Prototyping in a Learning Environment - Digital Publishing Projects from the Escola Superior de Desenho Industrial

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Abstract. This paper focuses on the educational role prototyping plays on interaction design projects. Three case studies from ESDI (Escola Superior de Desenho Industrial, Rio de Janeiro, Brazil) will show different solutions for displaying visual information on tablets. Each case will show different approaches, namely: low and high fidelity and experience prototyping. It will be argued that the activity of prototyping stimulates student's critical thinking and encourages the search for innovation.

Keywords: Low and high fidelity prototyping, experience prototyping, visual information, digital publishing, pedagogy**.**

1 Introduction

With the introduction of tablets in the 2000's, visual information displayed on a screen has for the first time encountered ergonomic conditions similar to that of printed media. More portable and lighter than laptop computers, tablets have joined input and output on a single plane, approximating the screen's format to that of a page. The transposition of the page from print to digital touches a much broader historic and technological issue: new technologies tend to import features of previous ones before introducing their particular formal and experiential innovations. As Marshal McLuhan, has explained to support his well-known dictum *the medium is the message*, "…the content of any medium is always another medium. The content of writing is speech, just as the written word is the content of print…" [1]. Implied in this statement is the weakening of the rigid limits between form and content. Following McLuhan's reasoning, in the tablet's case the printed page, being considered the "content" of e-book readers, would have (as it did) formal implications on its designs. This influence is subtly noticeable in Amazon Kindle's preserving of typographic and layout conventions (page number and chapter name positioning, for example) [2]. Much less discreet is iPad's first e-book interface design, which visually mimics, with realistic detail, the tactile aspects of the book. While these imports might fairly indicate usability concerns (allusions to a traditional technology would facilitate intuitive navigation), they actually may reveal a resistance to engage in new mediums' design innovative opportunities [3]. Such conservative spirit is also

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noticeable in stereotyped and pre-formatted design decisions and assumptions that are embedded in software tools – the preservation the "form page" being an important example.

This paper presents three case studies of student's projects for digital publishing that challenge these aprioristic postulates with inventive solutions brought about through the practice of prototyping. At the Escola Superior de Desenho Industrial (ESDI) we stimulate students to prototype very early in the development of design projects and to keep doing it through all phases of the process. By constantly simulating, in rudimentary or sophisticated ways, how devices, actors, environments behave in a given proposal they learn to respond to the continuous formulation and reformulation of design problems. I intend to show that prototyping, when taken as a pedagogical tool, can establish a fertile and investigative learning environment that leads students to both achieve creative solutions and to gain an awareness of software tools biases and limitations. As I present the projects, I will emphasize, in each case, different approaches: low fidelity, experience and high fidelity prototyping.

Low-fidelity prototypes have been defined as exploratory tools that are quickly made, using materials not meant to be included in the final project. They are also identified by their low cost and communicative capabilities [4]. Bill Buxton prefers to name these early "instantiations of design concepts" as sketches. While prototypes are more refined and ready for usability tests, sketches – quicker and cheaper – are more connected to ideation phases within the design process [5]. The cases analyzed here are, I believe, more accurately qualified as prototypes and not sketches because some of the insights they have triggered reached an almost tangible presence in the later stages of the process. In the first example – Duotone magazine – playing with paper has inspired a form of navigation that became definitive in the final rendering of the interface.

In the second one, TxtoTracker, students used video recording to document the enacting of a proposed interaction in a real scenario. Not only the ideation phase, but also the final stages of this project were decisively influenced by experience prototyping. A concept that amplifies traditional definitions, it includes aspects like role-playing, time pressure, social interaction and environmental concerns. [6] There is, of course, a variety of specific techniques that can be combined, including paper prototyping, storyboarding, using index cards, live prototyping, animation, video recording and even faking. One should not forget, however, that prototyping techniques are constantly changing and multiplying, "fueled", as Bill Moggridge has put, "by the increasing complexity of design contexts" [7]. As Marion Buchenau and Jane Suri propose, experience prototyping is "less a set of techniques, than an attitude, allowing the designer to think of the design problem in terms of designing an integrated experience, rather than one or more specific artifacts …" [6].

