UXD Beyond the Screen. A UX approach to Industrial Design Teaching

Matt Sinclair, Programme Director for BA Industrial Design, Loughborough School of Design & Creative Arts, U.K.
Val Mitchell, Programme Director for MA User Experience Design, Loughborough School of Design & Creative Arts, U.K.
Garrath Wilson, Lecturer, Loughborough School of Design & Creative Arts, U.K.
Stuart Cockbill, Lecturer, Loughborough School of Design & Creative Arts, U.K.

Digital Touch concept for couples in long distance relationships, by Aakif Imthiyaz, Abbie Langley, Alice McCutcheon, Eliot Greenwood and Tobi Cahill, 2019.

Touching Things

The suggestion that, in future, user experience designers will need to engage with interactions mediated through interfaces that are not flat, hard, rectangular screens, is not particularly new or insightful. Most of us are familiar with concepts that utilise projection and motion sensing, and augmented- and virtual-reality technologies are increasingly being seen in consumer products. Even where screens continue to appear in future products, it is likely they will become softer, non-planar and non-rectangular. In “A Brief Rant on the Future of Interaction Design,” Victor [1] describes the paucity of feedback offered by a touchscreen compared to other objects. He writes about handling a book: “Notice how you know where you are in the book by the distribution of weight in each hand, and the thickness of the page stacks between your fingers. Turn a page, and notice how you would

know if you grabbed two pages together, by how they would slip apart when you rub them against each other." We would add that in addition the weight and glossiness of the paper tells us something about the book's value and perhaps whether it is fiction or non-fiction, whereas its smell will give clues about the book's age and history. This, Victor suggests, is the future of interaction: one in which the versatility of grip, precision, control and tactile response of the hands and fingers are celebrated and exploited.

If none of this sounds particularly contentious, then the question of who should design these future interactions may do. In the digital domain, on-line and off-line, it is HCI and UXD specialists who can claim 'ownership' of expertise. But in the design of tangible objects, from medical devices to earth-moving vehicles, from power tools to luxury watches, it is industrial designers that have a tradition that is both longer and broader than that of digital designers. And in our view it is industrial designers, if trained to be familiar with contextual enquiry, empathic insight generation, persona and scenario creation, experience mapping and prototype testing, that will be best placed to design these future interfaces.

Domestic insect cultivation, a Final Year Design project by Tom Constant, 2018

Short-throw projector, a Final Year Design Project by Raymond Ng, 2016

It is important to state here that this contention does not come from a group of industrial designers trying to 'reclaim' or appropriate interaction design or UX design. Of the four authors, two are from ID backgrounds, one from HCI and one from service design (but having originally trained as an industrial designer). We have come to the teaching and expounding of UXD through different routes, and continue to have different perspectives and areas of emphasis. What we share in common is the belief that the teaching of ID through a UXD lens leads to designers capable of imagining user-centric interactions beyond the screen.

UXD at Loughborough Design School

At the higher education level, particularly in Nordic and other Northern European traditions, there has been a trajectory from Industrial Design to Interaction Design [2], with students transferring these skills to the workplace in the sectors of UX and Service Design [3]. In parallel, approaches to UX pedagogy have emerged from the HCI tradition [4], evolving from the theories and practices of subjects such as Computer Science, Psychology, and Ergonomics. At Loughborough Design School, the pedagogic roots of our UX teaching have bridged both traditions, however in recent years we have pioneered an approach that challenges these conventions, by situating UX processes at the core of ID teaching. We suggest that such an approach results in graduates who are better suited to the multidisciplinary modes of creative working that industry increasingly requires.

