THE AMBIVALENCE OF ENGAGING TECHNOLOGY: ARTIFACTS AS PRODUCTS AND PROCESSES

BY CRISTIANO STORNI
INTERACTION DESIGN CENTRE
DEPT. COMPUTER SCIENCE AND INFORMATION SYSTEMS
UNIVERSITY OF LIMERICK, IRELAND
CRISTIANO.STORNI@UL.IE

In this paper, I will discuss several cases in order to explore how technological artifacts engage and are engaged in larger sociotechnical arrangements. I will show how they inscribe a certain relationship between users and designers and a certain level of engagement. At the same time, I intend to show how these relationship and levels of engagement are not intrinsic characters of artifacts *per se* but rather they are effects that are produced and reproduced within socio-technical assemblages. In this sense, different artifacts entangled within different socio-technical assemblages afford different levels of engagement and different instances of a user/designer relationship. The contribution of this work is to show that we are witnessing the emergence of an ambivalence of engaging technology, as some recent innovative ICT artifacts seems to be better understood as open-ended processes rather that fixed products or services with important consequences for our understanding of the user/designer relationship.

INTRODUCTION[1]

In this paper, I assume that the level of engagement of ICT artifacts reflects a certain definition of the relationship between users and designers. I also assume this definition as a relational effect that emerges from the encounter of ICT artifacts' materiality and their relationality. This means that I look at levels of engagement and the enactment of a specific user/designer relationship not as intrinsic attributes of technological artifacts but rather as an effect produced within more or less large socio-technical assemblages, constituted by heterogeneous associated elements. In this sense, different artifacts entangled within different socio-technical assemblages afford different levels of engagement and different instances of a user/designer relationship at play.

The idea is to examine a series of case studies regarding recent technological innovations, and to see that we have different ways in which artifacts can be engaging and enact different user/designer relationships in larger socio-technical arrangements. By affording different forms of participations at different moments of the innovation's design and use, I will show how artifacts can influence the establishment of a specific relation between user and design or rather contribute to its dynamic nature.

POSITIONING

The first aim of this work is to develop a relational understanding of ICT artifacts and their attributes and qualities. Engagement can be understood as the degree of attachment and involvement allowed and afforded by an artifact, and in this sense it can reflect a specific inscribed relationship between the user and the designer. A relational understanding would suggest to see this not as an essential character of the technology itself, but rather as an emerging effect of relations between the artifact and different entities in larger socio-technical assemblages.

Design research has already started to be influenced and enriched by recent developments in other scholarly

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traditions that are concerned with the relation between technology and people, use and design, production and consumption. For instance, innovation studies have recently moved beyond simple statements about passive and active users, about diffusion and impact of technology, and have started to focus attention on different types of users and user agency and different context of use (Haddon et al. 2005; Leatbeater et al. 2004; von Hippel, 2005). Similarly, sociology of technology has shown how users and different social groups become agents of technological shape and change (Bjiker, 1995; MacKenzie and Wajcman, 1999). Cultural studies have also developed a series of approaches that address the relationship between technology and people and production and consumption: media studies have, for instance, developed a critique of the traditional separation between production and consumption also suggesting concept such as domestication (Lie and Sorensen, 1996; Silverstone and Hirsch, 1992) or appropriation (Eglash et al. 2004), while feminist and post-colonial studies have disclosed power interdependencies (Berg, 1999), forms of discrimination and dominance (Cockburn and Ormrod, 1993) embedded in technology. In a different way, material-semiotic approaches such as Actor Network Theory have developed conceptual frameworks where technological artifacts have their own agency, they become actors with specific *politics* and user's configuration (Akrich, 1992; Akrich and Latour, 1992; Woolgar, 1991).

Although in different ways, all these works support a relational understanding of technological artifacts and their attributes: they more or less acknowledge a certain degree of agency to the artifacts themselves, but also their dependence on the association with other agencies. To support this understanding, John Law was probably the first to coin the term *relational materialism* (Law, 1992, 1994). According to the British sociologist, things (be them artifacts or people) have not intrinsic and essential attributes, but instead gain them through the relations in which they are involved: there is nothing else hidden behind them. In this sense, each attempt of definition of something is always an inter-definition where boundaries between entities are never clear-cut. Therefore, what an artifact is and does and how it can be more or less engaging cannot be understood by looking at the artifact in isolation but only by looking at how it is entangled in a set of relations.

