Where, Who, Why?
Tools to Encourage Design In Context

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Figure 1: Sketches, mockups and storyboards.

ABSTRACT

We need to teach our students 360-degree design, taking into account the physical and social context in which their designs are placed in addition to the screens or aural interactions users have with them. Unfortunately, despite 40 years of HCI, UI and UX methods that have emphasised the importance of this wider view, the dominant tools in current UX practice are focused almost entirely on the screen. We want to understand the requirements for next generation design tools, and to take steps to fill the void. This snapshot of work in progress presents some examples that are driving our thinking, early prototypes of tool concepts, and our current work engaging with designers, developers and other stakeholders.

CCS CONCEPTS

• **Human-centered computing → HCI design and evaluation methods**;

KEYWORDS

user-experience design, user interface design, prototyping, design tools, storyboard, wireframe, HCI education

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1 INTRODUCTION

1.1 The problem

We all have similar stories ...

The students had been given a brief to design a “just on the horizon” digital product. One group presented their idea, a newspaper using rollable digital paper in a scroll-like device. They described enthusiastically how the user could unroll the paper then using controls on the edges, flick from page-to-page.

“When the user is finished,” they said, *“they let go, the paper is spring-loaded and rolls back into its case, and next time it is opened it is back on the front page.”*

“Where would they use it?”, the instructor asked.

“Perhaps sitting in an armchair at the end of the day.”

“So, I’m sitting reading, reach for my mug of tea and the paper springs shut...?”

“Ah!”

The superficial problem was easy to fix, but the real problem was that the students had only thought about the device itself and the contents of its screen (no matter how flexible). They had considered, but not fully visualised how and where it would be used.

As good educators we will try to emphasise the importance of considering a full 360-degree context, from the screen ‘looking out’ as well as into the screen itself. This is critical to ensure that students take into account where and when the interaction is happening, who is involved and why. We might suggest creating rich scenarios and storyboards and offer sage advice, *“Whenever you draw a screen design, draw a sketch of the user in context as well.”* However, it is critical that we can offer students aids to help them in this process.

Since the earliest days of human–computer interaction, theory, philosophy and practical methods have emphasised this broad approach to understanding the people, purposes, objects and places that surround interaction. This has included socio-technical design such as Checkland’s Soft Systems Methodology [5], ethnographic techniques [14], contextual enquiry [2] and current user research approaches. Unfortunately, popular tools do not currently reflect this wide perspective.

1.2 Tools for design

When we come to teach prototyping (both low fidelity and high fidelity), we are likely to suggest tools such as Balsamiq or Figma. When Campos and Nunes surveyed UI practitioners' tool use in 2007 [3], they found limited uptake, but today the situation is reversed. Taylor Palmer's annual *Design Tools Survey* of more than 3000 UX practitioners [10] found that almost all used multiple tools, but that these are almost entirely focused on individual screen design and screen-to-screen linking. There are professional tools for story-boarding and user stories, but these have relatively little use, with most designers opting for free-hand techniques.

We can hope that experienced designers will constantly refer back to these sketched contexts – perhaps having sketches of physical settings and persona descriptions pinned around their workplace – remembering that each wireframe will be used by a person in a situation. However, the tools offer little support for this beyond space for comments, and no scaffolding for the less experienced designer.

1.3 Does it matter?

Every carpenter is constantly aware of the grain of the wood, the way the growth layers rise up towards the surface, whether they are cutting with the grain, across the grain, or against the grain. If you are very skilled, if you have the right tools, if they are sharp enough, and if you are very careful, you can work in any direction. Indeed, there are special saws specifically for cutting across the grain. It is possible to work in any direction, but it is far easier and more natural to follow the grain, to work *with* the grain.

Similarly, every tool has a grain, a set of things that are easy and natural to do and other things that are – in principle – possible, but far harder to do, or simply not suggested by the tool. If you are expert enough, it is possible to keep the context in mind whilst using a wireframing tool, but it naturally suggests a device/screen-oriented approach.

2 THE CHALLENGE

The challenge we have set ourselves, is to understand the potential for future design tools that scaffold the learning and application of context-rich approaches, both for students and practitioners. We are looking towards next generation design tools, that are not simply replete with features, but actively support best practices. As well as our immediate focus on context, this might include other facets such as physical prototyping or just-in-time access to relevant evidence-based advice (for those with long memories, think Mosier and Smith [9] embedded in tools).

