Faculty of Design

2016

Design Ethics in socio-technical systems: Addressing the ethics of connected appliances

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Design Ethics in socio-technical systems

Addressing the ethics of connected appliances

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Abstract

This paper seeks to address design ethics, going beyond traditional approaches and focusing on socio-technical systems instead of on individuals. It investigates some issues that affect the ethical interests of designers as professionals, together with technological and environmental issues that have not received much attention from ethicists. The methodological framework combines the Value-Sensitive Design (VSD) developed in computer ethics with the methodology based on need, requirements and performances developed in architecture. This approach is applied to the development of connected appliances, dealing with problems in a positive and proactive way. Some guidelines are drawn at the end of the dissertation to achieve this purpose, establishing responsibilities and limits of the designer in the design process.

Introduction

Despite the variety of perspectives to address the ethical issue, most of the literature focuses on the theoretical dimension of ethics, following traditional approaches:

- Deontology, based on obligation and duty, i.e. the knowledge of what is right and proper;
- Teleology, which maximizes the utility, based on principles and goals;
- Virtue ethics, which considers the role of character and his virtue, i.e. the worth living.

Even design ethics literature tends to frame ethics according to these approaches (Anjou, 2010:1 and 2010:2). From a philosophical and theoretical debate in the mid-twentieth century it raises the need for an applied dimension of ethics, an application perspective (Albrechtslund, 2007). This led to the fragmentation of applied ethics in many disciplines with overlapping boundaries, including Computer Engineering, Business and Design, to name a few. The bulleted list that follows is an attempt of categorizing

- Economics and business ethics
- Bioethics
- Organizational ethics
- Social ethics
- Environmental ethics
- Professional ethics (all the disciplines)
- Ethics of technology

This paper seeks to address the last four categories. Referring to the professional ethics, the work focuses on design (d'Anjou, 2010:2; Devon & van de Poel, 2004; Manzini, 2006). However design ethics concerns a vast area, overlapping many independent fields of applied ethics (Chan, 2016). Among the Ethics of technology, (i) Technoethics, (ii) Cyberethics, (iii) Internet Ethic and (iv) Information Ethics are taken into account, although providing an exhaustive analysis of them is out of the scope of this paper.

Social Ethics

Traditionally, ethics has primarily been the study of appropriate standards of individual human conduct. According to Devon & van de Poel these traditional approaches to ethics have focused on individuals, actions and consequences (Devon & van de Poel, 2004). Floridi has defined this approach as *anthropocentric* (Floridi, 1999). Applied dimensions of ethics have been extended to non-human living things (*biocentric*), and ultimately to inanimate things (*infocentric* and *object-oriented*). Social ethics deals with how people collectively make decisions about technology, which is different from extending the scope of ethics to collective decision-making.

> *A collective decision has to be made with participants who have different roles, knowledge, power, personalities, and, of course, values and ethical perspectives. Social ethics is therefore certainly practiced, but it is not usually treated as a subject for philosophical inquiry (Devon 1999; Devon and Van de Poel, 2004).*

This approach considers the social arrangements for decision-making in an iterative design process and stands among the others in being more focused on the design process – as a reflective action of choosing between different possibilities (Manzini, 2006) – and project management. Products or services are defined by several choices occurring throughout the design process and these decisions can be made in explicit or implicit ways. Moreover this method seems to embrace the socio-technical complexity of the systemic product-service contexts, which is useful to define strategies of systemic integration (Jones, 2014). In this way it examines structure and process, involving social relations and their values. Value Sensitive Design VSD (Friedman et al., 2002, Cummings 2006; Albrechrslud, 2007) provides the methodological framework to this paper, since it bridges the gap between technical design and human values. From this point we refer to a specific scenario, i.e. the design of connected home appliances. The application to a specific case study should be helpful in illustrating relevant ethical issues (Cummings, 2006).

