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The Interplay between Ethics and Aesthetics in Intelligent Systems-Users Interaction

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Abstract | In this paper, I address the interplay between ethics and aesthetics, in the context of everyday interaction with smart systems. This study is the result of a year's time development of my PhD research, whose general aim is to understand how people's beliefs and behaviours come to be shaped by the aesthetic experience with smart *things*. The expected outcome is a set of design strategies to integrate moral reasoning in the framework of design for behaviour change, relying on aesthetics *in* interaction. Preliminary results are presented, based on a literature review in the area of *aesthetics of interaction*. Although basic, these findings are helpful for they suggest that ethics and aesthetics in users-smart systems interaction are interdependent. This insight holds promise for the development of an aesthetics of moral reasoning, in the context of users-smart systems interaction. A research-through-design approach will be adopted in the remaining two years, with the aim of testing assumptions by means of working prototypes.

KEYWORDS | AESTHETICS OF INTERACTION, ETHICAL CHANGE, INTELLIGENT SYSTEMS, BEHAVIOUR CHANGE, RESEARCH-THROUGH-DESIGN

1. Introduction

As technology advances, the production of design mutates, and so does the experience of users (Lessiter, et al., 2014). In this respect, the advent of artificial intelligence and its widespread use in all sorts of application has led to a radical change in the way users interact with products, prompting researchers to focus on a new form of aesthetic experience (i.e., aesthetics of interaction) (Iannilli, 2015; Russo & Ferrara, 2017).

What makes this type of experience unprecedented is the responsiveness of the artefacts, namely, the dynamic change of the features of the artefacts in response to the user's actions. The result is a complex relationship developing between users and systems, where meanings, emotions and actions bundle in a dense network (Jacucci, et al., 2014).

In the body of this network, ethics comes to acquire a prominent role (Latour & Venn, 2002; Lukes, 2010). Indeed, moral values crystallise into artefacts and ethical judgement actively stands behind the user's decision-making process (Verbeek, 2008). The dynamic character of such a relationship between users and products engenders a form of aesthetics that gives the user's ethical reflection a practical dimension of application. When contextualised, thus, ethics proves tightly bound to aesthetics (Saito, 2007). An exemplar case in research is that of the Kantian and Romanticist vending machines (Ross, et al., 2009), where the aesthetics of the interaction was deliberately designed to elicit *good* behaviour in users according to specific ethical values. The Kantian vending machine, for instance, adopts a rationalist perspective, representing candies through a description of their constituent parts (proteins, sugar level, etc.). While interacting, users are reminded of their body mass index and finally asked whether they really want to proceed with the purchase. In this way, the type of aesthetics epitomises a deontic proposition, that is, a statement concerning what one should and should not do.

These studies show how ethics in smart system-user interaction takes shape, literally, influencing people's behaviour. However, in the large body of research on aesthetics of/in interaction, ethics and its connection with aesthetics is hardly ever addressed and never in depth. This despite the endeavours to broaden the notion of aesthetic experience by including the psychological dimension of the interaction between smart systems and users (e.g., (Hassenzahl, et al., 2012)). Strikingly, the same applies to areas most directly concerned with changing people's behaviour through design (see e.g., (Redström, 2006; Lilley, 2009; Tromp, et al., 2011)).

Overall, a crucial aspect of aesthetics of/in interaction remains under-explored: its power to change users' behaviour by embodying ethical issues. In particular, what misses is a specific aesthetic language designed for intelligent systems, which aims at fostering users' behaviour change by stirring moral reasoning. In the context of design for sustainability, this is a great lack as moral reasoning, when conscious, can strongly affect daily behaviour by pushing people to bring into question their own individual interests in the face of collective ones.

As part of a PhD research project, this paper proposes an expansion of the notion of change-through-interaction, which includes moral reasoning as an integral part of the decision-making process at the base of users' change in behaviour. The main result of a year's time development of the project is a preliminary understanding of the interplay between ethics and aesthetics in the users' everyday interaction with smart products. This knowledge is a starting point for the development of an aesthetics of moral reasoning able to foster the users' ability to change actively their beliefs and behaviours (see 4.1).