At Loughborough Design School, undergraduate ID students have been offered an elective module in UXD since 2007. LDS has always had a strong focus on both user-centred design and project-based learning, putting the human experience at the centre of a design process which encourages making

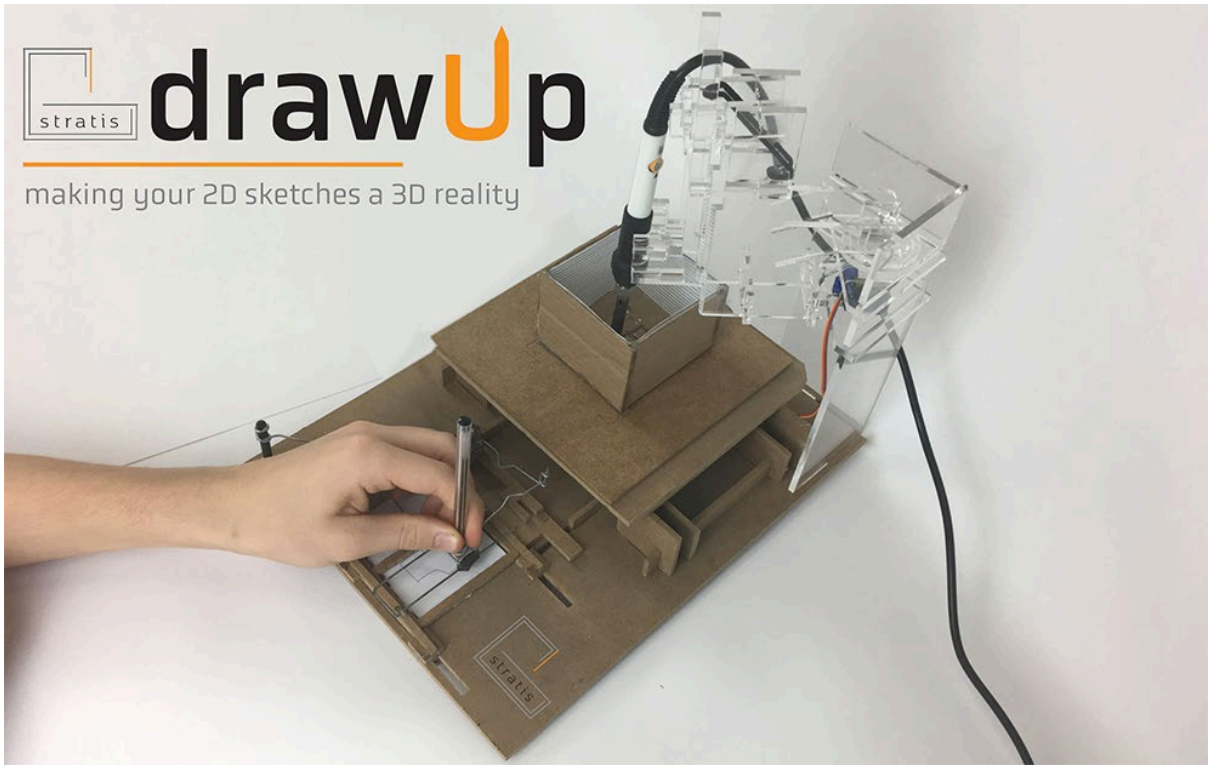
and user engagement. Within this context, our UX teaching initially developed from a mindset that viewed UX as an additional skill for ID students. Nonetheless, despite accounting for less than 10% of the total credits for an undergraduate degree, this approach to teaching has led to a situation where approximately one third of graduates (35-40 students per year) from the programme currently enter industry as UX designers. Graduates from LDS's ID programme now occupy senior UX positions at companies such as IBM, Google, BBC, Fjord, Foolproof and Goldman Sachs.

Gradually, this notion of the place of UXD as an addition and a development of our ID programme, has changed. As our UX teaching became more established in the curriculum, we initially encountered students who wanted to change focus, who wanted to study to become UX rather than Industrial designers. But in recent years, we have increasingly observed students who, rather than seeing UXD as additional to ID, or even as a distinct discipline, instead see little division between the two. As educators we might describe this as multidisciplinary, but from a student perspective this could more accurately be described as uni-disciplinary: "*it's all design, it's just related to different aspects of a product*." In response to this, the teaching of ID at LDS has increasingly evolved to consolidate the use of UX methods and processes.