This does not means that we should look at artifacts, as they would be empty screens waiting to be filled with meaning. It is in fact by being in relation with other entities that such artifacts can start to enact their own specific non-human agency.

Among many, the material-semiotic approaches that I have mentioned are the ones that have most directly addressed the investigation of the agency of technological artefacts, by developing a series of now well-established concepts such as script, inscription and configuration of the user. I believe that these concepts are useful here because they explicitly point to that particular aspect of the design work that deals with the - more or less explicit, more or less central - pre-figuration of uses and users' behaviours. According to Callon (1986) *'A large part of the work of innovators is that of 'inscribing' his vision of (or prediction about) the world in the technical content of the new object'*. Akrich (1992) argued that the end product of this inscription could be understood in terms of Goffman's concept of script or scenario (1959). In her words: '*The technical realization of the innovator's beliefs about the relationships between an object and its surrounding actors is thus an attempt to predetermine the settings that users are asked to imagine for a particular piece of technology*'. She continues: '*Thus, like a film script, technical objects define a framework of action together with the actors and the space in which they are supposed to act*'. By moving from a focus on the materially inscribed script to the very process of inscription, Woolgar (1991) suggests the concept of *configuration of the user*, arguing that, among many activities, designers configure their users in a specific manner that reflects in their design. In this way a new designed technology comes to inscribe - along with other cultural, economical and aesthetic elements - a certain configuration of the user where the user is enabled to do something but not something else[2].

Back to our interest, I said that engagement of artifacts and their problematization of the user/designer relationship is what emerges from the interplay between their materiality and their relationality. In line with the just introduced concepts, it is an encounter between what is inscribed in their matter in a fixed way by designers (a script) and their ways to pre-configure the user (a configuration of the user) and what can be triggered, inhibited or transformed by unpredictable

[2] By discussing a participatory design processes based on a Rapid Application Development, MacKay et al. (2000) showed that configuration is not always asymmetrical as firstly described by Woolgar, but it is often symmetrical because while designer configure the users they, in turn, are also configured by the user themselves.

relations activated by other entities such as users. In this sense, different engaging artifacts entangled within different socio-technical assemblages afford different instances of a user/designer relationship.

CASE STUDIES

The idea now is to examine a series of case studies regarding recent technological innovations and to see that we have different ways in which artifacts can be engaging and enact different user/designer relationships in larger socio-technical arrangements. We will see that, by affording different forms of participations at different moments of the an artifact's design and use, artifacts influence the establishment of specific and more or less fixed relation between user and design[3].

- Portable Sony Playstation™ and Apple iPhone™

The first story I want to tell regards the Portable Sony Playstation™ (PSP) and the Apple iPhone™, as it provides a couple of interesting examples to start with. Sony™ released its portable game console in 2004 in the attempt to challenge the market of portable consoles dominated by Nintendo™. The design of the console was closed and protected by the many patents that the big corporation was able to deposit during its development. Hacking the system is considered illegal and it threatens Sony's warranty and business model. According to the way it has been designed, users should buy original games and stick with this particular use. Sony PSP is certainly an engaging artifact, also because Sony managed to continuously release new games and peripherals for its costumers. But after little time from the official release, PSP fanatics and expert users have started to add new unauthorized capabilities and features. As Tapscott and Williams (2006: 135) reported: "*now PSP costumers go on-line in vast number to swap home-brew applications and games on a variety of user-developed web sites. Some of the more user-engineered hacks have turned the PSP into a streaming music player, a wifi device, and a web browser. Even relative novices can enjoy these clever extensions by following carefully prepared on line instructions*". In response, Sony has taken steps to retroactively lock up its PSP platform. Before users can load Sony's latest games and peripherals, for example, they must upgrade the PSP firmware. Frustrated costumers learn after the fact that Sony's new firmware disables all of the home brew games and applications that they developed on previous versions. Inevitably, it has been a losing battle because hackers crack the new firmware versions just as fast as Sony can release them. Among many, DarkAlex (http://www.dark-alex.org/) - who defines him/herself as a PSP developer - is one of the most acknowledged hackers (or crew of hackers) in the PSP community, who is able to release cracked firmware just a few hours after Sony releases the new one. In this socio-technical assemblage made of the corporation, its engineers, lay users and more skilled ones, to ask to upgrade the firmware it is like for Sony to try to reaffirm its role of designer toward users that are treated as passive and fixed within certain prescribed uses. It means to put in play strategies which materially (re)configure the users as originally intended; it means to reinforce the original inscribed script by imposing to users to let Sony materially reinforce its protections (that here take the form of a required firmware update). From a use perspective, users are put in the condition of either using the PSP as Sony want them to do, or violating the systems by fighting back Sony's original script and its firmware upgrading strategy.

