Abstract: The products and systems we design transform society. As design encompasses ever more complex, ‘Ambient Intelligent’ technologies, its influence on society concurrently becomes increasingly complex, profound and ethically relevant. Designers have both an opportunity and responsibility to take this social influence explicitly into account in the design process, inspired by a vision on a desired social transformation. A challenge for design research is to find how to design for such social transformation. In the current paper we present three research-through-design approaches we are currently pursuing, namely (1) an explorative approach, (2) an in-depth approach, and (3) a cultural-societal approach. These approaches are illustrated with concrete design research work and results. The paper concludes with a preliminary evaluation of these approaches and a reflection on how these three design research approaches complement each other in terms of resulting design knowledge.

Key words: Ethics, aesthetics, culture, interaction design, design research approach.

1. Introduction

The designs we make have an impact on the everyday life of people. In general, technology brings about change in people’s lives, once it enters the life of these people [18]. The mobile phone provides a vivid example. Social scientists describe how it has changed the way people organize their everyday life, and especially among teens tightened social networks. SMS technology even changed language use amongst teens [8].

New technological possibilities continuously emerge. The consumer electronics industry currently develops technologies for a new generation of devices that are networked, adaptive, context-aware, personalized and anticipatory [1]. These devices are envisioned to ‘weave into the fabric of everyday life until they are indistinguishable from it’, as Marc Weiser [19] put it. These ‘Ambient Intelligent’ devices have the potential to influence everyday life in new ways. It is unrealistic to expect that such intelligent products and systems will just assist us in what we normally would do. Similar to the effect of the mobile phone’s introduction, adoption of such products and systems will transform our daily life. And as these products and systems are omnipresent and deeply interwoven in our lives, their influence on people will be even more profound.

The new technologies that enable these highly integrated products and systems confront design with new opportunities and challenges. If these intelligent products and systems weave deeply into our personal lives, we cannot leave their possible transformational role to chance. We risk non-acceptance, we risk a de-humanizing
effect on people, and we will miss opportunities for improving people’s lives. In the context of highly integrated intelligent products and systems, design will increasingly be about creating opportunities for changing people’s lives in a positive way. This means that design will be decreasingly technology driven, market driven or problem driven. It will increasingly be driven by a vision of a better life, made possible through humanized technology. A vision of a better life implies a strong ethical dimension to design of intelligent products and systems. For what is a better life? What transformations are desirable? How do we want or allow our products and systems to influence people’s lives? What transformations will be accepted, rejected, or needed in society?

This transformational and ethical role of design confronts design research with challenges that are directly relevant to everyday life. New design knowledge is needed to find how this ethical dimension can be incorporated in the design process. How can we formulate a vision on transformation, useful in the design process? What are effective design techniques to pursue such visions? What are mechanisms that underlie the influence a design has on the life of people, and how can we take them into account in the design process?

This paper presents three design research approaches that pursue the generation of design knowledge for transformational design, namely (1) an explorative approach, (2) an in-depth approach, and (3) a cultural-societal approach. The main aim of all three approaches is to find how to incorporate ethics in design of interactive and/or intelligent products and systems. They have a research-through-design [5,3] nature in common, but differ in terms of the kinds of design knowledge that are targeted and how this knowledge is pursued. In the next section the three research approaches are briefly explained and illustrated by means of case studies. This paper concludes with a reflection on how these three approaches complement each other in terms of design knowledge and techniques.

2. The explorative approach: Ethics and Aesthetics in Interaction

This first research approach was aimed at exploring the potential of explicitly incorporating ethics in design of interactive products and systems. We were seeking a ‘designerly’ approach. Related work, like Value-Sensitive Design [6] focuses on the domain of computer systems. We were searching for design knowledge for systems that have a more elaborate physical dimension, leaving the confines of the computer screen.

For the development of a more design-oriented approach to incorporate ethics, we turned to aesthetics, which is in our view an essential ingredient for design. Links between ethics and aesthetics have been made throughout design history. Compare for example how a number of designers affiliated with the Bauhaus explicitly aimed to emancipate the working classes with their products, embodying a universal aesthetics [4]. Linking ethics and aesthetics goes back to classic Greek philosophy. Aristotle united both concepts using the term to kalon, meaning both ‘beautiful’ and ‘good’ [14]. For Aristotle, these concepts were intertwined. Even in our common language today, the close relation between ethics and aesthetics is recognizable in utterances like: ‘That is a beautiful thing you did’ or ‘Don’t be so ugly’.