2. Literature review

2.1 Scope of the enquiry

The relationship between ethics and aesthetics in the interaction with intelligent systems is a complex matter, requiring a multidisciplinary approach to be understood. Thus, the areas of knowledge involved are multifarious, often outside the domain of design. In my research project, I am focusing on three main areas, which can be regarded as fundamental to gain a first understanding of the mechanisms underlying the relationship under investigation: *aesthetics of/in interaction; user's affective response; ethical awareness in interaction*. In this paper, I focus on *aesthetics of/in interaction*, providing a brief account of the main approaches and theories developed in this area.

2.2 Aesthetics of/in interaction

Aesthetic (as a quality of) experience

Since the notion of *user experience design* has gained popularity, the aesthetics of products and systems has come to be conceived as part of the relationship between users and things (Hassenzahl, 2010, p. 21). Aesthetics, in this view, is not a property of objects nor is limited to their appearance. Rather, it is a dimension of the quality of the user experience, i.e., the sense of beauty springing from the subjective appreciation of things through perception.

The long-standing idea that aesthetics resides within the things being judged comes from hundreds of years of aesthetic theory searching for universal principles that allow for generalisation (Krippendorff, 2005). In this perspective, the vocabularies and guiding principles that theorists have developed focus on artefacts, neglecting the role of the perceivers. This conception, however, has been challenged over recent years by several studies claiming that aesthetics cannot be treated separately from the individual who is judging. In this light, aesthetics is deemed as context dependent as well as culturally rooted (i.e., non-universal).

In today's design research, aesthetics is conceived as a quality of the user experience, directly related to the user's affective state (e.g., see (Desmet & Hekkert, 2007)). This

approach brings the attention back to people, namely, it focuses on the empirical phenomena pertaining to the appreciation of artefacts through senses.

Interaction: where the dynamic of aesthetics unfolds

The type of experience that users have when they interact with products has changed significantly over the last few years, due to the massive spread of artificial intelligence. Indeed, the dynamic change of the features of the artefacts in response to the actions of users gives rise to a new form of aesthetic experience. For this reason, researchers in the fields of HCI and interaction design have started taking an interest in the *relationship* (i.e., interaction) between users and intelligent things, there where the dynamic of the aesthetic experience unfolds. The understanding of aesthetics in HCI and related fields, however, is anything but shared. In this respect, Hassenzahl (2008) identifies three main approaches to the study of aesthetics: *normative; experiential; judgmental*. Such a distinction is part of a larger attempt to reduce the inconsistencies emerging from different studies on the subject. Despite this attempt, the recent studies on aesthetics of interaction often combine the three approaches. Moreover, researchers adopt different epistemological perspectives on human experience, making it difficult to reach a consensus. A brief account of the different views on aesthetics of interaction follows.

Phenomenological perspective

In their study on the aesthetics of “computational things”, Redström and Hallnäss (2002) developed the concept of “expressiveness”, focusing on the way things appear to users. The authors draw a fundamental distinction between the notions of *use* and that of *presence*. The latter refers to the “existential definition” of things, namely the way we accept things in our *lifeworld*, giving a place and a meaning to them. The researchers position aesthetics in the relationship between intelligent systems and users, applying a phenomenological perspective to its understanding. In this view, appearance acquires importance to the extent that it embodies the identity values that users project onto it as a consequence of an inner conceptualisation. Although the authors emphasise the “existential definition” of things – their *presence* in the inner life of users – aesthetics is viewed as part of an experiential dynamic, which involves both users and things.

Pragmatist perspective

A pragmatist viewpoint on aesthetics, based on Dewey’s understanding of experience (Dewey, 1980), has been quite successful among researchers in the field of HCI and interaction design. In particular, Shusterman’s concept of *pragmatist aesthetics* (Shusterman, 1992) has informed various strands of research on what is termed *aesthetics of interaction*. This approach affirms the central role of the socio-cultural context in the human aesthetic experience as well as its instrumental character in everyday life. Moreover, with the concept of *somaesthetics* (Shusterman, 1999), the body is considered an indispensable

part of the aesthetic experience. This view refuses the Cartesian separation between mind and body, claiming an ontological unity between the two. Although popular, this approach has been adopted (and adapted) differently by various groups of researchers.

Peterson, et al., (2004) developed a framework for the design of interactive systems, promoting the concept of aesthetics of use as an alternative to that of aesthetics of appearance. In this respect, they are in line with Djajadiningrat, et al.'s holistic conception of design for interaction (2002), which emphasises the role of bodily experience, user's motor-skills and action-related affordances. Following Shusterman, they strongly criticise the analytical conception of aesthetics, pointing out that merely promoting visual appearance proves to be a highly reductive and simplistic view on aesthetics, given the complexity of human experience – which includes feelings, emotions, actions, and movement.