One might be led to think that such an attitude could only take place through the use of improvised, sketch, non-professional means. The third case study will demonstrate that it is not quite so. Wide World, a sci-fi story, employed high-fidelity prototyping, which is typically characterized by being fully interactive and having the exact look and feel of the final product [4]. The subtle experiences this project provides show how software tools, when used intelligently, can lead to creative

findings. We will see that the project's author was able to employ pre-defined solutions in a remarkably idiosyncratic way.

These three approaches were not necessarily committed to commercial efficiency. In a professional design process, prototypes are valued as aids for ideation, communication, testing and innovation. While the case studies analyzed here may confirm this, I will focus in understanding the pedagogical value of prototyping. This value should not be confused with the teaching of prototyping techniques but understood in terms of how they can be used to develop in students the ability of specifying design problems. As Swiss designer Karl Gerstner has stated, back in 1964, "to describe a problem is part of the solution". Implied in this idea is the notion that "for no problem there is an absolute solution… there is always a group of solutions, one of which, is the best under certain conditions" [8] Prototyping, being essentially characterized by experimentation, is evidently an excellent tool for describing problems. In the course of perfecting such descriptions, we will see, students also improve their critical thinking.

2 Exploring Electronic Magazine Navigation

Considering today's technological acceleration, one would expect interaction design to follow the same pace. However, there are several design solutions that become essentially unchanged for certain periods of time. That's the case with tablet's digital publishing design. One of the dominant trends since the launching of the first iPad has been, as mentioned earlier, the insistence in references to traditional media. Apple's e-book reader's first interfaces emulate not only the unity of the page, but also its texture and physical turning effect, a trend that has been called "skeuomorphism" [9]. In one advertising, for instance, we notice a rhetoric approximation of the reading experience provided by the app to its printed counterpart: "reading in an iPad is exactly like reading a book… turn pages with a flick", says the apple's ad [10]. In other companies' marketing strategies we also see that even to show off technological advances, this is done through references to the well-known format of the traditional page. In an *Outside* magazine's ad film we hear: "we've all seen sci-fi movies where magazines and newspapers have their pictures moving right on the page… that's what we're doing here". [11]. These are just two examples of interface designs that, even with all innovation brought about by tablets, insist on the model of the "page".

This very model is challenged by project Duotone, developed by students Aline Alonso and Isabelle Lavigne ad ESDI in 2010. The idea was to create a magazine containing two issues in one. The students had developed, one year before, a printed version of the project. So, they already had text and photos as content to work with. Instead of merely transposing that content from one media to another, they forgot about the original design and engaged in experimenting with a bunch of fragments of photos and texts. They came up with a vague idea of arranging those items in a plane with irregular page boundaries. To experiment with this concept, they assembled a collage of what would later, in the final prototype, become the representation of one entire story. Navigation would, then, take place not by page turning but by plane panning in all directions "underneath" the tablet's screen (Fig. 1).

Fig. 1. First low fidelity prototype for *Duotone*

Fig. 2. (A) Out of focus area signals another plane and (B) the icon on the bottom left launches the 3D vision that can be rotated and used as a selector of sections

Playing with this physical prototype has also inspired the solution for the problem of how to navigate from one story to another. Because at this stage the bi-dimensional plane was *physically* available, students were able to perceive its potential three-dimensionality. They have decided that the magazine would contain several piled planes and that the user would be able to somehow switch planes. But what could be an interesting and effective interactive design solution for this concept? The releasing of planes in space called attention to a visual manageable feature: that of focusing. Displaying an out of focus plane, the interface managed to both signal the existence of more content *and* provide a "button area" that, when clicked, could bring the user to a different level/story (Fig. 2A). Here, the metaphor derives not from a magazine page but from cinematic and photographic features. Having solved this navigation problem, there was yet another challenge: how would the user change the view from one issue to the other, considering that the whole idea of *Duotone* was to present two issues in one. By clicking the magazine's icon on the lower right corner, one can access 3D

navigation layers, where it is possible to choose not only the "reverse" issue but also one story within that issue (Fig. 2B).