The story of the Apple iPhone is quite similar regarding the strong *a priori* separation between designer and users. Patented elements along with the establishment of a precise Digital Right Management systems aim to constrain the user to certain prescribed use and prevent unauthorized ones. But differently to Sony, Apple has decided to open something and create an iPhone Developer Platform that allows expert users to develop iPhone applications to be shared through the iPhone Apple store. While, cracking with the iPhone is still considered an illegal act of violation, Apple redefines the relationship between users and designers as far as some iPhone applications are concerned by providing some users with the means to design their own applications and share them. From a use perspective, development kits such as the one created by Apple configure the user in a softer way, thus allowing for different level of engagement to emerge in relation with users.

- User Generated content (UGC) platforms

The recent landscape of technological innovation and the explosion of the so-called web 2.0 applications provide another area where it is interesting to tell

[3] Cases studies have been developed on the basis of document analysis that includes reviews of on-line magazines and more or less official websites (e.g. Wired, Slashdot.com, etc.), and analysis of on-line discussions around some of the examined technologies. When possible this has been supplemented with non-structured in-depth interviews with original developers (as in the case of the Arduino project).

another story or two. Social network sites such a Facebook, Flickr, Youtube or De.Li.cious and their related new activities represent interesting examples of engaging artifacts and of specific user/designer relationships in play.

These are web-enabled platforms that allow a usually large community of computer users to upload and share contents in the form of text, web links, pictures, and videos. Not different in nature to what the first online communities were (Rheingold, 1993), these platforms are now collecting the contribution of hundreds of thousands of users. While it is true that UGC infrastructures are not necessarily open (an aspect that inscribes a clear separation between who implements and owns the infrastructure, and who uses it and fills it with contents), their existence and success depends on the mass participation of users in the building of contents that are publicly shared. On the one hand, we have specific designed spaces offered for specific contents to be created and stored, but these are nothing without the generative contribution of a collective of actors that generate and share contents. This participation can go from tagging a picture, to uploading a self-made video, from commenting to a post to revising a text. In some cases, the participation is massive and the collective achievements impressive. Wikipedia (and Wikis) is probably one of the most evident examples of new innovative collectives in action. What it is challenged here is the production of knowledge that a traditional paradigm of top-down academic production moves toward a bottom-up, collective and open-ended production, where an anonymous mass build a huge and open knowledge repository. As the Wikipedia entry for Wikipedia displays: '*Wikipedia is a free, multilingual encyclopedia project supported by the non-profit Wikimedia Foundation. […] Wikipedia's 12 million articles (2.7 million in English) have been written collaboratively by volunteers around the world, and almost all of its articles can be edited by anyone who can access the Wikipedia website. Launched in January 2001 by Jimmy Wales and Larry Sanger, it is currently the most popular general reference work on the Internet'*. The role of the wiki technology as engaging artifact is here as central as the collective contribution because: '*A wiki is a page or collection of Web pages designed to enable anyone who accesses it to contribute or modify content, using a simplified markup language'*. [Wikipedia's entry for Wiki]. As we can see, this technology materially inscribed a script where the user plays a proactive and generative role (at least with respect to the two previously discussed technologies).

The second story that I want to tell here is closely related with UGC applications and has to do with Open APIs and Mash ups. Open APIs (Application Programming Interfaces) describe a set of technologies that enable websites to interact with each other by the use of specific programming scripts (SOAP, JavaScript etc.) that can be developed freely. Mash-ups[4] are a particular type of opportunistic programming that is defined as: '*pieces of software created by programming against one or more public web APIs, also known as infrastructure services* (such as Google Maps). In this way, they become a *combination of pre-existing, integrated units of technology, glued together to achieve new functionality, as opposed to creating that functionality from scratch'* (Hartmann et al., 2008).

The story of the first mash-up by Paul Rademacher nicely illustrates this situation[5]. In 2005, he was looking for a new house to rent in Silicon Valley. He used Graiglist.com to look for house renting notes and, for each interesting message, he was querying Google Maps to see where the mentioned houses were. That was boring and so '*he created a new Web site that cleverly combines listing from on-line classified ad-services with Google's mapping service. Choose a city and a price range, and up pops a map with pushpins showing the location and description of each rental. He called his creation Housemaps'*.