3 DRIVING EXAMPLES

We have a number of examples that we are initially using to drive our own thinking. We are conducting a review and feature analysis of current user-experience tools pertaining to several stages of the design process, but this will be augmented by focused workshops with students, educators and practitioners to identify their perceived gaps and engage in the envisionment of future tools.

Figure 2: Internet fridge – situated and phone-based interfaces

3.1 Example 1 – Traditional App Design

The first example is of a fairly standard application design of an internet enabled 'smart' fridge. These have been available for more than 20 years but are now being more extensively marketed due in part to improvements in the image processing needed to keep track of fridge contents.

As part of a masters course, one group of students chose this as their focus, but quickly hit barriers in tool support. Figure 2 shows a sketch of a screen embedded in a fridge, and an example of screen contents (sketches reproduced by one of the authors). While the tools available supported low and high fidelity prototypes and mock-ups of the fridge-door screen designs, these were divorced from their location.

In addition, the full application involved a partner phone app, which itself might be used in a variety of situations. The same screen design may function very differently when sitting in an armchair in one's own home, or while holding on to a toddler with one hand whilst shopping in a supermarket. Finally, usage scenarios include actions such as scanning an item as it is put into the fridge, this would be included in early storyboards, but harder to include in later stages of prototyping.

3.2 Example 2 – Physically Situated Design

A research project with Swansea City Council has created an installation, called *Lookout* [6], to enable the public to visualise a new urban regeneration project that is still under construction. Figure 3 shows an example of the storyboards and early visual mock-ups used to communicate the design and context of the Lookout with the stakeholders and community members.

The devices, which are now deployed, offer a form of teleportation to view the future of the Swansea Development site once the construction has been completed. The original sketches were based on the Telescopr system [11] designed to allow VR views of the Hafod Copperworks site, and are also similar to Augurscope [12]. While both Telescopr and Augurscope were designed to look back

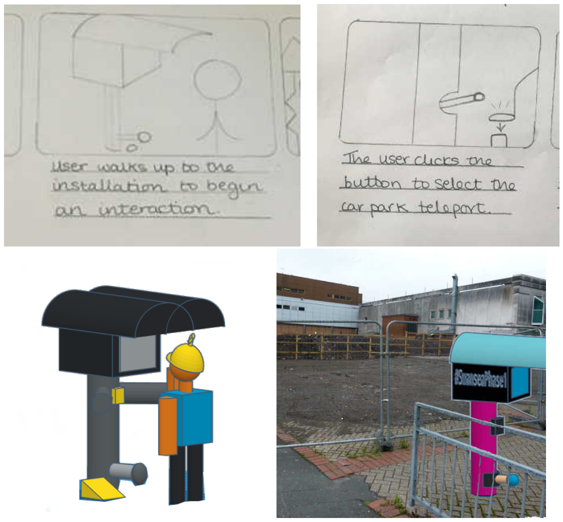

Figure 3: Viewing the future – highly situated walk-up and interact device

in time, the new device is aimed at giving the public an interactive glimpse into the near future [4].

The screens themselves enable the users to venture around the different buildings within the development and include the ability to put photographs of oneself into those views with the option of adding AR based filters. Furthermore, the installation had to be Covid-safe (elbow and foot controls only) and also attract the interest of passers-by.

Several aspects of this design are highly situation specific and the custom hardware had to be designed alongside the screen content. Physical actions on the physical device have an effect on the screen display, and there are no point and press interactions at all as this would have not be Covid-safe. Crucially the communication with stakeholders about the physical situation was critical, including establishing the need for a second child and wheelchair friendly device.

The visual mock-ups were created by both hand drawing and with photo-editing tools, but this was not supported by UX tools.

3.3 Example 3 – Design Futures

Figure 4 shows example storyboards as part of a project examining the interaction potential for shape-changing materials. This included screens with non-standard and malleable shapes and also devices (a physical–digital jacket) where the dominant interaction potential was not screen-based at all. The storyboards were developed in response to the 'future work' speculations of peer research in the field of shape-changing interfaces [13].