Duotone, in short, presents three inventive ways of displaying visual information in a digital publishing environment: panning navigation on a plane that is not shaped as a rectangle; the attribution of semiotic and interactive qualities to depth of field; and a 3D representation that is also operative in navigation terms. All three aspects are the result of an exercise in describing a problem as part of a solution, as Gerstner has proposed [8]. While Apple's and Outside magazine were describing the problem how to transpose the printed page to digital form, Duotone has taken one step back and described another problem: how to present a certain content that include photos, text, audio and video, in a touch screen device. If we analyze the path that led to the final solutions, we conclude that (1) manipulating paper, glue and paper cutter and (2) being able to perceive a space between a paper mask and the content planes, played a fundamental role: that of providing a distance from pre-defined solutions and opening up a terrain suitable for innovation.

3 Vision Information in an Augmented Space

The combination of the Internet with mobile communications has, from the common user's standpoint, freed digital information from the ergonomics of desktop computers. The popularization of the word *cloud* as synonym for data storage is an indication of information's putative omnipresence. People are getting as used to expect instant access to personal or public data anywhere they go as they are to the idea of *ubiquitous computing*. Mark Wiser, PARC's scientist who coined the term, has stated: "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it." [12]. But one would be mistaken to take the *cloud* for the same thing as *ubiquitous computing*. The two concepts have a strong difference: While the first one symbolizes information that can be accessed virtually anywhere, the latter points out to interactions that take place locally with devices (hidden as they may be) that *physically* sense the presence of an individual in specific places, promoting exchange of data between them. Concerned with the phenomenological aspects of such interactions, Lev Manovich has created the term "augmented space", derived from the older concept "augmented reality", coined around 1990. As Manovich puts it, this new space is distinguished by "*overlaying dynamic data over the physical space"*. It is not to be thought, however, as one single space for everyone. Each "space is unique – since the information is personalized for every user, it can change dynamically over time" [13]. Given such dynamism, the stability of the tablet's "page" might give in to different design forms, which could represent and evoke the new phenomenological experience with augmented space. This is precisely what project *TxtoTracker*, developed by student Clarissa Baumann in 2010, was intended to.

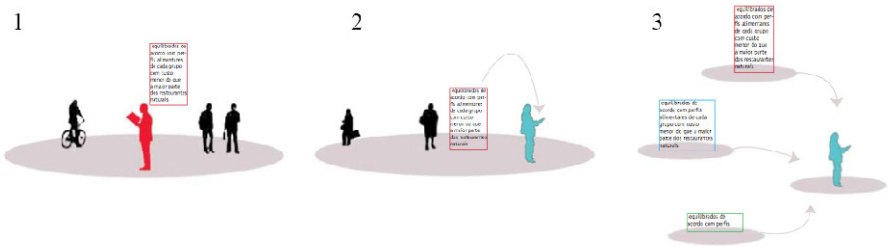

Fig. 3. TxtoTracker's interaction's basic diagram

Fig. 4. TxtoTracker's activation icon "sticks" on any reading application

The project's proposal was to establish a connection between certain urban places and the uploading and downloading of text fragments being read by passerby users on a tablet. A typical interaction sequence would go like this: (1) a user is passing by a certain place and activates a mode that allows access to what s/he is reading; (2) another user, passing by the same place, turns the app on and have access to what the first reader was reading in situation 1; (3) users can select other users as favorites so that a web of "friends" is created, and each person can follow the chosen ones through other places and moments (Fig. 3).