Drawing on the work of Peterson, et al., Ross and Wensveen (2010) developed their own framework, with the aim of establishing a new design approach called “aesthetic interaction through aesthetic interaction”. This approach builds upon the idea that the design of interaction with smart systems is too complex to be addressed by means of non-interactive media (see (Frens, 2006)). Such a shift from theory to practice is carried out through the design of a lamp, which is intended to generate a specific aesthetic interaction by eliciting human values such as social power and helpfulness. In this respect, the researchers pursue a method to integrate ethical values in the design of (smart) product experience, connecting ethics and aesthetics.

A different interpretation of Pragmatist aesthetics is offered by Lim, et al. (2007), who look at aesthetics of interaction through the lens of *interaction gestalt*, i.e., the abstract qualities of the interaction emerging from the user experience. From a theoretical point of view, interaction is seen as an abstract entity situated between the user experience and the attributes of the artefact. This conceptual separation, it is argued, allows designers to better examine the manifestation of the interaction gestalt, turning aside from a focus on the intrinsic properties of the artefact. In this respect, Lim, et al. are interested in the immediate level of the interactive experience, i.e., the “tight coupling between human sensory and materials”, which is thought to drive experience itself. This moves away from the idea of experience as something unfolding over time within a given socio-cultural and environmental context. While embracing the concept of somaesthetics, Lim, et al. focus on the abstract and intangible aspects of aesthetic experience, leaving aside the physical dimension of interaction.

Building upon Shusterman and Petersen, et al., Löwgren (2009) offers a further theoretical contribution to the understanding of interaction aesthetics. Embracing a pragmatist perspective, he seeks an “inclusive” notion of aesthetics, which combines emotions, meaning and perception. Moreover, he highlights the distinction between aesthetic judgement and “factual reports on sensory impressions” (e.g., feeling cold or warm, seeing blue or green). Overall, Löwgren stresses the fact that the qualitative assessment of aesthetic experience does not necessarily reflect the degree of allure that such experience

elicits. As an example, horror films and similar experiences seem to be appealing to people even though they elicit negative feelings. Löwgren proposes four conceptual categories that describe the aesthetic qualities of interaction: *pliability*; *rhythm*; *dramaturgical structure*; *fluency*.

Critical perspective

Marching to a different drummer, Bardzell (2009) advocates the combination of two rather different philosophical traditions – *critical theory* and *theory of aesthetics* – to strengthen and advance designerly speculation in the field of HCI. The friction between the analytic and the continental philosophy reflects the tension currently alive between the scientific and the cultural dimensions of HCI. Indeed, design has a transformative vocation, which makes criticism and speculation two fundamental requirements. On the other hand, the need to understand the phenomena pertaining to user-system interaction requires the empirical approach of science. Hence, Bardzell views the merger of science and critical theory an opportunity for the field of HCI to advance in theory development. In this regard, he strongly criticises common-sense based definitions of aesthetics that proliferate in interaction design research, soliciting an aware and rigorous use of the concepts elaborated in this long-standing philosophical tradition. As a contribution to the field, Bardzell (p.2365) identifies and discusses four strategic roles that aesthetics and critical theory can play in HCI research:

1. *“Informing the existing design process”*;
2. *“Resist[ing] or innovate[ing] on the design process”*;
3. *“Develop[ing] theory”*;
4. *“Expos[ing] the consequences of design”*.

3. Method

3.1 Epistemology

In my research project, I adopt what may be regarded as a *constructionist* perspective on how knowledge is produced (Darlaston-Jones, 2007). Indeed, I deem reality as *shaped* through socio-technical relationships, which are situated in specific cultural, historical, economic, and political contexts. In these contexts, individuals hold and develop their own interpretation of reality through the interaction with both the environment (natural and designed) and other individuals. In the realm of scientific enquiry, I believe that knowledge is a construction that researchers articulate into a rhetoric. This rhetoric uses a specific language and semantics, with the aim of claiming the trustworthiness of what is regarded as knowledge.