Prototyping Experiences

At LDS, the first attempt to explicitly use UXD methods in the teaching of ID has been in the compulsory 2nd year IDS2 module, worth 30 credits (15 ECTS), delivered over two semesters to approximately 90 students. The module focuses on the use of prototyping, in its broadest sense, as a means to explore, test and iterate concepts towards improved outcomes - this is in contrast to traditional ID teaching in which 'prototype' is often synonymous with 'model', which in turn implies a demonstrator rather than a learning opportunity (see for example ID Cards by Evans et al). The class is taught over a single day and based in a large studio, with additional computer labs and workshop spaces close by. It begins with a one hour lecture, followed by three, 2-hour sessions; in one of these sessions a student will receive specific software skills teaching while the remaining two sessions initially focus on fast, one-day projects, but then move to project support through group tutorials. Students deliver three submissions throughout the course of the module; two group projects and one individual.

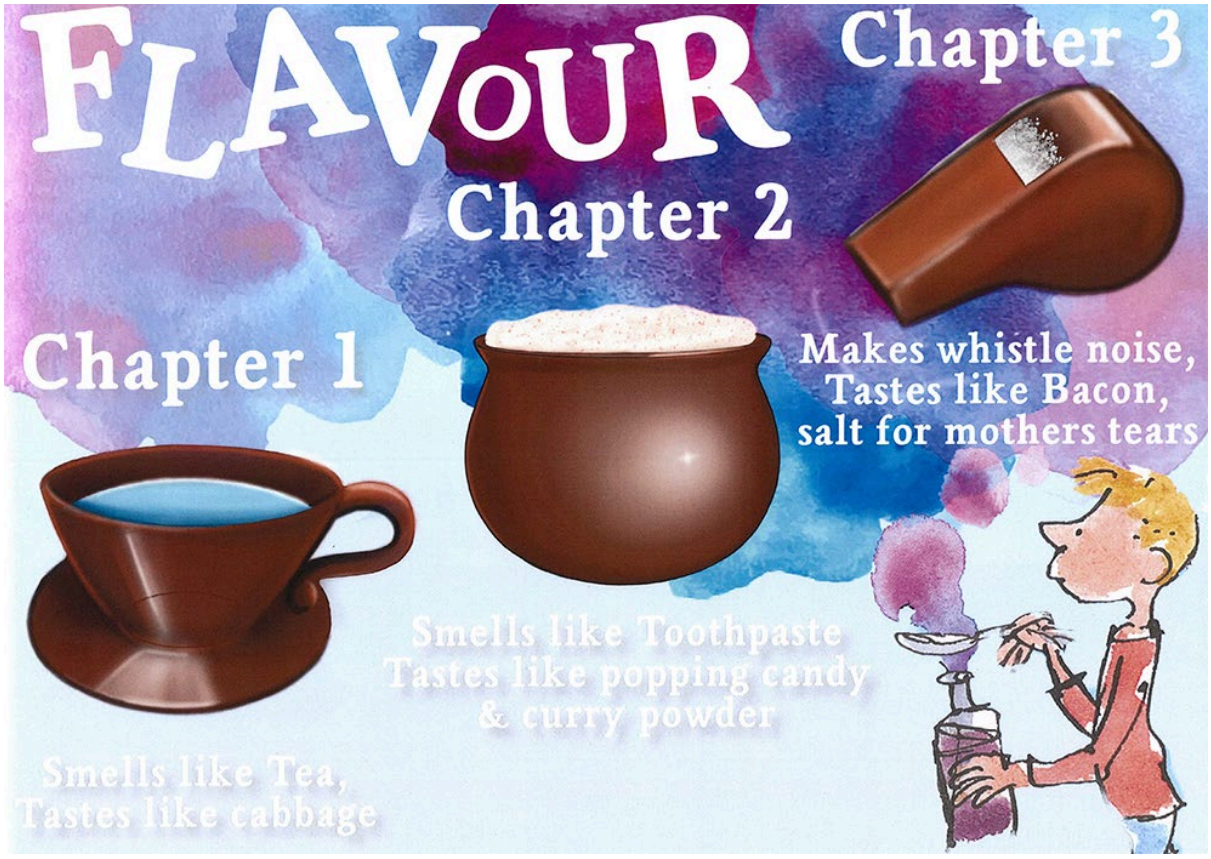
In Semester 1, students spend two hours per week learning Arduino breadboarding and coding. Working in groups of two they are firstly required to complete weekly tasks such as designing a repeating lightshow or controlling a servo motor. Students submit a circuit diagram in Fritzing and a 30 second video to a personal blog (see for example: https://lewisteasdale44.wordpress.com/author/teasdale44/). Having established a basic understanding of physical computing, students then work in groups of four or five to design a response to a brief broadly related to 'personal well-being', and are required to submit an Arduino prototype as part of a concept that is integrated with elements below.