Methodology

Many authors pointed out a lack of a formalized approach (Cummings 2006; Devon and Van de Poel, 2004; Chan, 2016) to provide a specific guidance on what stages to include ethics in design instruction. One methodology developed in human-computer interaction research, the VSD approach (Friedman et al., 2002), can be considered an engineering decision-support tool to bridge the gap between technical design considerations and ethical concerns expressed through human values. It includes the way decisions are and can be made during the design process. VSD indeed makes moral values a part of technological design in the early stages of its development.

> *VSD is a theoretically grounded approach to the design of technology that accounts for human values in a principled and comprehensive manner, throughout the design process (Friedman et al., 2002).*

It is an iterative tripartite methodology consisting of conceptual, empirical, and technical investigations. In this paper VSD methodology, which expressly refers to decision about technology, is analyzed in parallel with a broader and more generic methodology based on needs, requirements and performances. The latter identifies the early design stages, by structuring the decision-making process in the scenario analysis (Germak and De Giorgi, 2008). It has been theorized in architecture and then successfully applied to the design. As Ciribini stated:

> *A building is made to respond to human needs, [..] These needs must be presented in the form of incoming requirements to which out-going performance must correspond (Ciribini, 1984).*

VSD generally falls along design principles of conceiving an idea, designing an artifact and then testing the design, it can be incorporated into established design processes.

Conceptual. Defining needs or values

The explicit decision-making made in the process of design and technological development should involve a wide network of stakeholders and it requires an inclusive approach (Devon & van de Poel, 2004), to make sure the right people are included in the decision-making (Devon, 2004) (Fig.1). Figure 1 shows the stakeholders involved in the design of a connected appliance.

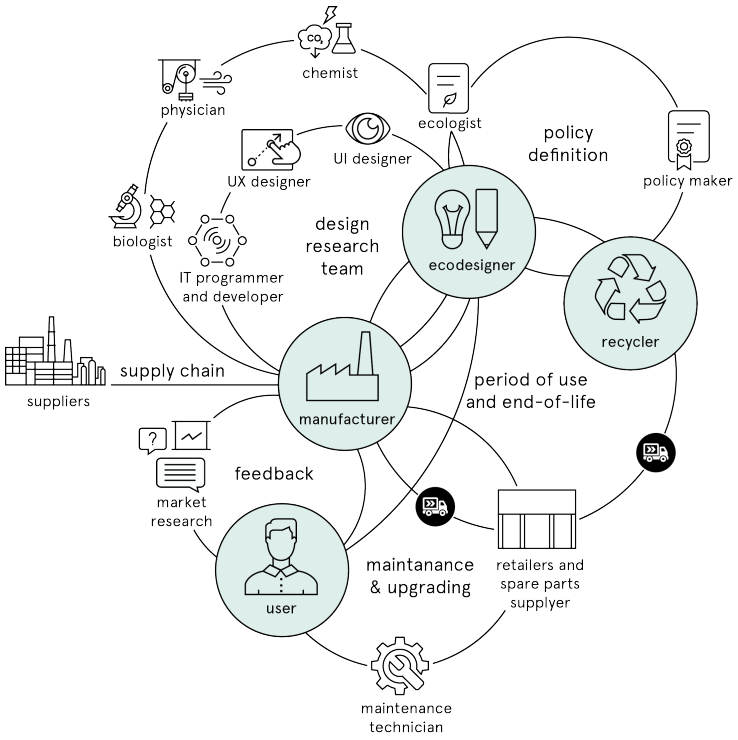

Fig.1 Stakeholder network

> *Design may be the best place to study ethics in technology, because design affects us all. However, not all of us are involved in design, and this asymmetry has great import for the social ethics of technology (Devon, 2004).*

During this first stage, according to Cummings twelve specific human values are considered in the design process. These values are based on Friedman's ones (Tab. 1).
The inclusion of the VSD values into the system of needs highlights that they fully fit the information security, leaving other areas uncovered. This is far from being an unexpected result, since the author's intention was clearly expressed, as well as the main focus on technology.