The interface design seems at first very simple: just one icon – a blue circle – stands at the upper right corner of any reading application. When touched, the circle turns into the app's icon, an open eye, signaling that the mode "capture" is on. This means that whatever s/he is reading is being accessed and stored. The icon's drawing is purposely childish and unsophisticated so that it will look weird in the usual professional looking graphic interfaces of most reading apps (Fig. 4).

While in "capture" mode, two things would happen: the text being read by the user would be uploaded and all texts left at that location from other users would become available in a temporary memory in his/her tablet. The design problems, up to this point, were solved. The student then turned to the problem of selecting downloaded texts.

Her first idea was to display text fragments in different orientations and sizes on the reading plane. Such solution was, though, merely intuitive and not really connected to the project's general concept. She was encouraged to try experience prototyping in order to have an approximate idea of how would it feel to "collect" information from a spot in real space and see it on the tablet's screen. Having gathered some friends, she took a tablet to a square nearby the school and filmed enacted situations trying to rehearse all interaction steps (Fig. 5). Since no software was implemented in the tablet, each student's attention was driven to how it felt to be sitting or standing in the middle of a square concentrated on the tablet screen.

Fig. 5. Enacted experience prototyping with post-production

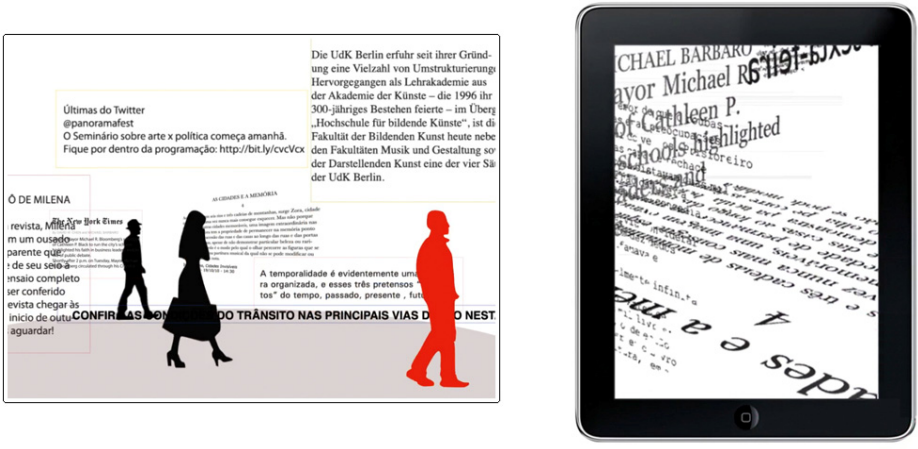

Fig. 6. On the left, an animation still showing the representation of augmented space. On the right the design solution for navigating and selecting text fragments on a tablet's screen.

The enacting confirmed initial assumptions that the sensation of finding information in specific places created an interesting awareness of today's augmented spaces. But it was in post-production that this experiment proved to be more effective. Text was added to the filmed sequence so as to represent the hybrid environment. When the student positioned the text boxes over the filmed image it became obvious that each of them had to follow perspective rules in order to appear either foreshortened or distant. This logic was a base for the design solution (Fig. 6). It is important to notice that, in spite of resembling Duotone magazine's 3d navigation, TxtoTracker's solution provides an all over effect that is remarkably different from the vertically ordered planes we saw earlier. The contact with real space tri-dimensionality inspired the student to create a 3d view of text fragments that would enrich the perception of overlaying real and virtual spaces.

4 Innovating with Available Tools

At the time Duotone and TxtoTracker were conceived, (2010) there was no affordable tool to create functional prototypes for tablet's e-publishing design. In 2011, Swedish media firm Bonnier Corp. released Mag+, an Adobe InDesign plug-in that could be downloaded and installed for free. In spite of some inconsistencies and incomplete documentation, Mag+ appeared to be a very interesting tool for exploring tablet interaction features. But we did not use it right away after its releasing. In 2012 I was more concerned with assignments involving Processing and Arduino open source platforms, and left e-publishing design aside for a while. In 2013 the theme was reintroduced in the course and students received Mag+ with enthusiasm. Especially attractive were the possibility of using a tool – InDesign – most were familiar with and also the easiness how Mag+ provided fast reviewing in the tablet itself. The tool, as expected, had its own preset of design solutions, the most striking one being a combination of horizontal navigation through "pages" with vertical scrolling in a layer-based design.

