Prototyping as a powerful tool in a user centered innovation process

Tiago Barros
Recife Center for Advanced Studies and Systems (C.E.S.A.R.)
R. Prof. Pedro Viriato P. de Souza, 5300
Curitiba, PR, Brasil
+55 41 3208-2773
tiago.barros@cesar.org.br

Paulo Melo
Recife Center for Advanced Studies and Systems (C.E.S.A.R.)
Av. Nações Unidas 12551, 9th floor,
São Paulo, SP, Brasil
+55 11 3443-1656
paulo.melo@cesar.org.br

BRIEF DESCRIPTION

This short course aims to present prototyping techniques in the contexts of an user centered innovation process. Prototyping is a powerful tool to quickly communicate concepts, obtain feedback from end users and try ideas out. Thus, it has a key role in an innovation process. Apart from that, prototypes are a better option in comparison with more developed solutions due to the lower investment in time and money needed to create it, while still providing relevant information for the development cycle. Strongly based on practical activities, this short course will focus on how and with which purpose prototypes should be built. Additionally, participants will be invited to build various levels of prototypes (from paper to working prototypes) during the 8-hour course.

Keywords
Innovation process, interaction design, prototyping, , Arduino, user evaluation.

COURSE OBJECTIVES

The course will focus on prototyping techniques and tools for producing low and high fidelity prototypes. Through a hands-on approach, participants will be invited to create its own prototypes according to certain goals proposed.

The low fidelity prototypes will be exercised through the use of cheap materials and simple techniques to build quick, while powerful prototypes. The high fidelity prototypes are addressed using the Arduino development tool [1]. This short course will present an introduction to the Arduino platform, with practical exercises.

ATRACTIVENESS OF THE SUBJECT

In a market oriented perspective, innovation is the behavior change of people: both producers and consumers of products and services. Behavior change may be associated to almost anything: from processes and practices to devices and services. In an interconnected society, living in an information economy with knowledge-intensive services and processes, to be in fact innovative it is fundamental to consider the dynamic and complex triad People, Business, and Technology. Concepts that take that perspective into account are solutions that address people's needs, have a consistent business model and are feasible to be implemented.

C.E.S.A.R Innovation Process (CIP) is inspired by the principles of User-Centered Design (UCD) (Figure 1) [3]. Our view is that Information and Communication Technology (ICT) are designed to serve people – within certain contexts, purposes and strategies. In addition to that, it is an assumption that aiming a rich user experience is fundamental to be successful with innovative solutions in ICT.

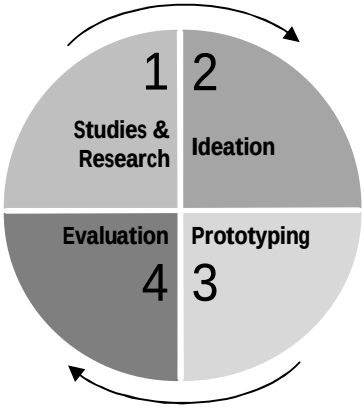

Figure 1 – C.E.S.A.R Innovation Process phases.

CIP is formed by the following phases:

1. Studies & Research: a review of the existing literature alongside with the execution of quantitative or qualitative studies in order to develop a well defined profile of the target group and to identify opportunities and challenges for innovation in a certain context.

2. Ideation: this phase is focused on the generation of as many solutions as possible. Those solutions are inspired by the collected data during the previous phase. Later on this phase, a joint selection of proposals is performed based on an meaningful selection criteria from end users and stakeholders.
3. Prototyping: production of possible alternatives (artifacts or experiences) via prototyping in increasing levels of fidelity, from paper prototypes to fully working models.
4. Evaluation: Finally some prototypes are selected to be tested by end users in the field or in usability labs. In both cases, user tests are important to anticipate problems and to make sure the artifact or experience is fitting users´ needs.

Prototyping as an tool to innovate

Due to the uncertainty of the economy and the unexpected manifestation of new trends and technologies in the ICT field, releasing a product as a final version has not proved to be a promising idea. In this scenario, the notion of a product in a permanent beta state makes much more sense. In this direction, prototypes are a very interesting option to try ideas out in a fast and cheap way. Additionally, prototyping is important to bring abstract ideas to a more concrete level. While prototyping, developers face several limitations that could not be identified while they were discussing abstract concepts only. Apart from that, prototypes bring light to new aspects and opportunities that have not been considered by designers and developers. Those new aspects are fundamental to create a consistent concept that can survive to a more critical and systematic analysis. Prototypes are a very powerful tool to communicate ideas among software engineers, designers and stakeholders of a project.