> *Influencing the design of technology by explicitly attending to which human values are taken into consideration and integrated into and throughout the design process.*
> *[..] Thus complex socio-technical systems involve intertwined interactions between humans and technology and cannot be designed in a value vacuum (Cummings, 2006).*

However in order to address design ethic more completely this approach should be expanded to the other needs. How Albrechtslund states the relative weight of ethics, functionality and even aesthetics must constantly be considered.

Needs			**VSD values** ([1]Friedman et al., 2002) ([2] Cummings, 2006)
User specific	Safety	Health	-
		Information	Privacy[1-2] Freedom from bias[1-2] Trust[1-2] Autonomy[1-2] Informed consent[1-2] Accountability[2]
	Comfort and wellbeing		Human welfare[1-2] Calmness[2]
	Aesthetic		Identity[2]
	Usability		Universal usability[1-2]
Product specific	Management and maintenance		Ownership and property[1-2]
	Integration and upgradability		-
Environment specific	Environmental protection		Environmental sustainability[2]

Tab. 1 Integration of VSD values in the system of needs defined by the UNI 8289 standard (needs are taken, translated and freely adapted from the Italian standard)

The first choice takes place in the first stage. The designer should choose some relevant values "*that could be viewed as common thread throughout the project"* and iterate the process through other two phases, that can add or remove values (Cummings, 2006).

Empirical. Identify requirements

> *The second stage is the empirical investigation, which focuses on quantitative and qualitative measurements to evaluate the design from both a technical and value assessment approach (Cummings, 2006).*

It represents the mediation between values and technical aspects, between values and feasibility. How to translate those values into practice? How to translate them in the design process?
This second phase is a part of the decision-making and should be based on multi-stakeholder requirements. It provides the means to establish a hierarchy among the values depending on the specific case and prioritizing competing values. It allows the designer to support or detract from value conflict. Once ethical issues and their relation to the critical human values are understood in the conceptual and empirical investigations, they can be applied to the technical investigation phase of the VSD methodology.

Technical. Define performances

The last phase concerns the investigation of technical issues. It evaluates the service or work provided by technical solutions and how they support particular values. It evaluates also how values identified in the conceptual investigation could be best supported by different design possibilities. Even the third step includes the decision-making, by choosing from several solutions

that meet the requirements. This stage serves the dual purpose of have clear in mind the state of the art and predict potential future needs if the solution is currently missing. However much of the decision-making is also implicit and incremental and many choices are made in designing that are not explicitly recognized as choices or decisions at all (Devon & van de Poel, 2004). In this phase a number of decision support tools could be used, most of them are based on a decision matrix. They usually establish a set of weighted criteria with which to analyze a set of solutions. At the end of the process these tools can provide a rank of these solutions, although it is not always necessary. One of them is Multi-criteria Decision Aid - MCDA (Roy, 1990; Doumpos and Zopounidis, 2002; Figueira et al., 2005)

Ethics of technology: a connected appliance case study

> *Design should be a synergy between the abstract knowledge of the expert and the local knowledge of the user. At its best, value-sensitive-design is not simply the accommodation of local values in the designers' vision of the future, but a process in which designers and citizens depend upon each others' knowledge in the production of a better world (Kroes et al, 2008).*

What is missing between the design and the user is the product or service, which should be the medium through which the dialogue takes place (Fig 2).