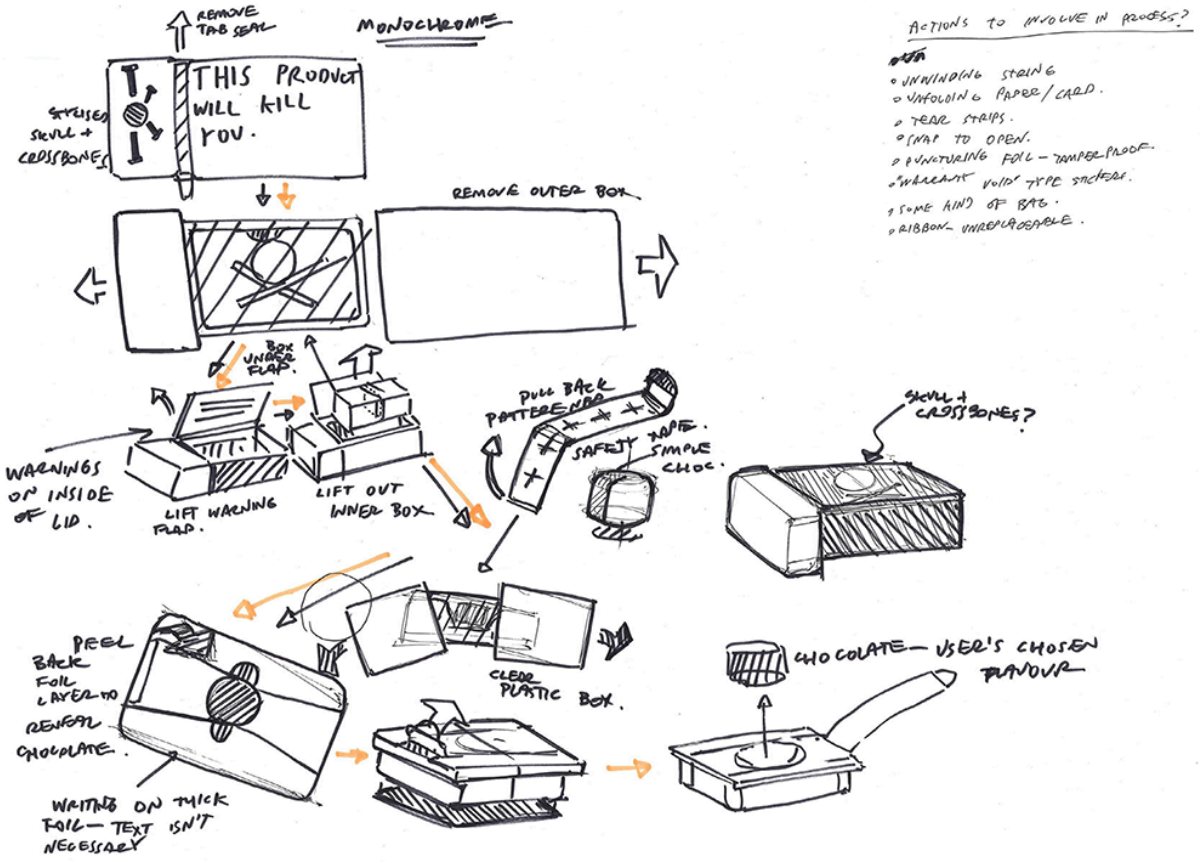
3D Printer prototype by Anna Mitchell, Livi Ablett, Ollie Butt and Teddy Dickson, 2018