In the current research line, we explored how to design for to kalon in interaction. This means we were trying to design for interactions that were good according to specific ethical beliefs. How can we explicitly design interactive products that elicit good human behavior in interaction, according to specific ethical beliefs? Concretely, designing for to kalon was researched through conducting and evaluating a workshop called Ethics and Aesthetics in Interaction (for a detailed description see [12]), which was later adapted into an Industrial Design Master Class called Ethics in Design.
2.1 Workshop set-up

In a one-day workshop, we gave three groups of three participating designers/researchers the assignment to design interactive products targeting specific ethical beliefs. We defined three kinds of interactive products that differed in terms of primary functionality, i.e., candy vending machines, cattle corps destruction lines, and electronic payment systems. The groups of participants each were assigned one product functionality, and were instructed to design two products, while targeting different ethical beliefs for each product. Evaluating these pairs of products with similar functionality, but targeting different ethical beliefs, made it possible to assess the impact of the ethical system on the final designs by comparison.

In cooperation with philosopher of technology and ethics Dr. Jan Vorstenbosch, a set of mutually differing ethical systems were selected as targets for the design work, including Kantian Rationalism, Romanticism, Nietzschean ethics, and Confucianism.

In light of the Aristotelian unity of the good and the beautiful, we used beauty as a means to elicit these good interactions. We made this aesthetics input as ‘material’ as possible, to give the designers concrete inspiration for their work as well, next to the highly abstract ethical systems. The aesthetics input had the form of artworks, like paintings, music, video art and images of sculptures, which related to the ‘targeted’ ethical systems. Participants were asked to act out Choreographies of Interaction [7], which are aesthetic expressions of the human-system interaction. These choreographies combined the aesthetics of art, the ethics of the provided ethical systems, and the functionality of the targeted products. The final product designs were finally designed based on these choreographies.

2.2 Workshop results

To illustrate the nature of the design work resulting from the workshop, this paper describes two designs: a Kantian vending machine and a Romantic vending machine. Very briefly put, and highly simplified, Kantian Rationalism views reason as the mechanism to come to the right actions. Contrastingly, Romantics respect non-rational forces, like passions and inspiration of the individual. Figure 1 en 2 show and explain the Kantian and Romantic vending machine interaction designs respectively. A more detailed and in-depth explanation of these concepts is given in [12].

![a. setting parameters](image1)
![b. "Are you sure? Your fat index is already above 17."](image2)
![c. picking up the candy](image3)
![d. done](image4)

Figure 1: The Kantian vending machine interaction. Candy is constituted by setting parameters that describe the desired candy in terms of its elements, like protein and sugar level (a). In (b) the machine reminds the buyer of his fat index and asks whether he would like to proceed. The candy is paid, and the buyer takes his candy (c,d). The salient link to Kantian rationalist ethics in this design is the emphasis on reason throughout the process of buying candy. Abstractions are used to constitute a piece of candy, which is physically hidden behind these abstractions until the last moment.
a. selecting candy physically
b. …even smelling it
c. paying
d. receiving the candy

Figure 2: The Romantic machine physically presents the candy to the buyer, allowing him to smell it and crave for it. Candy is selected by taking it from one of the presentation plates and dropping it on a horizontal tray (a,b). Then the buyer drops his money onto the money tray (c). After the money is taken in, the candy tray flaps down, overwhelming the customer with candy literally falling into his lap (d). According to the designers, this interaction is Romantic because of the drama and climax that characterize it.

An analysis with philosopher Jan Vorstenbosch indicated that most of the workshop’s concepts indeed elicited interactions that corresponded with the targeted ethical systems. Incorporating ethics through aesthetics turned out to be promising. The innovative character of the concepts also pointed towards the merits of the approach. Further analysis of the workshop indicated that the successful elicitation of the intended interactions could never be fully determined. Would the Romantic machine still be able to elicit Romantic interaction when a Kantian person interacts with it? Context and personal factors need to be taken into account when incorporating ethics through aesthetics.

The workshop is now regularly repeated in our Master’s education at the department of Industrial Design, to develop the students’ sensitivity towards, and skills for, ethics and aesthetics in interactive product design. The same level of innovation occurs in the student projects.

2.3 Reflection on the explorative approach

The workshop and its analysis indicated that the approach of incorporating ethics through aesthetics is fruitful. For the designers, ethics was usable and inspirational input for their design process. The workshop suggests possible ways to incorporate ethics through aesthetics. The resulting designs were however very preliminary and never systematically evaluated with people from outside the workshop. The ethical systems were inspirational for design, but they are theoretical and do not necessarily coincide with the complex and less systematic ethical beliefs of real people.