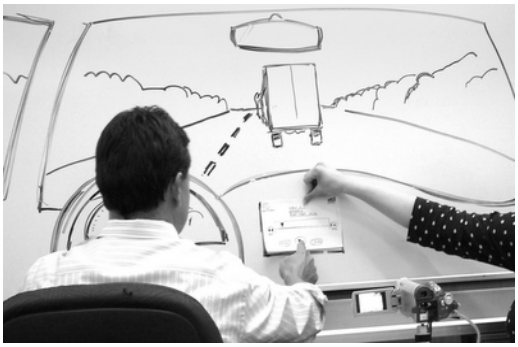

Figure 2 – Researcher testing with a user the interaction with a navigation tool through a low fidelity experience prototype.

Due to its unfinished state, prototypes are very helpful as a way to invite people to collaborate in the creation of new features of a product. Prototypes are also important tool in sessions of co-creation where users are invited to participate in the process of building a product. Especially with low fidelity prototypes, users feel very comfortable to bring their opinions to the table and help developers. When invited to participate in a session with a well developed prototype, users do not feel comfortable to give criticisms and suggestions since those may hurt developers' feelings. Thus, instead of helping in the process, users are more inclined to agree with what is presented to them.

Recently designers have been working in another kind of prototypes (Figure 2). They are known as experience prototype [2] and instead of building a prototype of a product, designers bring the user experience to a more concrete state. Similarly to what occurs while prototyping a product, experience prototypes are also helpful to show constraints of solutions.

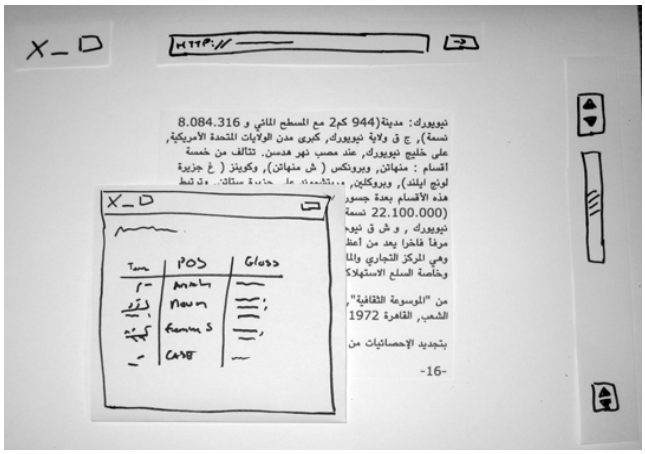

Figure 3 – Paper prototype of a GUI.

Prototypes have gained popularity in the software industry because its creation can be almost effortless. Especially to the considerable effort that has been spent by software engineers to develop software that can be significantly changed in a late phase, prototypes have shown its power to gather user feedback in usability tests while not requiring much effort to build them.

TARGET AUDIENCE

Students, professionals and researchers from design, engineering and related fields interested to learn and share experiences about how to create an amazing user experience through prototyping techniques. There are no pre-requisites to attend this course. The audience must be limited to 20 participants.

DURATION

8 hours.

ACTIVITY PLAN

This course will be divided in six parts.

Part 1 – Introduction to prototyping [30 minutes]

The first part will introduce the subject of prototyping to participants. At this moment, the audience will be presented to the general idea of prototyping, its goals, when to use it in the development process, among other theoretical issues. Instructors will present the necessary evolution of prototypes in the development process.

Part 2 – Low Fidelity prototypes [80 minutes]

During the second part of the course, participants will be divided in groups of 4 people. Each group will be responsible for creating a device that must have a Graphical User Interface (GUI) for a possible produtct with a physical

interface, with sensors and actuators. Initially, participants will create the features and goals of the artifact and will design a GUI accordingly, creating a low fidelity prototype (see Figure 3). Once the paper prototype is done, each group will be invited to present its prototypes to the rest of the audience. At this point, instructors will give feedback and the whole group will be able to give suggestions for improvements.