In the first story we have a socio-technical assemblage made of a community of contributors, web enabling platforms and artifacts allowing users to participate in the collective productions of contents. In terms of scripts, technology configures the user as relatively active although within certain specific and fixed limits. But as the case of Paul shows, expert actors can introduce new elements (e.g. programming scripts) that do not violate what was prescribed or configured in the technology but - more properly - reconfigure it in a new way by producing a new script over scripts. But then again, it is in the *otherness* of this script that lies underneath its success: without open API such as Google Maps and rental ads being public, Paul would have never thought of HouseMaps. Without the continuous posting of new ads by a mass of people, HouseMap would not have nothing to display.

4 The term "Mash-up" originates in music in relation with the practice of mixing.

5 See Tapscott and Williams (2006) for an account.

- The Arduino Micro-controller

The last story that I want to tell is about the Arduino micro-controller and it will be more detailed also because - to some extent - it serves to revise part of the considerations that I have collected thus far.

The case of Open Hardware (OH) and the recent popularity of some projects in this area represent an interesting illustration of engaging artifacts and the ways they (re)problematize the relation between designers and users. Here users are not intended just as creators of contents - within well-established information infrastructures - but most importantly as active participants in the development of uses and applications that were not originally prefigured. Wikipedia defines OH as: '*computer and electronic hardware that is designed in the same fashion as free and open source software (FOSS). Open source hardware is part of the open source culture that takes the open source ideas to fields other than software […] The term has primarily been used to reflect the free release of information about the hardware design, such as schematics, bill of materials and PCB layout data, often with the use of FOSS to drive the hardware*'. OH opens up these design resources to active communities of hobbyists, invited to do whatever they want with the original design: build new things on top of it, modify it to adapt to new contexts and needs, or radically redesign it[6]. Among the many examples of OH projects, the Arduino Microcontroller Board (AB) represents a successful instance that merits analysis, as it illustrates a rich case to challenge our traditional understanding of the user/designer separation. According to the official Arduino community website (www.arduino.cc), the Arduino is '*an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments […] It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board*'. AB can be used to develop interactive objects all based on electronic material that is widely available, not very expensive and easy to use. Essentially, the board is constituted by: a series of ports for inputs that come from whatever sensor is used (motion, light, proximity sensors, etc), a series of output ports connected with whatever actuator is used (motors, lights, computer devices) and a central processor (a micro-controller chip) with a flash memory where written code to process inputs onto outputs can be stored. This code is written with a specific FOSS programming language called Proce55ing (Proce55ing.org).

The AB was initially designed for teaching purposes within design education. As one of the main developers of the board recalls: '*We already work with Processing a lot. At that time Processing was limited to visual animations. When dealing with tangible and real-time interaction we had to use another language. One day we asked ourselves: why not to have Processing to generate programs for our hardware too?*"' A specific module for the Proce55ing language was therefore implemented so that students would not have to learn another language to program hardware in their tangible real-time interactions design works. Initially, the programming language was used with Wiring, a board that is more expensive, bigger and less open than the AB. The idea of developing a more agile and open board and an integrated development environment then emerged. In a couple of months - due to a series of collaborations among some volunteers in a design institute in Italy - the first board was ready. Along with it, a first series of workshops - where the board were given to students and interested design teachers – were organized to gather interest. In a few months, the AB was popular in design institutes all over Europe and - due to word-of-mouth – within many DIY on-line communities.

While in the example of the PSP or the Apple iPhone the roles of designers and of users are prefigured, they and their interdependencies are inscribed in the system and sustained by the commercial strategies of their corporation, this OH product – and open hardware in general – prefigures roles only partially, even less than in UGC systems. The board is in fact intended to be the central core for the implementation and prototyping of interactive products or environments designed by the users themselves. The design possibilities for users here are endless, also because Arduino developers have developed very loose forms of control over future uses. The negotiation of the role is not anticipated in the board design but it remains equally open through a series of strategies that I will now list. On the Arduino website, all the schematics, design files and software are posted for anyone to access. Anyone can download

[6] Certainly, there are differences with FOSS: the replication of written code is definitely less problematic than that of hardware physical components. At the same time, given that electronic components are becoming cheaper and powerful, computers are now widely available to run the software to program OH, the problem with cost is reducing.

them and manufacture their own Arduino (See fig. 1).