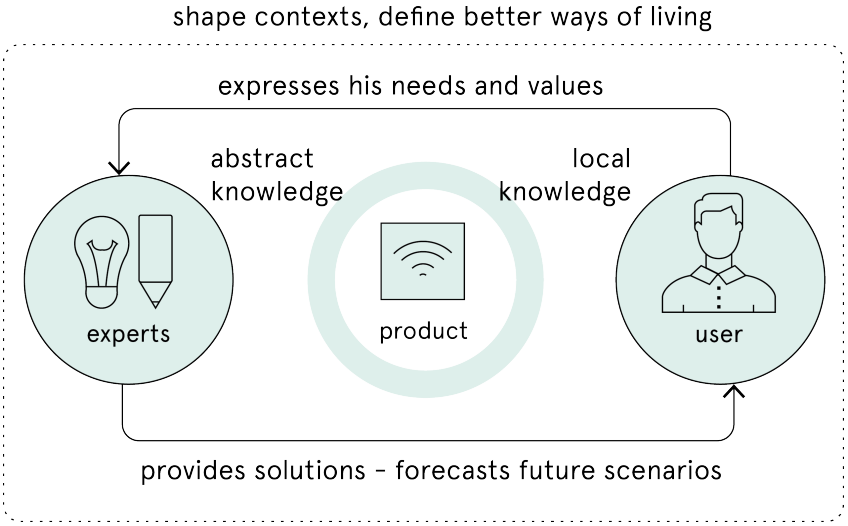

Fig.2 – Defining the medium of the dialogue between users and experts

In this case the medium is a connected device, which brings out the topic of Internet of Things (IoT). Combining different definitions, IoT could be defined as:

> *A global network infrastructure of Internet-connected devices or gadgets (Wasser et al., 2016) able to collect, store, process and communicate information about themselves and their physical environment (Ziegeldorf et al., 2014).*

Some legitimate questions arise, regarding the type of information and when is it collected, about who can access it and for what purpose, but also how long is stored, and so forth. These concerns, especially when they are related to privacy, provide an interesting counterpoint to the discussion started in 70's by Nicholas Negroponte about the automation in design.

He stated that :

> *A machine that is not able to recognize shifts in context, that cannot evolve or self-improve, should be considered as unethical (Negroponte, 1970).*

since it will not be able to adapt to changes and it acts applying solution based on "default-options" imposed simplistically by someone (Negroponte, 1970). In his opinion intelligent machines should be able to learn and understand contexts by interacting with them. This contrasts with our idea of smart, which it is used improperly to define connected objects.

Level of automation

> *How much automation is needed for a system and to what degree should humans be in the decision making loop? How automation can best support human decision makers and what level of automation should ben introduced into a decision support system to provide human centered automation support? (Cummings, 2006).*

Level of Automation (LOAs) is clearly defined from a minimal level of automation to fully automated systems (Cummings, 2006). A common risk for designers and user is the lack of system understanding and loss of situational awareness that fully automation can cause. It can lead to unanticipated effects for more complex tasks. Keeping the operator, the designer and the user (stakeholders in general) in the decision-making loop should contrast the tendency to rely upon automated (computer-generated) recommendations.
An example of that behavior is following the directions of the navigation system to reach a place, without questioning whether they are really effective. People are used to rely on it despite the fact that contraindications existed and verification of contradicting information is possible (Skitka et al., 1999).

Missing information

Every design tasks are characterized by a huge amount of missing information, both unavailable and undeterminable. Part of the design process is spent to obtain this information by doing research in the preliminary design stages (Negroponte, 1970). But some pieces of information are user-specific, related to experience, the use of the product, others are expected, assumed, foreseen or random, then they have to be tested and evaluated. A connected object can collect omitted and difficult-to-acquire information and allow users to be part of the design process, collecting their needs and desires. The object collects pieces of information; inform the user about what is collecting and for what purpose it is being used. The object can uses some bits of information to change functions or provide this data to the designer to improve the product when the machine is no longer able to adapt and modify functions to fit user needs. In this way the user express his needs and requirements while the designers provides solutions and forecast future scenarios. This should be considered as ethical. However switching from the Internet of user-generated content (self-generated data), in which user voluntarily handle devices to interact with their online environment, to thing-generated content or technically-generated data, Internet of Things will inevitably bring a new quantity and quality of data and as well as unprecedented opportunities, but also unprecedented challenges and problems. Collecting data should be proportional to the design end and the data collected must support the overall aim of the design