The illustrated storyboards were produced by hand drawing and colouring. Students who are introduced to the area of HCI as a design topic often use state-of-the-art digital storyboard applications. These do ensure a consideration of context but also tend to encourage single viewpoints, rather than looking at the same situation form different angles as recommended by expert literature [8].

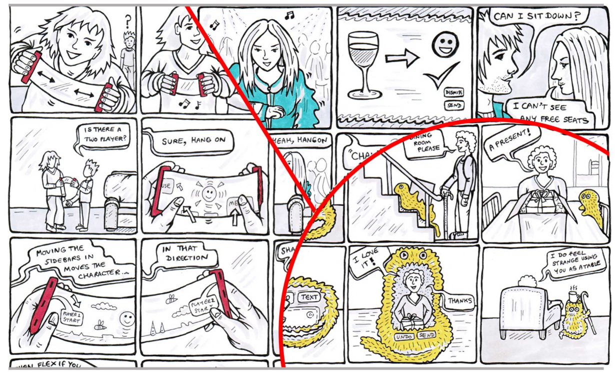

Figure 4: Storyboards of interactions using shape changing devices

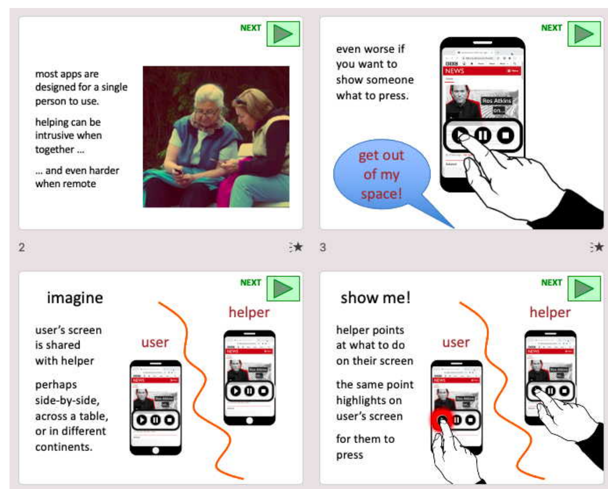

Figure 5: Using PowerPoint as storyboard

4 FIRST STEPS

In our first steps towards our challenge, we have been prototyping concepts of how some aspects of future tools could be realised (as in prototypes of tools for building prototypes). Figures 5, 6, 7 and 8 show some of these experiments. These are presented partly because they have been used to prompt our own thinking and partly as we are using these and other envisionments as provocations (see below).

4.1 Appropriating Existing Tools

The first two examples show an appropriation of existing tools. Often students and practitioners will use whatever tools come to hand, especially those they are familiar with in other contexts.

Figure 5 shows the use of Microsoft PowerPoint as a storyboard tool. The images in Figure 3 were also embedded in PowerPoint slides. The example provided includes both context and detail frames, two device images at different locations and animated hand movements pressing buttons.

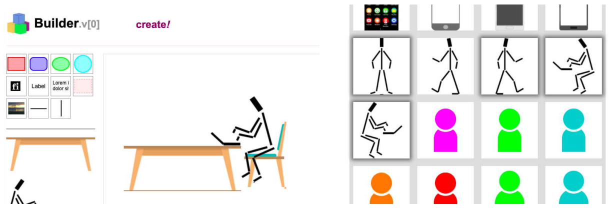

Figure 6: Using storyboard elements in design in a prototyping application – gallery includes figures and props as well as screen elements

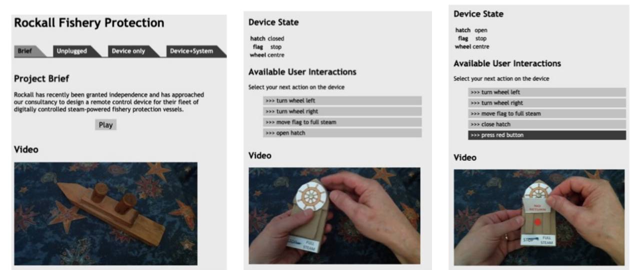

Figure 7: Using video to interact with physical prototypes

The example shown in figure 6 is taking a low-fidelity screen prototyping tool and adding context-related items to the gallery of widgets including schematic figures and props such as tables and chairs. This can be used to create simple context images, which can then use the prototyping tool to step through alternative scenarios by adding hot spots to the images.