Figure 1 - The AB and one of its circuit's schematic

In an extensive article on open hardware boards, Wired provide a provoking description of the AB: '*You can send the plans off to a Chinese factory, mass-produce the circuit boards, and sell them yourself — pocketing the profit without paying the creator a penny in royalties. Arduino developers won't sue you. Actually, they are sort of hoping you'll do it.*' The board schematics and design files are in fact released under the 'Attribution share alike 3.0 Creative Commons' license. Under this license, anyone is allowed to produce copies of the board, to redesign it, or even to sell boards that copy the design. You do not need to pay a license fee to the Arduino team or even ask permission. However, if you republish the reference design, you have to credit the original Arduino group (this is the attribution). And if you tweak or change the board, your new design must use the same or a similar Creative Commons license to ensure that new versions of the AB will be equally without fees and open to future modification and redesign.

The language used to program the microcontroller is borrowed by Proce55ing, an easy FOSS programming language originally intended for graphic design that has been extended - by the Arduino team - with a particular module in order to deal with microcontroller physical boards. The Arduino integrated development environment to write the code and flash it into the board is a piece of software released under the GNU GPL license. This license gives the user the power to change and distribute the software source code, provided that new enhancements are released under the same license terms (i.e. the copyleft clause). The Arduino Web site, where a collection of library of code examples from the user community is growing on a daily basis, is also released under Creative Commons so that you can freely make use of all the scripts, code and tricks posted by users. The only element that is registered as trademark is the name Arduino. An interviewee stated: '*The only protection we have in play regard the name of the board that is trademarked. If you want to make a board and called it Gino, it is ok with me and I do not care. But if you make a board and you called it Arduino you cannot. We want to prevent the diffusion of low quality copies. Arduino for us means that the design respects certain qualities as the easy of use, the quality of the components and of their assemblage.*' Another developer stated: '*in this way we have created a brand and brand matters'*.

Within months, hobbyists from all around the world suggested changes and improvements to the programming language, to the software and also to the physical board. People used Arduino to build their own robots, amateur UAVs (Unmanned Aerial Vehicles), music electronic gadgets and interactive systems. Expert users publish their projects while inexperienced users take advantage of the many step-by-step tutorials available over the web. Companies also offered to act as distributors, while a firm called Botanicals developed an Arduino-powered device that monitors house plants and phones you when they need to be watered: you can buy it online or, obviously, do it yourself. The web-site Makezine.com inaugurated an Arduino section (An Arduino gift guide) by introducing the board as *the best all-around centerpiece to a modern electronics project* and listing a large series of step-by-step tutorials on how to build nice gadgets with the Arduino. Also Ponoko.com - one of the biggest DIY technology web sites – sells Arduino based products along with a series of add-ons that extend the possibility of the board.

However, the Arduino board does not only aggregate but also divides users. Some, for instance, are not happy with the schematics provided in the official web site as making a compatible board is 'not easy' (enough) and users must reverse engineer the Arduino. Others ask for more computational power, or to have PIC processor instead of AVR ones to program for. According to this, projects like the Freeduino, the Saguino and the Pinguino have emerged even if the controversies that have generated them are still unsolved in many on-line forums (e.g. http://hardware.slashdot.org/hardware/08/10/24/0343244.shtml).

DISCUSSION ON DESIGN PARADIGMS

I have left the reader arguing that different engaging artifacts entangled within different socio-technical assemblages afford different instances of a user/designer relationship and level of engagement. I argued that this emerges from the encounter of materially inscribed scripts in the technology and the way they relate with other actors after their design. This encounter can take

the form of a struggle between actors with different concerns, or of a more loosely aggregation of heterogeneous actors that build upon one another's contribution. A relational understanding would also help us to see these problematizations of the user/design separation in action – which are nothing but interdependencies between different social groups with different powers and agency - as results of the interactions between actors in larger socio-technical assemblages and not as preconditions of their interactions. This means that they have to be explained along with the innovations and not as elements to (causally) explain it. It is in fact by studying innovations as they occur in larger socio-technical assemblages that we might grasp an understanding of the variety of user/designer relationships and of ways to innovate. The series of case studies that I have presented aims to show a variety of material inscriptions on one hand and relations' formations on the other that produce a specific problematization of the separation between user and designer and a specific level of engagement.