Project Wide World made no use of the vertical navigation option, and adopted the metaphor of sequential pages as in a printed publication. Renan Porto, who developed the project, took inspiration from tablet's typical orientation feature, associating vertical and horizontal positions with structural elements of his sci-fi story: in vertical position one sees an ordinary reality, and in horizontal position the same scenes are modified or amplified to show the Wide World, an augmented reality. The story is set in a psychiatric hospital where a physician gradually establishes connections across stories told by different patients. These ones, in the "normal world" (vertical) are depicted as mentally ill and in the "wide world", the doctor discovers, they live a perfectly sane, yet amplified, life.

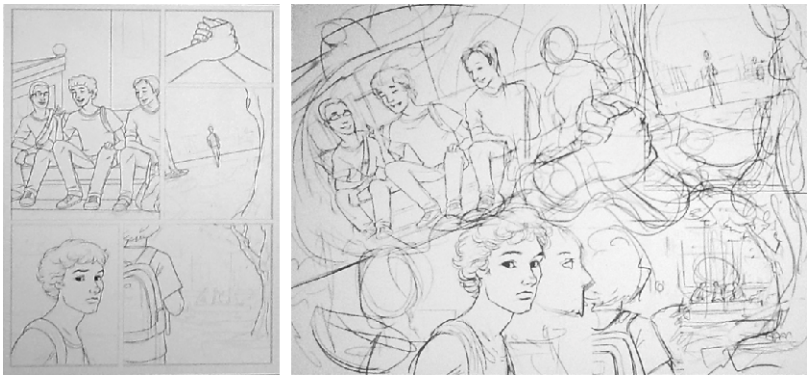

Fig. 7. Wide *World*'s first sketches

The visual solutions for these narrative ideas started with sketches depicting the relationship between the two worlds (Fig. 7). At this stage there was still no clear definition of how exactly this "wide world" would be depicted. Figure on the right's scrambled lines point to a somewhat chaotic intertwining between the two worlds. Note that the figure on the left obeys comic books' framing graphic behavior. As the project evolved the "wide world" was conceived as being not so different from the "normal world". For example, as we see in Fig. 8, the vertical position displays a group of three young men chatting, while in the horizontal version of the same scene other characters are added, graphically differentiated by the use of color. In these second sketches, one notes the abandonment of the comics' framing visual language.

Fig. 8. Wide *World*'s second sketches

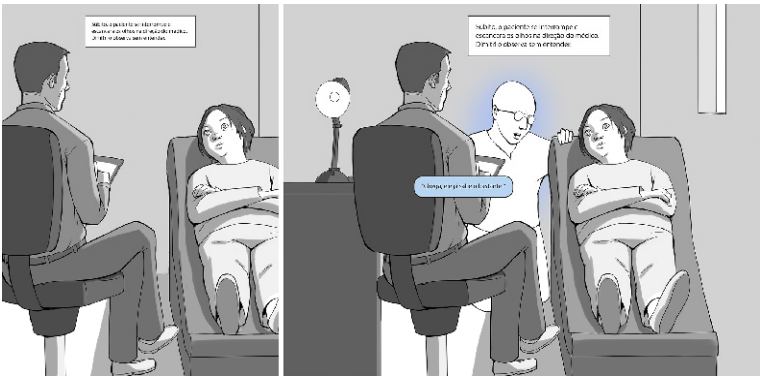

Fig. 9. Final illustrations show an economy of means: no comic book framing and very subtle use of color to identify elements of the "wide world"

In the final, fully functional high fidelity prototype (Fig. 9), color became restricted to a blue "aura" around the head of one character and to the text balloon. The prominence of black and white invests the story with austerity. In this and in all other scenes, the difference between "worlds" is very subtle. As a whole, from the first sketch to the final rendering there has been a movement towards economical solutions not only in graphic but also in interactive terms.