Existing commercial tools have extensive functionality and designers, researchers and students are familiar with them. It may be that the best way forward is to find relatively small modifications that *learn from appropriation* [7] to enable them to scaffold learning. The way in which Miro includes wireframe elements is a good example of how this is already happening for different aspects of design tools. Indeed, the flexibility of Miro and similar remote whiteboard tools have led to rapid uptake amongst UX practitioners, especially for the earlier stages of design.

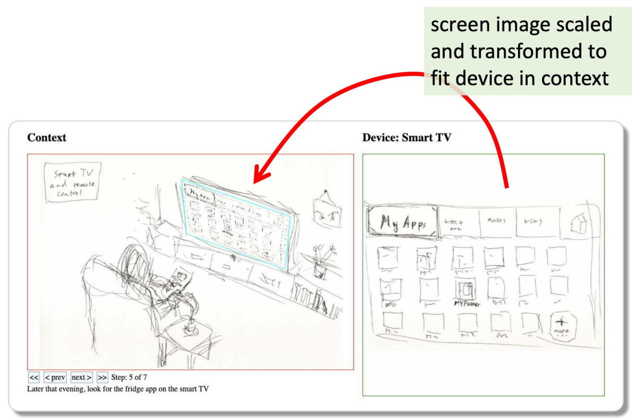

Figure 8: Prototype scenario viewer linking device to context

4.2 Dedicated Tools

Our experiments with existing tools might also help to highlight the limits of such an approach and where more specialised tools may be needed.

Figure 7 is a prototype of a tool for demonstrating physical prototypes. It was created in response to one of the outcomes of a series of workshops on the use of video in HCI education [15]. One of the participants voiced a difficulty they were finding during Covid, as students were not able to effectively share physical prototypes with one another. The system combines short video clips of the physical prototype being manipulated with a state machine representing the various settings of the device, a physigram [1]. The viewer can select actions, such as turning the small wheel on the device, or opening the flap and the relevant video sequence is played. In addition, the actions of the device can be linked to videos showing the effect of the device on the environment. In the example shown, the device is for a remote controlled ship, so the movements of the ship are shown in the video.

Figure 8 is a potential tool for connecting more standard screen-based devices with the contexts in which they are used. The example shown uses sketches from the internet fridge and allows the context sketches and screen sketches for any devices to be played side-by-side. Typically a scenario may show several device image frames within each context shot. To further bind the screens to context, the area of the screen that corresponds to the device is defined so the prototyping tool can embed a scaled and transformed view of the screen within the context sketch.

5 NEXT STEPS

Following a comprehensive review of existing tools, using Taylor Palmer's survey as a starting point for best practice [10], we are conducting a series of investigative workshops and detailed user interviews with experienced practitioners, educators and students. These workshops are in progress and are being attended by diverse groups from academia and industry. They are exploring the positives and negatives of existing tools, as well as using early prototypes as provocations to inspire blue-skies and speculative design thinking as to the future potential of user-experiences applications in a variety of contexts. Ultimately, our process will employ existing user-experience methods to discover ways in which we can better support these very processes.

Our workshop programme and thematic analysis is still in progress, but preliminary results are already leading to insights such as the central importance of collaborative features and versioning, the need to better link existing tools, connecting design to code and modes of physical and aural interaction beyond the screen.

The results of both the interviews and workshops will enable us to form a set of requirements for each user group, and integrate these into an overall best practice approach. This will be used to create a roadmap for next generation UX design tools, which we will also inform our own tool 'InContext'.

6 SUMMARY

We have outlined the importance of representing context in HCI/UX design education, ensuring that students learn a 360-degree approach. However, we have also seen that the tools currently used are focused almost exclusively on the screen. This is a problem both for teaching HCI/UK and for less experienced practitioners. Through our driving examples, we have seen some of the important aspects of context including spatial situation, physicality of the device, multiple devices and locations, and non-traditional devices. This creates a clear challenge to understand how potential future design tools can support and encourage best practice. We are building on extensive experience and this has been used to help create some initial prototype tools, or tool fragments. Furthermore, preliminary results from our investigative workshops are reinforcing these requirements and also suggesting new exciting directions. However, we are still at the beginning of our journey.

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