In the case of PSP we have seen that Sony has inscribed a strong a-priori separation between users and designers in its game console and so between prescribed uses and unauthorized appropriations. This is sustained by other entities that related with this inscription and reinforce Sony's program as, for instance, its mandatory firmware update that restores original proprietary settings. In this sense, the artifact within this specific socio-technical assemblage affords two basic and distinct type of participation and level of engagement: prescribed use or mere violation. I have also shown that in this situation we have a clear separation between a *design before* and a *use after* that is fixed and inscribed by Sony in its product. Centralization of the design and a top down management of the product life cycle further characterize this case.

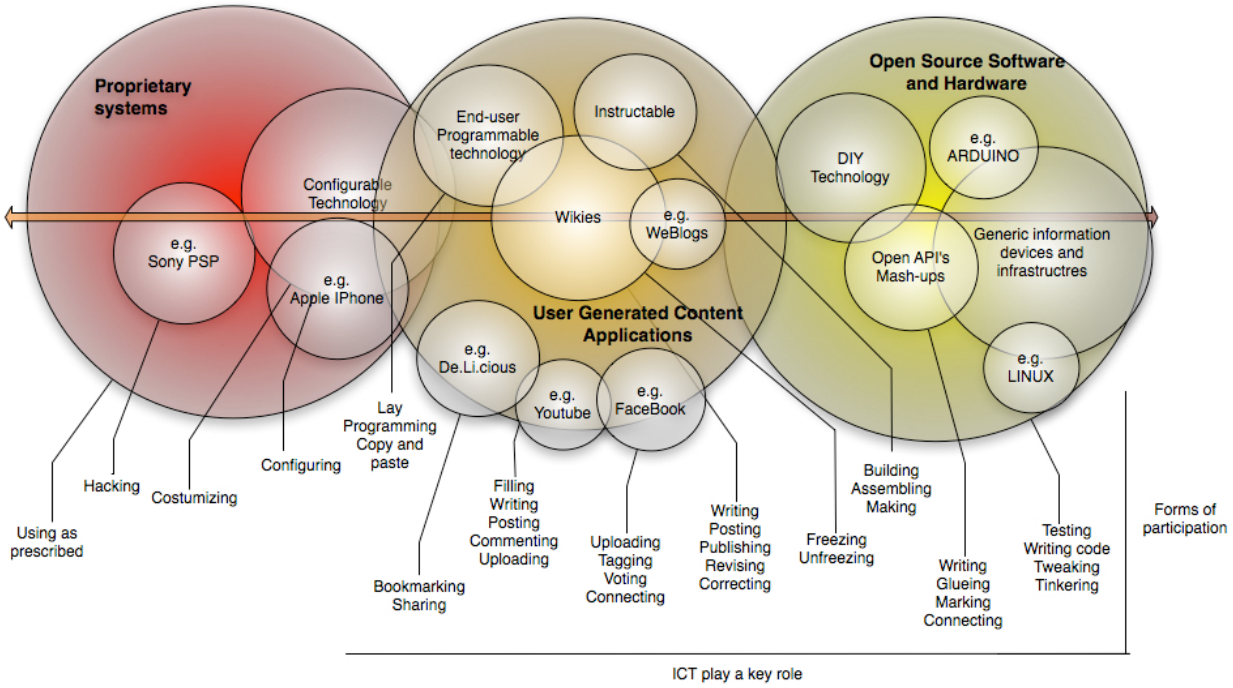
In the case of UGC and Mash-ups we witness different forms of materiality and relationality in play. First of all, UGC inscribed a more specifically active role to users that here is invested with certain agency. Although we have a specific set of elements that sustain a certain separation between users and designers (e.g. contents filters, possibility to freeze or not a content), UGC artifacts appear as spaces available for people to create and share contents. In this sense, also the separation between a certain design before and use after is a bit blurred because contents are often continuously shaped and reshaped by the active contribution of people as, for instance, we see in Wikipedia's entries (which sometimes can last only for few minutes). But then again, as soon other entities are brought into the process (as in the case of open API and freely generated scripts in the first mentioned Mash-ups by Paul Rademacher), the materiality of an artifact is reshaped by its relationality and the original separation between users (as Paul was) and designers (as Paul has became) are put into question again. The production and design process become here more decentralized and distributed among communities of users although those who own the infrastructures are able to exert several forms of control and power over users' behaviors[7].

