of future visions produced by the students demonstrates the scope of opportunity provided by this unique future-focused brief. Throughout all of the projects, however, is a consistent focus on the needs of the user, which is evident in proposals ranging from new ways for cancer patients to take and monitor their course of treatment, to the use of physical tools and augmented reality to map a patient's emotional journey.

For the students, this project offered a chance for them to utilise the skills and knowledge they have developed during their time at the Innovation School. One student described the experience as "a fascinating project that I thoroughly enjoyed", adding that "because of the project's complexity, I was able to develop my design thinking, research, and prototyping methods." Another added that "I learned a lot about conducting research in a controlled way," and claimed that "the Future Experiences project has exposed me to new topics and new design methods. This exposure has pushed me in my personal and practical development."

The many contributors to the project, including medical academics, healthcare professionals, clinical scientists and patient representatives also claimed that the process had opened their eyes to the potential for designers to offer an alternative perspective on their practice. They were impressed with how the students approached such a complex topic and were able to quickly identify opportunities for meaningful change. Several of the experts expressed a willingness to continue their engagement with the students in order to further explore some of the issues and ideas raised during the project.

On each occasion I met with the students I was inspired by the way they were able to see things from a different angle to what I expected. They had very original ideas and approached them in a completely different way to my own students. I came away from the meetings with a list of thoughts that I personally felt are worth exploring in more detail. Some of the ideas could be put into practice in the years to come.
Ed Tobias, Professor of Genetic Medicine at the University of Glasgow

The collaboration with the University of Glasgow was a unique collaborative initiative that provided benefits for both parties. The Innovation School's students had access to a wealth of knowledge and expertise in the emerging field of precision medicine, and the University of Glasgow was able to benefit from an alternative perspective on the subject it researches and teaches. This sort of collaborative practice is integral to the Innovation School's approach to design innovation, and helps to prepare our students for the kinds of multidisciplinary projects they may encounter in their professional lives.

I enjoyed working with the Innovation School because it brought me into contact with experts in their field that I wouldn't have come across in any other way. Working with the staff and students was tremendous because I got to see ways of working and thinking that are transferable across a whole range of projects. I also began to appreciate the unique skills and abilities that designers have. I now know that they are exceptional researchers and are able to quickly grasp complex concepts and turn them into something with real-world relevance or research potential. I could also see how in the future you might shape new ways of working by involving that sort of person in projects at a very early stage. They had no fear of the unknown and letting the project change and evolve as it went along.

Professor Nicol Keith

The varied outcomes of the Future Experiences project represent distinctly personal interpretations of a wide-ranging brief that challenged the students to examine new directions for a multifaceted topic. Precision medicine as a field of study will continue to evolve and expand over the coming years, and the role of designers will become increasingly significant as healthcare providers, pharmaceutical companies and genetic scientists seek to identify suitable real-world applications.

The work of the Innovation School on this project outlines some of the key issues that will face society as this scenario unfolds, and provides insight into the role design might be able to play in improving the future of cancer care.

DIGITAL IDENTIFIER AND OPEN SCHOLARSHIP

Immediately following the completion and presentation of the Future Experiences project, our partners at the University of Glasgow compiled the various research and outcomes as an open science project with its own digital identifier (DOI) on the University's data repository. This action makes it straightforward for anyone to access, navigate and retrieve resources relating to the project's methodologies and findings, therefore enabling the work to be referenced in academic papers, reports and applications for grants or funding.

By uploading the project to the data depository, it becomes part of the Open Scholarship programme. This will help to generate ongoing interest around the research, creating a legacy that is anchored to the institutes and people involved in its creation. Attributing a DOI to the project affirms its significance as a valuable example of academic study. It also ensures the provenance of the work is permanently recorded and any information used is traceable back to the originators. As part of an ongoing assessment of the project's value, any interest associated with the DOI can be tracked and acknowledgements in future research or papers will be officially logged.