UX Approaches in Industrial Design Teaching

While learning Arduino, students are simultaneously introduced to methods such as Personas, Journey Mapping, Cardboard prototyping, etc, which they will need to utilise in the module's submissions. Here the physical limitations of the Design School facilities create interesting dilemmas, and learning experiences, for staff and students. The lab in which Arduino is taught can accommodate 40 students, thus the cohort has to be split into three and the lab repeated three times. This means that in any one of the three, 2-hour sessions, one group of students will be in the Arduino lab while two other groups will be in the studio together. Depending on a student's group, they will encounter the day's teaching differently to a student in another group, and thus the teaching itself becomes a demonstration that individuals experience the same thing in different ways. This also provides possibilities for interesting learning opportunites. For example in one studio, students were asked to design a 'chocolate experience'. In session one, students in Group A went to the Arduino lab while students from Groups B and C formed teams to develop the concept for the experience. In session 2, students in Group B left, while students in Group A returned and worked with students in Group C to develop the concept; this was similarly repeated in session 3. Each time students returned to the studio, we observed how some were delighted, but some disappointed by the way their ideas had been interpreted and developed. The constraint of having to divide the cohort into three groups thus became an opportunity for students to reflect on communication within teams, the issues involved in developing and maintaining a shared vision, and the notion that no-one's idea is too precious to be improved.



'George's Marvelous Medicine' chocolate experience, 2019. Every time a child reads a chapter they are allowed to eat one of the chocolates.



'Dignitas' chocolate experience, 2019. Voluntary euthanasia by eating the best Swiss chocolate you've ever tasted.

In Semester 2 the ethos of the module continues to be one where prototyping is 'a way to arrive at better solutions', with students introduced to the use of Bodystorming to roleplay scenarios, Marvel and Sketch to create wireframes of increasing fidelity, and video prototyping as a way to construct compelling narratives. Hunt statements and How Might We questions are introduced as ways to frame research strategies and innovation opportunites. This is done within the confines of a project brief that asks students to develop a future-facing 'Digital Touch' product that enhances communication through touch. This brief was first developed as part of a collaboration between HCI, ID, and Social Science academics from LDS and University College London's Knowledge Lab, and was delivered to students on the elective User Experience Design module [5]. This was further developed to fit the IDS2 module, such that students are required to think about how sensations of touch can be used to communicate information, feelings, sensations, skills, thoughts or ideas between humans, humans and machines, or humans and other objects.

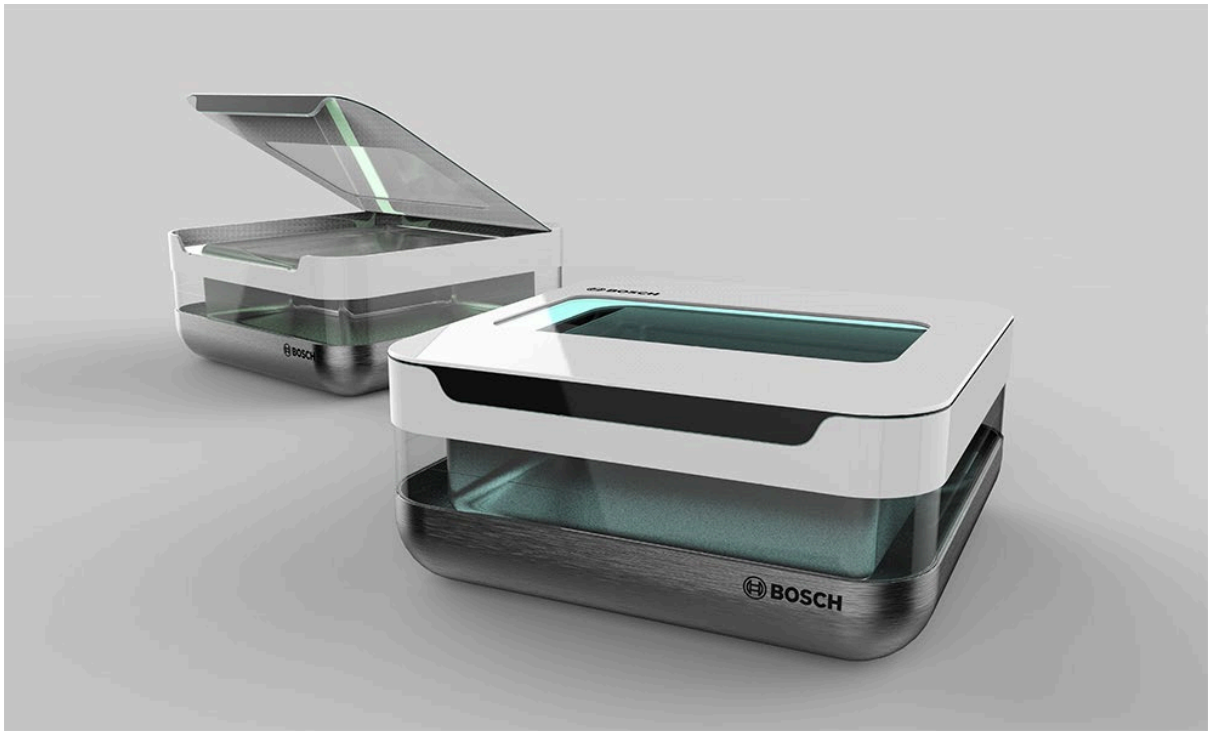
Working in groups, students create a research plan that involves conducting user research (typically observation and interview). They are instructed that their work work must adhere to an ethical framework to ensure participants' safety and wellbeing, which includes reflecting on what might be appropriate contexts and boundaries of touch. Students taking the module will already be familiar with concepts of responsibility and consent in research, having previously taken two compulsory modules in Design Research, and at Loughborough this is seen as a necessary pre-requisite for serious engagement with a project of this type.