In our last case on the Arduino we have an interesting mix where the materiality of the board and its relationality in a larger socio-technical assembles offer further occasion to think of the emergence of new ways to understand innovation and the relationship between users and designers. For Instance, open schematics make available the original design (here intended as plan) to anyone to appropriate and so also to re-design. The regime of different licenses in play helps to distribute the agency along the innovation process toward a series of actors that are different from the original developers and that act faraway in space and time. In this sense, we have the Arduino web communities which work in a similar fashion as UGC: people share contents, post them on-line, build step-by-step tutorials, comments on other people's posts, suggest changes. On another hand, we have the schematics of the board that have been released under a Creative commons license thus making any user a possible designer for improvements at the cost that new solutions remain equally available to anyone. Same things can be said about that programming environment (programming language and the software to write and run the code) which is released under the GPL license. Finally, we have a brand that - in a more traditional sense - is not different from Sony preventing specific (ab)uses. With the exception of this last aspect, that alone seems to be able to provide a sustainable business model to this Open source project, innovation and design is completely distributed and also fostered by the soft and weak forms of control in play. Through this series of case studies, I intended to show that - by affording different forms of participations at different

[7] Analysis of this new technological phenomenon risk to fall under enthusiastic accounts that see users as liberated by UGC technology. We agree with Beer (2008) that these account often suffer of 'an amnesia about the functioning of capitalism'. The case of Facebook clearly shows, in my opinion, this aspect.

moments of the innovation's design and use and framed within a series of elements that sustain specific strategies (from firmware to be updated, to contents filters, to licenses etc) - artifacts influence the establishment of a specific relation between user and design (with fixed roles) or rather contribute to its dynamic nature.

If we try to order our examples alongside a dimension that goes from a traditional situation (where we have a strong *a-priori* separation between users and designers and design before and use after) to a new series of cases



(where these separations blur), then we come to note an interesting character of certain technological artifacts that might suggests the emergence of a new ontology of designed artifacts. In this sense, we can draw a line (fig. 2) where we can move from socio-technical assemblages where artifacts and infrastructures enact a clear separation between user and designer (on the left), to new emerging assemblages where artifacts and infrastructures, instead, challenge the traditional understandings and partake to the establishment of new design paradigms (on the right) and thinking[8].

Fig. 2 Continuum of innovation from traditional models to emerging new ones

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Moving from left to right, means moving from centralized, top down designs based on strong *a priori* separations between users and designers and on very modest forms of users participation, to distributed, bottom up designs with weaker *a priori* separation between users and designers, new emerging forms of participation and a dynamic redistribution of power and agency over the innovation process.

What I would like to point now is that the more we move on the right side the more the technology is likely to be defined as *open* against forms of protection in play in proprietary systems. Open because they are public and freely accessible. Open because they contain – by design - the possibility to be transformed (through appropriation or re-design). And to have successive versions to be equally open (mechanism that, for instance, is put in play by the participation of certain licenses). But here, open also means *indefinitely* open thus showing another profound difference with a traditional model that concerns the specific nature of design processes' outcomes. In the first case we saw a tendency to fix things and to irreversibly black box the

[8] My intent is neither to reduce two paradigms to essences nor to suggest that we, as designers, need necessarily to move toward new forms of interaction with users. My point is to show that different artifacts in different socio-technical systems enact a certain relationship and this influences the ontological status of the designed objects themselves with consequences for our understanding of what to design is. More than an opposition between two models, I see a dialectic between different logics in play distributed in larger socio-technical assemblages and inscribed in many of their elements where each half of the duality presumes, differ from, and builds on the other.

design as Sony aimed to do with its PSP. Proprietary systems rely on closeness, a means to control user behavior that Mumford would have defined 'authoritarian' (1964). In new emerging systems, things can be fixed only temporarily and this means that, while - in the traditional paradigms - we have a clear distinction between means and ends, this separation also blurs as an effect of the open-endedness of the design process and its outcomes. That is also why it might be more appropriate to say that - while in the traditional model we have a clear separation between the process of design and its produced products - in the new models this cannot be said because designed products can be continuously re-appropriated by design thus becoming processes in themselves where the activity of use and design mix[9]. Take a Wiki entry: is this a product, is this an 'end'? Something designed and fixed by someone for the use of someone else? Well, yes and not. If the entry is not frozen (an act that marks a clear separation between a producer - who freezes - and a consumer - who cannot unfreeze - and that is specifically inscribed in a material function of the systems), the entry can be modified, corrected and transformed by anyone indefinitely thus losing its ontological status of an entity or a product or an 'end'. New design paradigms thus produce open-ended processes (flows and movements) and not objects (fixed entities): a wiki entry, a mash-up, an OH platform, an open source program. Here what is an end for some actors becomes the means for further design by other actors. That is why we are inclined to say that the more we move right, and the more technology is open: in blurring the separation between use and design and users and designers we cannot avoid blurring the distinction between means and ends and, therefore, between products (here understood as a fixed entities) and processes (here understood as an open and partly unpredictable flows).