3. An in-depth approach: human values in transformational design

The workshop was promising, but left many questions open. In what way can we incorporate real people’s ethical beliefs in design? Can we corroborate our claim that designing products that elicit behavior corresponding with specific ethical beliefs is possible? This section outlines and motivates in a very brief manner the steps of this in-depth approach (see [10] for a detailed account of the research). It roughly consisted of the following steps: (1) philosophical grounding and operationalization of relevant concepts, (2) formulating a sharpened problem definition, (3) design work and experiment design, based on operational concepts, (4) experimentation and analysis of results, and (5) reflection on the problem definition.
3.1 Philosophical grounding and operationalization of relevant concepts

The workshop implicitly assumed that devices could influence our behaviors. We first set out to make this presupposed influence explicit and to motivate it theoretically. The theory of Technological Mediation by [18], offered a well-founded framework that described and gave insight into the way products influence human behavior and experience. Verbeek argues that each technology in use on the one hand invites specific behaviors, and on the other hand inhibits specific behaviors. At the same time it amplifies specific experiences, while reducing other experiences. Verbeek calls this the mediating role of technology, in the human-world relationship. This framework laid the theoretical groundwork for our research how to design for inviting specific behaviors in interaction. Verbeek also outlines the ethical implications of the mediating role of technology [18, pp. 212-217].

In search of a systematic framework for ethics, we shifted from philosophy to human sciences. More specifically, we used Human Value theory of social psychologist Shalom Schwartz [15] to characterize different ethical beliefs. This theory was attractive since it was thoroughly validated, it systematically related a complete set of values to each other, it included a measuring instrument for empirical studies, and it was used in research related to product design (e.g., [2]). Schwartz provided the following definition of human values: 'Values (1) are concepts or beliefs, (2) pertain to desirable end states or behaviors, (3) transcend specific situations, (4) guide selection or evaluation of behavior and events, and (5) are ordered by relative importance’ [15]. A near-universal set of 57 values was identified in empirical research in 20 countries. Examples of values are Creativity, Social Power and Helpfulness. The theory of Human Values informed the current research in multiple ways. Firstly, the theory helped describe ethical beliefs of the people, and offered a measuring instrument called the Schwartz Value Survey [15]. Secondly, it helped characterize the targeted behaviors in the design process. For example, the product should invite creative or helpful behaviors.

To get a clearer understanding of aesthetics, the current research turned to Pragmatist Aesthetics philosophy [16,9] and distilled a definition for Aesthetic Interaction. Aesthetic Interaction was defined as an experienced interaction with a product or system that: (1) is instrumental next to intrinsically rewarding, (2) is colored by the values of the person involved in interaction, (3) actively involves a person’s bodily, cognitive and emotional skills, and (4) has satisfying dynamic form [10, pp. 54-59].

3.2 Towards a sharpened problem definition

Combining these concepts, we can define a problem definition: How can we design intelligent products and systems that elicit specific values in Aesthetic Interaction?

Eliciting values was specified as follows: a product or system elicits a value when it invites a person to portray behavior that corresponds to a value’s motivational content, and amplifies corresponding experiences in this person. For example, a product designed to elicit the value Helpful should invite a person to behave helpfully and feel helpful. Aesthetic Interaction is based on the four principles of Pragmatic Aesthetics. It points at the intention to actively involve the whole human being in interaction, acknowledges the importance of dynamic form, acknowledges the influence of the socio-cultural context (in this case simplified to the values of the people interacting) and acknowledges the instrumental value of aesthetics next to its intrinsic value (inviting behaviors has practical consequences, so it is instrumental).
3.3 An example design, experimentation and reflection cycle

It goes beyond the scope of this paper to fully treat the series of experiments we conducted to investigate this problem definition. We however briefly treat one design experiment to illustrate the approach. It addressed the question whether it is possible to design an intelligent product or system that elicits specific values in Aesthetic Interaction. In an Industrial Design Bachelor course, students designed lamps for their fellow students. These lamps were intended to elicit the fellow student’s highest priority value(s) in Aesthetic Interaction. A Kansei based design technique was used, involving dynamic video collages expressing behaviors that fitted a specific value [11]. This collage helped the students design their dynamic form (an essential part of Aesthetic Interaction according to the aforementioned definition). See Figure 3 for two example designs made for the experiment.