Iot privacy and security

In this complex scenario there are direct and indirect stakeholders, as well as internal and external use of these data. The internal use of data is the one expected. Providers are among the third parties in a legitimate way and they could be commercial actors, such as companies, suppliers, home

security providers, software and hardware vendors or standardization organizations (Jacobsson et al., 2015). Collected information can be used to reduce costs and improve the efficiency towards consumers, because this amount of data improves the understanding of user characteristics and requirements. How are both direct and indirect stakeholders affected by the design? What values are implicated? Design should ensure also the privacy of children and people towards other family members, the privacy of those who are visiting relatives and friends.
More pronounced and articulated a technology becomes, the more humanity is exposed to the unanticipated side effects and risks of harnessing technology (Chan, 2016).
Along with the consolidation of IoT solutions in different areas, there is an increased attention among companies on the value derived from the information made available by connected objects. This could lead to an external use of data by other side stakeholders, which might be interested in profiling clients. The improper use of data should include also unauthorized computer intrusions, motivated by malicious intentions (Fig 3).

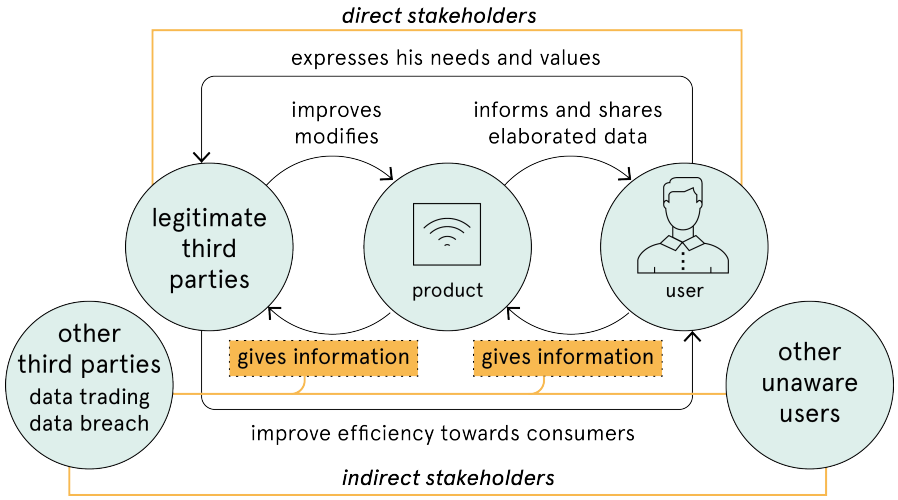

Fig.3 – Direct and indirect stakeholders and authorized use of information

The separation of technology from its social context (Van de Poel, 2001) and the idea that technological practices are free from any value should be considered overcome. Technology should get free from the instrumentalist paradigm, which perceived it as external to moral choices. Ethics of technology associated to this instrumentalist paradigm could only ask if the ends justify the means, or whether certain consequences are justifiable and to what extent is the designer virtuous or not in the use of technology (Chan, 2016).

Professional Ethics: Design Ethics

> *Design is, in the Aristotelian sense, a science of correct action. Ethics is an integral part of all aspects of our designs and all our uses of technology. Technology is human behavior that, by design, transforms society and the environment, and ethics must be a part of it. Different design theorists and practitioners have persisted in envisioning and articulating a design ethics that can inform, clarify, and improve design practices (Devon, 2004).*

Moral values in design and commitment to these values only become clearer as designers struggle through the problem; these values are rarely present by default at the outset of design (Chan, 2016) Design Ethics should bridge the gap between technology and context, considering context-specific, socio-political and cultural values. In doing so, the designer should fully understand the

environment and explore future possibilities, as well as provide solution to the current needs. Getting back to the case study, the connected device is the technical element of a wider system that contains also human beings and social contexts. Technology both shaped society and is shaped by social factors. Should the designer be considered responsible for the production of the material environment, through the existence and use of what is produced for his employers? (Van de Poel, 2001). Are both the design team and the company responsible for the information generated from IoT connected devices? What is responsibility in design? According to Chan responsibility in design has so far been problematically understood and defined, and mostly it does not go beyond the obligation for professional due diligence. A first way to consider responsibility is indeed a form of a professional ethic or code of conduct towards clients and users; the second however admits to a broader social intended as a social and moral responsibilities of design (Chan, 2016).
Giving more emphasis to the second way, moral responsibility is included into the design process though the definition of three guidelines. The aim is to demonstrate that the designer could act as a promoter of ethical aspects.