Contextual user research forms the basis of a persona that a group creates, listing motivations, pain points and the brands that the persona associates with the experience. These then feed into the video prototyping submission, where emphasis is on the use of video as a way of both creatively exploring design opportunities, and communicating these through compelling stories. Continuing to work in groups, students spend four weeks creating a user journey story of their developing concept, through video. In the initial stages, scenarios are roleplayed while being filmed in a deliberately 'rough and ready' manner (usually on a handheld mobile phone). To do this there will need to be a rudimentary script and storyboard, but inevitably, as the scenario is acted out, issues with the proposed concept will become apparent. Either during filming or when watching afterwards, students are told to stop the narrative, and clearly verbalise the issues, or painpoints, that the user within their scenario has encountered; these stop points then become the focus of improvements to the design. As the project progresses, the video prototypes become more sophisticated – filming is carried out in context, physical prototypes are built to better illustrate the scenario, filming and editing are more considered, and post production effects are added - but the emphasis continues to be on the way that prototyping leads to improved outcomes.

'Unfriendly Electrics' by Campbell Castagna, James Bayliss, Oliver Butt, Teddy Dickson and Thea Willmot, 2019. When the system detects too much energy is being used it ejects the plug of the electricity-wasting device.

Pollution detecting handlebars by Christian Abbott, Henry Smallbone, Jacob Gavaghan, Jamie Ross-Evans and Luca Griffiths, 2019. The bars analyse pollution levels, traffic density and road surface conditions, and direct the rider on the best route.

The final part of the module (the only part carried out individually), is the most readily recognised as a typical ID project. Students are instructed to build on the video (after all, it is a prototype rather than a final design) and develop it to a proposal for a future 'Digital Touch' product. In doing this, they must select a brand and analyse its design language (their submission must look as if it belongs to the brand's portfolio), conduct further user research aligned specifically to their own concept, develop a new persona based on this research, and storyboard the user's experience. Although students are told that their concepts should have a basis in technological reality, this is not the focus of the project – as long as they are able to show evidence of feasibility the project will satisfy the brief. Rather, we are aiming to encourage an understanding of the way that prototyping can lead to unexpected and original outcomes.