Figure 3 Left two pictures: This lighting system, consisting of several light balls hanging above the staircase, targets Creativity related behaviors. The balls give light when moved, and can be spatially rearranged easily. The system’s easy interaction, combined with the beautiful resulting light and shadow effects, invites a person to be creative while walking the stairs. (Design by Lissa Kooijman.) Right three pictures: This lamp, consisting of cubes emitting colored light on a mirroring surface, elicits curiosity. The cubes give different colored lighting patterns depending on their mutual orientation. The lamp gives little clues about the possible effects of actions, but rewards actions with beautiful and unexpected lighting effects. (Design by Jing Wang.)

A set of 12 lamps, targeting a range of different values was evaluated in an empirical study. In this experiment, non-industrial design students rated film clips of the 12 lamps in action, using ‘value scales’. These scales were based on definitions provided by Human Value theory [15]. Analysis of the results indicated that eliciting values in Aesthetic Interaction was indeed possible. It was however not a matter of eliciting a specific, isolated value, but rather a range of values compatible with the target value. So for example, a lamp targeting the value Pleasure, would also elicit the compatible value Excitement. See [13] for a more detailed account of this experiment.

3.4 Reflection on the in-depth approach

This research approach targets the same research area as the explorative approach, but clearly has different aims in terms of design knowledge. Experiments such as the one treated here aim to answer research questions based on systematic empirical studies. But making systematic varieties of the designs also reveals patterns that, once identified, serve as design knowledge as well. For example, a new Kansei based design technique was developed, that focused on dynamic form. This concrete dynamic form input (present in the dynamic collage the students made) combined in a useful way with the abstract input of values in the design process.

4. A cultural-societal approach: Rights through Making

As stated in the introduction, design will increasingly be driven by a vision of a better life, made possible through humanized technology. To the question “what is a better life”, the Rights through Making project proposes a cultural-societal answer: we think that a better life, within the constraints and the opportunities of
society, is based on respect between people. Rights through Making proposes a design culture based on the respect of human rights, achieved through sharing the language of making. This making activity is able to surpass any cultural, ideological or social barrier, by singling out a tangible common goal. It is a transnational project born between the Eindhoven University of Technology and the Università degli Studi di Firenze (University of Florence). Rights through Making is developed through shared activities all around the world (i.e., as Ethics in Design didactic modules at the Eindhoven University of Technology, as project assignments for courses and individual final projects at the University of Florence, and as special workshop at the Southern University of Santa Catarina, Brazil). The common format is a workshop, where students from the participating countries design products and systems (communication, services, business, education) that empower, entice and seduce people to reach the ideals expressed by the Universal Declaration of Human Rights (UDHR), through “to kalon”, a synthesis of beauty and good [14,10]. With the use of such products, we aspire to promote the respect of human rights, as part of the everyday life of multicultural societies. The workshop is based on the UDHR, for we believe in the authority of this agreement on basic rights and values amongst different countries and cultures all over the world. This concept is a fundamental element for sustainability in the contemporary context: sustainability, be it economical, social or environmental, is nothing more than the practice of respect in space and time. The approach of Rights through Making combines latest technologies with saper fare. The focus is on smart products or systems that use different tools in the making process: electronics on one hand and locally available “making” skills and techniques on the other. This integrates intangible values to the product, made of respect and genius loci, able therefore to enrich habitats and cultures.

4.1 Rights Through Making workshops approach

Each workshop focuses on a different theme, e.g. wearable technology [17]. Students are asked to design within the given theme, a product that materializes the values expressed by a specific article of the UDHR. Once the design theme has been analyzed through different means, such as Choreography of Interaction [7], the design concept needs a definition and a translation into an experiential prototype. The techniques applied in these projects are of different kinds: we use both high technology and centuries-old crafts. The design process therefore continues through making: design students are asked to make an experiential prototype together. The Rights through Making approach is based on people’s abilities, not only cognitive, but also perceptual-motor and emotional, aiming to achieve a balance, both in the design process and in the final product.

4.2 Workshop results

The system resulting from this design process is a product: (1) that when used empowers people towards the values of respect, expressed by the UDHR; (2) whose use interprets contemporary societal values; (3) which expresses a unity of form, function and interaction; (4) which is able to demonstrate, through the applied techniques and technologies, a use experience showing all the tangible and intangible values of the product itself. The following examples are a result of two different workshops, the first held in Eindhoven and the second in Florence.

Beehugged is a concept that materializes the values contained in article 25 of the UDHR. It focuses on how people can provide and get trained to provide mutual care.
Art. 25. Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control.