Guidelines

1) Consider privacy and security

In this specific field the designer should consider privacy and security issues and current limits to avoid falling into one of these problems. This task is all the more pressing when designers can no longer count on social norms to provide guidance in many matters of new technology and design (Flusser, 1999). In the current state of the art there is a general lack of legislation and policies, which directly led to the possibility of:

- A wrong/improper use of the information;
- User identification, tracking and profiling;
- That this could affect the user freedom.

As mentioned before, these issues should be included in the design process, in the same way as user needs are taken into account. The designer should question about how to prevent and avoid wrong or bad behavior resulting from the misuse of the products and information.

2) Keep the user in the design loop

Together with the introduction of time-saving technology (Aldrich, 2003) it came the concept of wellbeing as the minimisation of personal involvement.

> *The best strategy seems to be the one which requires the least physical effort, attention and time and, consequently, the least need for ability and skills (Manzini, 2006).*

This way of looking at wellbeing has progressively led to disabling solutions, i.e. systems of products and services that seek to reduce user involvement and sequester formerly widespread knowledge and skills to integrate them into technical devices *(Manzini, 2006).* This "not-so-hypothetical" context promotes passive user, who will not be able to understand how things work and eventually will accept automatic and hyper-technological devices, losing interest in them. This increases the distance between the user and the object, decreasing the interaction with it, but also lead to a loss of awareness. An ethical design should shift from passive to active involvement of the user with his active participation in the design process. In this way the final user, which was part of the problem, becomes part of the solution. A user who is also a co-producer of the result, is able to do so because he/she has (some of) the necessary intellectual and practical resources and, above all, because he/she is best acquainted with the specific problems to be solved (Manzini, 2006).

3) Shift the focus on sustainability
As Simon stated:

> *Design should be consider in the broadest sense of "changing existing situations into preferred ones (Simon, 1972).*

In this way design should try to direct the evolution in an ethical and sustainable direction.

> *The first ethical move that designers have to make is to find a new and (hopefully) sustainable idea of well-being (Manzini, 2006).*

Manzini also pointed out the responsibility intrinsically rooted in design to lead to a transition towards environmental sustainability although this direction is by definition, unforeseeable.
For Devon designing technology is equivalent to *"design lives and establish constraints, often severe, for future generations",* which immediately calls to mind *"meets the needs of the present without compromising the ability of future generations to meet their own needs"*. Design process through technology is able to transform the society and the environment.
However, as Chan stated:

> *Sustainable design, which by one formulation is at least to reduce the impact of design on the environment, is nullified when the scale of its realization in material and energy consumption exceeds its aggregate impact reductions (Chan, 2016).*

Therefore we must ensure that the use of technology does not conflict with the overall goal of improving the environmental sustainability.

Conclusions

Design Ethics, as far as possible, should be able to foresee future problems and, in the meantime, continue to address current ones. Ethics should investigate the cause-effect that may occur, detaching from the case-specific, looking at the whole picture and the relations that can be triggered by a product or service. However designers should be aware of the limits of foresight (Albrechtslund, 2007), but still anticipate ethical scenarios ad possible issues.
Keep the user in the design loop could lead him to understand how things work and how to use them properly. It could change eventually wrong behavior. It allows him/her to build his/her own opinion, understanding the cause-effect of different actions and modifying his future behavior to reach a personal, social or environmental goals.
Designing of socio-technical systems requires the designer to pay attention to a number of implications, even unexpected, in order to ensure that the user is not exposed to risks. In this kind of systems the behavior of the agents is generally unpredictable and maybe cannot be controlled (Kroes et al, 2008). However design in an ethically responsible manner is an evolutionary process, and we cannot generalize trying to follow predefined rules, because every context changes and the whole system evolves. Even the user evolves while is using the products, and the design should try to direct the evolution in an ethical and sustainable direction.

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