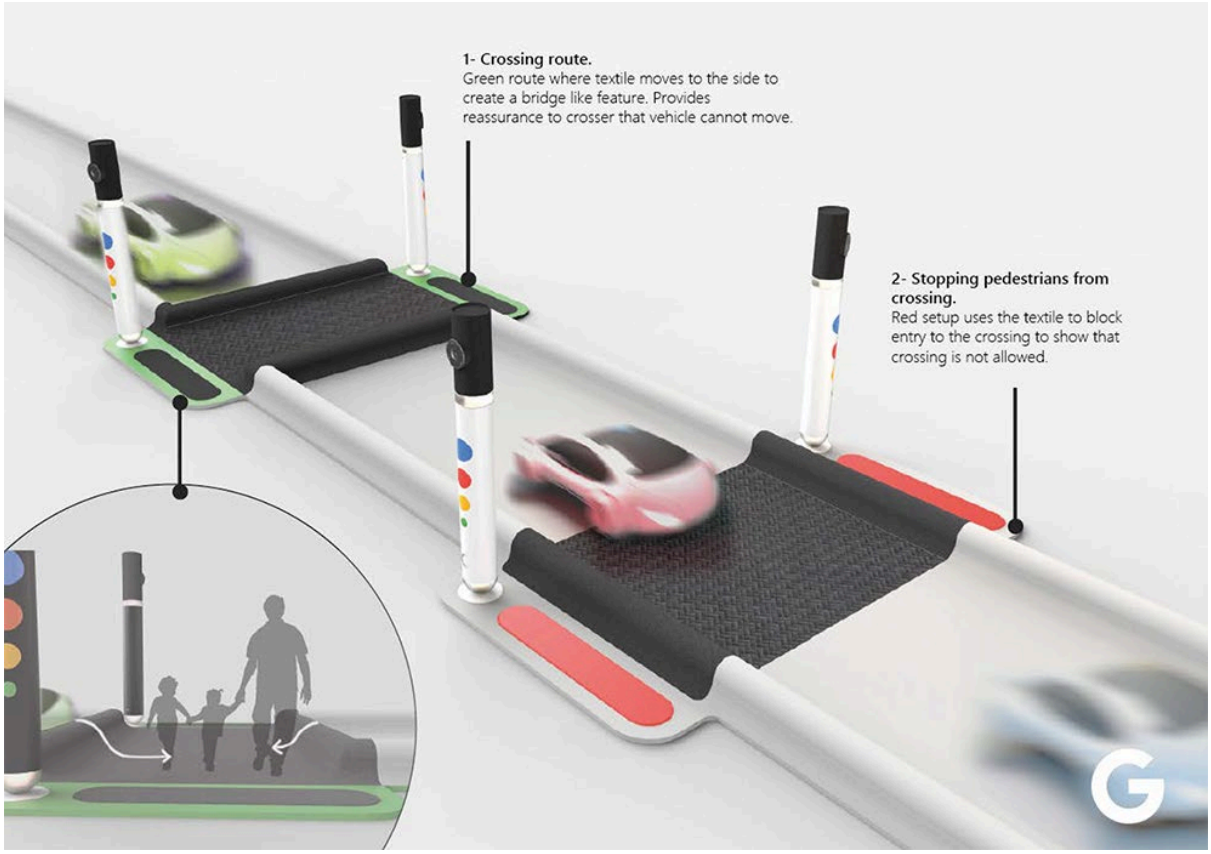
Smart storage containers by Rosie Roberts, 2019. The container expands as it detects food is nearing its use-by date, taking up space in the refrigerator and encouraging users to eat the food.

Expertise

This emphasis on designing the unexpected is the primary struggle that students face on the module, and a key transformation in their development as designers. The Digital Touch brief, which requires students to define their own problem, user, context and technology when developing a solution, will be the most complex design problem they have experienced at this point in their education. Cross [6] cautions against the use of conventional studies of expertise, which tend to focus on well-defined problems, unlike those that designers often encounter. Nonetheless, as Dorst and Reymen [7] comment, similarities with conventional models "are intuitively recognizable to anyone involved in teaching design". Students entering their second year will typically use design strategies associated with occupying the boundary between the Novice - Advanced Beginner [8] categories. At the end of this year, most will have moved to the boundary of the Advanced Beginner – Competence categories, at which point they are beginning to work in a radically different way [7]. Introducing UX methods to students at this stage in their development therefore has the potential to profoundly influence their model of design as they progress to the stages of Proficiency and Expertise.