Bringing the GSA/UoG Cancer Precision Medicine collection together in this way as a data deposit with its own DOI is a major step forward and represents innovative thinking around how we address complex projects with multiple 'data' types/outputs and a range of contributors. The speed at which this was done is also an important factor in its value – as soon as the project was finished it was out in an organised meaningful collection format. It's essentially real-time dissemination of results, knowledge and know-how. By putting the collection in the repository we can also track interest. There has already been considerable interest in this work for a variety of reasons, some specific to an aspect of the project, while others are interested in the design innovation approach or indeed the transdisciplinary way in which it was achieved.
Professor Nicol Keith

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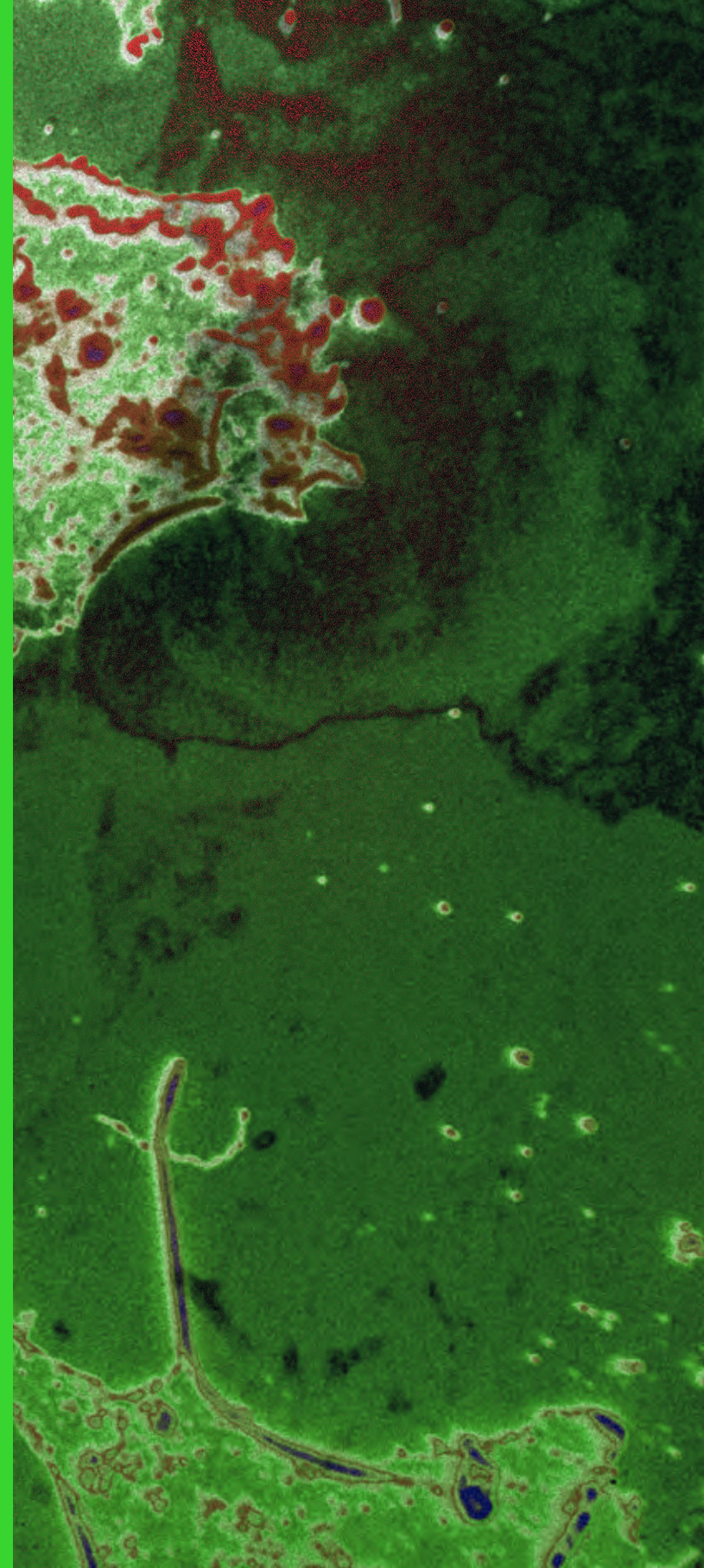
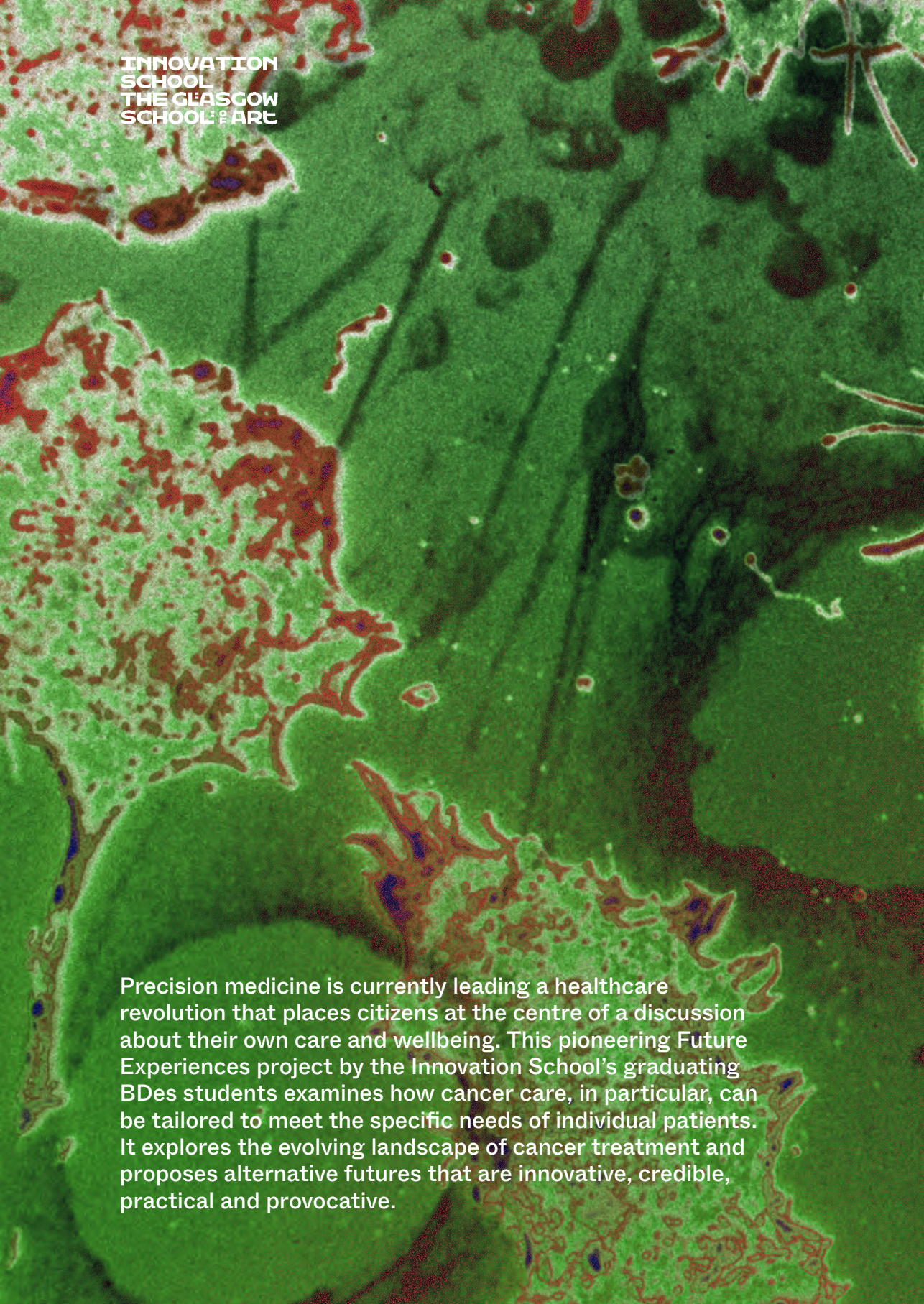
INNOVATION SCHOOL
THE GLASGOW SCHOOL OF ART





Precision medicine is currently leading a healthcare revolution that places citizens at the centre of a discussion about their own care and wellbeing. This pioneering Future Experiences project by the Innovation School's graduating BDes students examines how cancer care, in particular, can be tailored to meet the specific needs of individual patients. It explores the evolving landscape of cancer treatment and proposes alternative futures that are innovative, credible, practical and provocative.