Figure 4. In case of need of energy for a portable electronic appliance, it is possible to get it from other people around you that are willing to share theirs. Physical contact transmits energy for recharging. The more contact people make, the faster the recharge.

In today’s Western society, the majority of people carry some sort of electronic product. BeeHugged is a system that enables electric energy sharing. When people are in need of energy, they can be recharged by other people, who have enough energy and are willing to share. This system aims to educate people towards mutual care, so that sharing becomes a natural habit. The charge level of people’s garments is visible for others through light indication on their sleeves. The pace in which energy is transmitted depends on the amount of physical contact between people. For example a handshake will result in a lower transport rate than a hug. Running LEDs illustrate the transportation of energy and the level of charge.

InTouch is a concept that materializes the values contained in article 1 of the UDHR. See Figure 5. It focuses on how people can be induced to act towards each other in a spirit of brotherhood. When people accidentally bump into each other in public spaces, the response is often unsocial and disrespectful against what is stated by article 1. Therefore, situations like these are opportunities for changing behavior towards an increased spirit of brotherhood. InTouch is a piece of garment, worn as a jacket or on a jacket, integrating a sound clip, whose playback is triggered when accidentally touched. The element of surprise, as well as the personal and emotional characteristics of the sound, may induce people to focus their attention outwards instead of inwards, reinstating people as actual human beings instead of obstacles in each other’s path.

Art. 1 All human beings are born free and equal in dignity and rights. They are endowed with reason and conscience and should act towards one another in a spirit of brotherhood.

Figure 5. In case of accidental contact this garment emits a customized sound, transforming the annoying moment of bumping into a stranger, into a funny experience that makes you notice other people, create eye-contact and appreciate them as human beings rather than mobile obstacles.

4.3 Reflection on the cultural-societal approach: process and product

Sharing the language of making has demonstrated to be an effective tool to build multicultural design teams, although it is not a painless path. Examining the designers’ experience in adopting this approach into the
teamwork, their emotional and design process is clearly visible. They start with a general attitude that mixes both apprehension and curiosity, the further reaction is frustration due to lack in communication (either for cultural reasons, or because of a linguistic barrier). Once this moment is surpassed, there is always something enchanting going on: the designer performs a dramatic turn in his own approach. Time and again when making becomes the only propeller to the final activity, the result is valuable, if not in the design output, at least in the generated design knowledge of those who participate. Design knowledge starts to be created as soon as the barriers among people break when the making starts.

Although the designed products were prototypes and not tested in the market, they show merit and potential that would be worth pursuing. Most of the results incorporated the ethical values stated in the inspirational article. However, forcing the UDHR into the concept design sometimes led to underexpose other aspects (e.g., formal quality, scenario’s realism).

5. Reflection on the three approaches
The three approaches treated in this paper all have an explorative nature in their own way. The area of incorporating ethics in interactive product design, in this ‘designerly’ way, is new. No matured tools, techniques, or quality measures are established yet and the mechanisms that underlie this kind of design are still largely unknown.

The three approaches have in common that the input for the design process is a combination of the immaterial concept of ethics (either in terms of ethical systems, values, or the Universal Declaration of Human Rights) and bodily exploration of these concepts (behavioral analysis in the dynamic personality collages, and Choreography of Interaction in the Ethics and Aesthetics workshop and Rights Through Making). This is how ethics is opened up through aesthetics. It is a process of giving form to ethics.

The design knowledge from the Ethics and Aesthetics workshop has the form of directions the ‘ethics through aesthetics’ design approach could take. It also sensitizes the designers to the subject, which is why we also apply the workshop in education. The in-depth approach delivered design knowledge in the form of experimentally tested hypotheses, e.g., is it really possible to successfully invite behaviors with ethical relevance? Furthermore, the auxiliary frameworks give the opportunity to ‘map’ the field. For example, Human Values theory gives an overview of all values. This map of all values gives the opportunity to explore how to design for this complete field. Furthermore, specific kinds of values can be systematically compared to each other, which allows identification of patterns in the resulting designs that relate to the nature of the range of ethical beliefs. The design knowledge of the Rights Through Making approach is focused on the making process: How can we create a new kind of dialogue between cultures, based on craftsmanship and making?

Despite of the different design knowledge aims, the three approaches can benefit from each other and complement each other. The research of the in-depth approach was initiated as a result of the workshop’s encouraging results. The application of theoretical frameworks to operationalize relevant concepts can be combined with the Rights Through Making approach. For example, through systematic making, patterns between cultures could be identified and thus explain the ‘making dialogue’ between them.
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6. References