Cooking for the blind, by Lloyd Potter, 2019. Heat is controlled by raising, lowering and turning the controller which hovers above the cooking hob.

In this project, the giving of permission to take a concept in a direction that hasn't previously been judged as 'good design' is difficult, sometimes even traumatic, for students. For most it is the first time they have been expected to be comfortable with ambiguity and speculation, where imitation of existing examples is not possible. Our feeling is that introducing UX methods helps here – they are new, which reinforces the notion that the design a student is doing is different to what they have done before, but they are also prescribed, giving structure to the progress of the project. Similarly the focus on an existing brand provides boundaries for experimentation, and is one aspect where students are within their comfort zone. Encouragingly, we find that many students become confident enough to challenge their original notions both of what communication is, and of what is worth communicating.



Pedestrian crossing by Hannah Le Gassick, 2019. Reassures pedestrians that autonomous and driverless vehicles will stop to allow them to cross safely.

Reflection

In reflecting on the module, in particular the work that students do and the feedback they have given, we make a number of observations that support those we have made previously when teaching the elective UXD module. Firstly, while some students are simply 'good designers' and do well in all modules, others identify more narrowly as industrial designers – it is what they have been told they are good at in the past, and it is what they came to Loughborough to study. These students are often skilled – they can sketch well (in a ID style), and create good renderings of 'cool-looking' design solutions – but are challenged when told these are not the attributes (or definitions of 'good design') that we are looking for. In the Advanced Beginner category [8] they are among the best in their cohort, but subsequently experience the most difficulty in letting go of their mental models of what ID is as they transition to the Competence category. In contrast it is the students who have previously seen themselves as good, but maybe not the best (and who are disproportionately female), who are most receptive to the module and the argument that they must become the designers of experiences rather than just 'things'.

In the past these have been the students that have gone on to employment as UX and Service designers, but who are increasingly sought after in conventional ID roles. They tend to be the students who understand research is a part of the iterative work that designers engage in, rather than something that occurs prior to designing. Similarly they understand prototyping as part of a creative process of improvement (Question – Plan – Test – Reflect - Repeat) rather than a stage gate to pass through (Test – Prove). At the end of the module their work might be less polished than that

of their peers, but it has the potential to go forward in many different directions. This, then, is the first iteration of a model that we propose as the future for ID teaching. It will form the basis of a new programme soon to be announced at Loughborough, that will replace the existing Industrial Design programme. And we hope, and expect, that its graduates will continue to be at the forefront of experience design practice.

[1] Victor (2011), *A Brief Rant on the Future of Interaction Design* [online], available from: http://worrydream.com/ABriefRantOnTheFutureOfInteractionDesign/

[2] Bill Moggridge (2007), *Designing Interactions*, The MIT Press: Cambridge MA.

[3] Marc Hassenzahl (2018), A Personal Journey Through User Experience, *Journal of Usability Studies* 13(4), pp. 168–176.

[4] Steve Harrison, Phoebe Sengers, and Deborah Tatar (2011), Making epistemological trouble: Third-paradigm HCI as successor science, *Interacting with Computers,* 23(5), pp. 385-392.

[5] Val Mitchell, Garrath T. Wilson, Kerstin Leder Mackley, Carey Jewitt, Lili Golmohammadi, Douglas Atkinson and Sara Price (in press), Digital Touch: Towards a Novel User-Experience Design Pedagogy*, Design and Technology Education.*

[6] Nigel Cross (2004), Expertise in design: an overview, *Design Studies*, 25(5), pp. 427-441

[7] Kees Dorst and Isabelle Reymen (2004), Levels of expertise in design education. In *DS 33: Proceedings of E&PDE 2004*, the 7th International Conference on Engineering and Product Design Education, Delft, 02-03 September.

[8] Stuart E. Dreyfus (2004), The five-stage model of adult skill acquisition, *Bulletin of Science, Technology & Society*, 24(3), pp.177-181.