Coffee break [15 minutes]

Part 3 – Low Fidelity prototypes [40 minutes]

With all the feedback and suggestions collected, the groups will work on the development of a higher fidelity prototype. At this point, the groups will use Microsoft Power Point as a prototyping tool to build the new version of the GUI. Power Point is an interesting tool for prototyping interfaces due to its ease of use and availability in most computers. Once again, when the prototype is ready, participants will present their work to each other and receive feedback.

Part 4 – High Fidelity Prototypes [75 minutes]

The fourth part of the course will present how to use hardware and software to prototype physical objects for interaction. In this part, the audience will be introduced to the physical computing subject [6]. Instructors will lead a discussion about how the physical computer interfaces are designed today and how it should be designed. After that, the groups will start to set up the Arduino development environment and create a hello-world project of blinking a LED.

Lunch [90 minutes]

Part 5 – High Fidelity Prototypes [120 minutes]

In the sequence, some concepts needed to build small electronic circuits such as electric potential, electric current, electric resistance and ohm's law will be presented. The participants will start to create more complex circuits, using the presented electronic components as analog and digital sensors and actuators. The programming language [5] and programming concepts and syntax [7] will be presented as needed, during the evolution of the created prototypes.

Coffee break [15 minutes]

Part 6 – High Fidelity Prototypes [105 minutes]

After the Arduino exercises, the groups will be invited to design and prototype the physical interface of the device created before, using the concepts learned. Once the prototype is done, the groups will present it to each other and receive feedback.

Equipments

For paper prototype it will be needed the following material:

- A4 paper sheets;
- Pen and pencil;
- Scissors; and
- Tape.

Apart from the above material, the instructors will need a laboratory with 5 computers. Computers must have Microsoft Windows and at least one USB port available. In addition to that, computers must have Microsoft Power Point available.

All the additional equipments, such as Arduino boards, protoboards, electronic components and cables will be provided by instructors.

INSTRUCTORS

Tiago Barros

Tiago has got a M.Sc. in Computer Science (UFPE – 2007), a B.Sc. in Computer Science (UFPE – 2003) and Technician in Electronics (CEFET/PE – 1998). Tiago has been developing software since 1994 in a wide variety of languages and processors. Currently he works at C.E.S.A.R, where is a senior systems engineer and internal consultant. Tiago has taught classes since 2000 at institutions such as CIn/UFPE-Motorola, Qualiti, C.E.S.A.R, Universidade Positivo and Faber-Ludens Institute.

Paulo Melo

Paulo has got a B.A. in Psychology (UFPE – 2005) and a M.Sc. in Cognitive Psychology (UFPE – 2007). Recently Paulo has obtained his P.D.Eng. degree in User-System Interaction (TU/e – 2011). Paulo has been working with HCI and interaction design since 2005. Paulo has worked at C.E.S.A.R., CSIRO, In/situm and Philips. Nowadays, Paulo is a Business Manager at C.E.S.A.R, in São Paulo.

ACKNOWLEDGMENTS

We thank C.E.S.A.R for giving us the opportunity to learn and execute prototyping in a daily basis. Additionally, we are thankful for all the support we had in order to formulate this short course.

REFERENCES

1. Arduino website. Available at http://www.arduino.cc
2. Buxton, B. *Sketching User Experiences: Getting the Design Right and the Right Design.* Morgan Kaufmann, 2007.
3. Cooper, A., Reimann, R., and Cronin, D. *About Face 3: The Essentials of Interaction Design.* Wiley, 2007.
4. Igoe, T. *Making Things Talk.* O'Reilly, 2007.
5. Noble, J. *Programming Interactivity: A Designer's Guide to Processing, Arduino and open Frameworks.* O'Reilly, 2009.
6. O'Sullivan, D., Igoe, T. *Physical Computing: Sensing and Controlling the Physical World with Computers.* Thomson Course Technology, 2004.
7. Reas, C., Fry, B. *Processing: A Programming Handbook for Visual Designers and Artists.* MIT Press, 2007.
8. Snyder, C. *Paper Prototyping: The Fast and Easy Way to Design and Refine User Interfaces.* Morgan Kaufmann, 2003.