3.2 Approach to design research

As a methodology, I refer to *Constructive Design Research* (CDR) (Koskinen, et al., 2013), an approach similar to *Research through Design* (RtD) (Giaccardi & Stappers, 2017; Zimmerman, et al., 2007). Compared to RtD, this approach offers a wider interpretation of the term *design*, meant as a (research) practice where methods and theories borrowed from other disciplines can be combined and adapted in a constructive way, according to both the aim and the context of the enquiry.

In the preliminary phase of the project, I addressed my research question through a classical literature review. This phase was preparatory, however, to an empirical study based on a research-through-design approach. In this respect, my process started with “thinking analysing abstracting”, to use a definition from the *Reflective Transformative Design* model (Hummels & Frens, 2011).

3.3 Methods of enquiry

In the first stage of my research process, I addressed the research question by reviewing relevant literature in the areas of *aesthetics of interaction*, *user's affective response*, and *ethical awareness in interaction*. In this paper, I give an account of the studies in the area of *aesthetics of interaction*, focusing on the understanding of the interplay between ethics and aesthetics in users-smart systems interaction. In this respect, my enquiry relied on a qualitative analysis of specialised academic literature on the subject.

In the remaining two years of my PhD project, I aim to conduct empirical research in the field, adopting a RtD-based approach (i.e., CDR, see 3.2). This entails the use of a diversity of methods for data collection and analysis, ranging from ethnographic to action research-based techniques. To specify, as far as the data collection is concerned, I expect to adopt the following methods: *cultural probes* (Gaver, et al., 1999); *prototyping* (Martin & Hanington, 2012, pp. 138-139); *diaries-questionnaires-interviews* (Goodman, et al., 2012, pp. 243-272). For data analysis, I expect to adopt the following methods: *grounded theory* (Muller & Kogan, 2010); *artefact analysis* (Martin & Hanington, 2012, pp. 14-15). As mentioned in 3.2, these methods will be adapted in the context of an RtD process.

The enquiry will be carried out mainly in the home environment, although the ubiquity of smart technology – which I address in my research – makes it difficult to confine the research to a specific context. As far as the recruitment of participants is concerned, I expect to adopt a *purposeful sampling* strategy (Rapley, 2014).

4. Results

4.1 Preliminary findings

The interplay between ethics and aesthetics in user-smart systems interaction

The findings here presented constitute a basic understanding of the complex relationship between ethics and aesthetics in the interaction with smart systems. Three research areas have been addressed: *aesthetics of interaction*; *user's affective response*; *ethical awareness in interaction*. The theory in the area of *aesthetics of interaction* informs much of my first understanding of the relationship under examination.

The following points summarise my basic understanding of this relationship.

1. *Relationship of interdependence*

All technological artefacts mediate our relationship with the environment, affecting our decision-making, interpretations, and actions. As mediators, they hold the ability to direct (i.e., to change) both our understanding and behaviours as users (Verbeek, 2008).

According to Verbeek (2008), morality crystallises into artefacts, following a twofold process: “pragmatic” (related to action) and “hermeneutic” (related to interpretation). Both forms of mediation happen in the context of human experience, which is characterized by cognitive, perceptual, and emotional processes through which people attribute meaning to their own possibilities of action and the related consequences. In these processes lies much of what is termed aesthetic experience. Indeed, aesthetics consists of a qualitative (cognitive) appreciation of the features of artefacts through senses (perception and emotions). Therefore, aesthetic experience is an essential part of the mediation to which technological artefacts give rise, i.e., it contributes to the meaning-making process originated in this mediation.

As put by Saito (2007), when moral judgements are based on the “sensuous features of the objects” they can be linked to aesthetics and regarded as “moral-aesthetic judgements” (p. 210). In this view, any judgements concerning the moral character of designed objects qualify also as *aesthetic* in so far as they are based on “first-hand experience” (p.211). Moreover, there are cases in which aesthetic judgements are dictated by moral beliefs in the first place (p.215). This is the case of normative values of social and cultural type, which influence (i.e., regulate) the criteria for the appreciation of beauty. Although Saito focuses on architectural design, this interplay between ethics and aesthetics can be extended reasonably to all designed artefacts.

In all cases, the socio-cultural context – moral values included – plays a crucial role in determining the type of aesthetic experience that users have when interacting with designed artefacts. At the same time, the aesthetic experience drives moral decisions by characterising phenomenologically the mediation between people and artefacts.