CHALLENGES FOR DESIGN AND DESIGN EDUCATION

What we have learned so far is that distinctions such as the ones between users and designers, means and ends or products and processes are becoming very limiting to understand some of the actual and future forms of innovation in society.

Certainly, these become problems because although the traditional separations are losing value in many cases we still need to understand what it is to be a designer and what it is to educate and to train a designer.

Such new forms - within emerging socio-technical assemblages - undermine the traditional separation that has guided both the theory (the way design researchers talk about design) and practices (the way design processes are managed and implemented) so far, and so ask to rethink the way we talk and we manage design and innovation in future ICT. If what has been traditionally understood as a passive user is now becoming a variety of active actors participating with a variety of activities (as in figure 2), then how to adjust the role of future designers? If to adopt always means to adapt (Callon, 2004), if what was an 'end' is just a new starting point (as in the case of Wikipedia entries), not an entity but an open-ended process then, what it is for professional designer to engage in new innovations? And, again, if we come to acknowledge the role of some artifacts (e.g. licenses, hacking tools etc…) in redistributing agency and participation between different entities in an innovation process, then how should our understandings and methods be adjusted?

We have learned that to look at artifacts in a relational way means to look at a larger unit of analysis, where the materiality of artifacts gains its agency through its relations with other parts of the systems. We have also seen that the contribution of ICT technology is sometimes fundamental. For a design point of view, this means that designers of future innovations will not only have to respond to demands or satisfy needs but will also need to participate in the shaping of agencies (theirs and others'), in the reconfiguration of new ones and in the making room for collectives to emerge[10]. Some of the problems for new designers in ICT will be not to shape only matter into products but also collective and individual agencies into processes. As Callon (2004) stated talking of technological innovation in participatory settings: *The main challenge for the next years will be to discuss which type of human agencies people want to develop. Or, in other terms, which types*

[9] According to Akrich et al. (2002), this means that *the users, as well as all the intermediaries in development and production, participate in the design work.* Furthermore, as Callon (2004) commented about innovating collectives, *use and design merge, or at least constantly interpenetrate each other. The corresponding social roles become hybrid; any designer is a user and vice-versa. This hybridization creates communities consisting of actors with different competencies and sometimes-antagonistic interests and conceptions. These collectives are made and unmade. They appear, spread, diffuse throughout organizations, merge, and sometimes disappear. They are the key actors of our innovation societies.*

[10] I have elsewhere argued that future designers should be able to engage into different *regimes of delegations* (Storni, 2008).

of socio-technical arrangements people will design and experiment. This is a key issue for participatory design of information […] Hence, the slogan I propose: change the collective, change the socio-technical arrangement, and you change the agency. (pg. 8)

These are certainly new challenges that we need to address as designers and design researchers, and that make some of our traditional categories and oppositions (e.g. use and design, means and end, product and processes) very limiting in accounting for what is going on in technological innovation. In a provocative way, this might also push us to think if we better need further and more elaborated design methodologies, or if instead we need to think of using methods, users' design tools and spaces. And then again, having acknowledged that the relationship between users and designers is a result to be explained along with the status of an artifact (as product or as process) can only further puzzle what it means to be a successful design. Given the character of open-endedness, what it means to be a successful story in such new paradigms? If innovation is distributed and open ended then its success could not be accessed, isolated or universally defined as it was used to be. Is Wikipedia a successful innovation that is paradigmatic of new emerging models? Well, again yes and no as its founder Jimmy Wales has recently written an open letter[11] searching for support as the project is dying down and - in order to maintain its original spirit - it cannot be owned or bought by some private financier.

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11 http://wikimediafoundation.org/wiki/Donate/Letter/en?utm_source=2008_jimmy_letter_r&utm_medium=sitenotice&utm_campaign=fundraiser2008#appeal