The opting for black and white language, for abandoning comic book's framing and for ignoring Mag+'s double navigation feature reveal an economy of means that is in itself a statement: choosing not to make use of available powerful tools, the author creates an experience that attain maximum effect with minimal interactive or graphic features. What was it to be gained? Answer: the narrative, that many times in interactive editorial pieces runs the risk of being relegated to second plane, is again the center of attention. The simple trick of turning tablet orientation has nothing attractive in itself: it is only an interactive tool at narrative's service. In the case of Wide World, innovation comes, paradoxically, from refusing to innovate: in a milieu – digital publishing – where the imperative is to create mesmerizing interactive experiences, Wide World presents us with black and white austerity and minimum interaction acrobatic novelties. It was not, however, a matter of a merely conceptual exercise. User experience is itself displaced from sensorial seductions into evocative thinking. It is an interesting case of high fidelity prototyping at the service of simplicity that shows the student's awareness of a set of predefined design solutions he has chosen not to use.

5 Conclusion

The importance of prototyping as a crucial activity in designing interactions is frequently explained in terms of time and money saving, creativity stimulation, team communication, usability validation, among other aspects. This paper was dedicated to see prototyping as a pedagogical tool. The three case studies have presented educational gains in different areas of interaction design problems.

With Duotone magazine, students learned how to reformulate the description of a problem. The kind of low fidelity prototype they executed provided a way of describing differently the problem of displaying publishing content in a digital environment. Instead of assuming the form "page" as a given, they devised a 3D layered-plane representation derived from the manipulation of paper cutouts.

Project TxtoTracker has lead students to employ enacting methods typical of experience prototyping. The interactive omnidirectional space created by type reinforced the project's concept of navigation on an augmented space. Again, such an abstract idea was represented by inspiration drawn directly from the prototyping experience.

Finally, Wide *World*'s visual and interactive solutions revealed a minimal style deliberately imposing a distance from today's inflated interactive possibilities and visual pollution. In this project a sophisticated tool (InDesign's plug-in Mag+) had its multiple possibilities restricted in favor of a much older technology: the narrative itself.

In the first two cases, students have experienced a way of projecting interaction that made them reformulate problems and find inventive solutions. One might argue that those solutions are not exactly unheard of. However, from the students' standpoint, it was a great novelty to find out that the page form was not a definitive solution for displaying publishing content. From a pedagogical point of view, it can be concluded that low fidelity and experience prototyping proved to be effective as tools for innovation.

One would be tempted to rapidly conclude that these low fidelity approaches would be superior to high fidelity functional prototypes, developed on the third example. While in terms of innovating in interaction and experience design this may be true, one cannot overlook the advantages of using a tool that makes it possible previewing designed pages right on the tablet's screen. This speed and the easiness of doing it have released time for the conceptual elaboration that gave birth to the also inventive visual and interactive statements implicit in an apparent simplicity. As a final conclusion, I would like to suggest that both pedagogical approaches are important and, obviously, non exclusionary.

But an aspect present in all three examples needs underlining: all three processes show that the students have been empowered with an awareness of design-presupposed solutions. Both the page and the software were understood as technologies to be used if / when necessary. The practice of both low and high fidelity prototyping has enabled autonomous decisions and provided a conscience of the transient and circumstantial status of any technology.

These cases are examples of how prototyping can work as a powerful tool for "unlearning" taken-for-granted solutions, being them embedded in software tools or established by cultural stereotypes. In a designer's formation, to be able to continuously move in and out presuppositions is the only way to innovation. To exercise this flexibility is, I believe, the greatest gain provided by prototypes in a learning environment.

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