In brief, ethics and aesthetics seem to be *interdependent*, in the context of the interaction between users and designed artefacts. Indulging in a simplification, aesthetics contributes to shaping moral values, as well as moral values influence the aesthetic experience. Certainly, the way this happens is anything but linear, nor it can be reduced to a simple principle of causality. Rather, the complexity of this interdependence entails multiple forms, i.e., different roles played by ethics and aesthetics in their interplay, depending on contextual factors (both at the macro and micro levels).

2. *Higher space for communication*

Intelligent artefacts give rise to a peculiar type of user experience, given their ability to respond dynamically to the users' input. Besides performing complex tasks, sensors and smart materials allow for multi-layered, highly articulate forms of communication between users and systems. Such communication can even happen at a purely sensory level (i.e., non-linguistic) without diminishing its elaborateness. The peculiarity of this type of artefacts amplifies the range of possibilities in terms of depth of communication and intensity of the experience, which makes the previously mentioned *interdependence* between ethics and aesthetics of a different kind. Indeed, the type of aesthetic experience that users have with these artefacts is phenomenologically different from – possibly richer than – that generated by ordinary artefacts (i.e., non-interactive). Likewise, the moral reasoning that such a type of aesthetic experience elicits is conceivably more elaborate, allowing for complex propositions to be articulated. In other words, the greater space for communication (whether sensory- or linguistic-based) offered by intelligent artefacts paves the way for a type of relationship between ethics and aesthetics that is multivariate and can be deeper than in the case of non-interactive artefacts.

In brief, when users interact with intelligent artefacts, the interdependence between ethics and aesthetics can have many forms and be highly elaborate, given the higher space for communication that such artefacts provide compared to non-interactive artefacts. The enhancement, in this respect, is both quantitative and qualitative. This twofold enrichment does have implications for the kind of ethical issues that can be raised through (or embedded into) the aesthetics of the interaction with intelligent artefacts. To specify, the logical chain of links that some elaborate moral issues require in terms of reasoning could be addressed by means of dedicated intelligent artefacts, whereby the space of communication is high enough to permit such a conceptual leap.

4.2 Expected results

Short-term

The main result expected in the short run is an advancement in my basic understanding of the interplay between ethics and aesthetics in users-smart systems interaction. By completing the literature review – i.e., addressing the other two areas of research previously mentioned, *user's affective response* and *ethical awareness in interaction* – I expect to gain

an essential knowledge regarding the relationship under consideration. This knowledge, I anticipate, will allow me to plan a series of experiments to be carried out in the next two years (see *Long-term*).

Essentially, by accomplishing a thorough literature review in the two remaining research areas, I expect to be able to understand what forms the interdependence between ethics and aesthetics can take. After having identified interdependence as a significant attribute of the relationship between the two, I need to examine both the mechanisms behind moral reasoning and how the affective response of users influences their aesthetic experience.

Long-term

The results I expect to attain in the long run consist of theoretical constructs (e.g., frameworks) that can be used by other researchers in the future to advance in the enquiry pertaining to the relationship between aesthetics of interaction and ethics, in the context of design for behaviour change. It is worth to clarify that the results I aim to achieve are both of propositional (i.e., pragmatic or instrumental) and investigative (i.e., hermeneutic or interpretative) type. There is no contradiction between the two as empirical research in design does have such a dual spirit, as it were.

To achieve these results, I will conduct a series of field experiments, investigating the interplay between ethics and aesthetics in the users' everyday interaction with smart products (see 3.3).

5. Discussion

5.1 Towards an aesthetics of moral reasoning

The preliminary findings of my research suggest that ethics and aesthetics in users-smart systems interaction are interdependent. This paves the way for a deeper enquiry into the *forms* that such an interdependence can take and, more importantly, into the impact that these forms have on people's beliefs and behaviours, in the context of everyday practices. Indeed, the general aim of my research is that of integrating moral reasoning – and its interplay with aesthetics – in the framework of design for behaviour change. The reason is that ethics informs (in combination with aesthetics) the decision-making process at the base of users' change in both beliefs and behaviour. As a long-term horizon for my own PhD research project, I see the development of an aesthetics of moral reasoning, in the domain of design for users-smart systems interaction.

6. Conclusions

In this paper, I presented the preliminary results achieved in my first year of doctoral research. In my project, I am addressing the problem of how aesthetics in the interaction between smart systems and users embodies ethical constructs. In particular, I aim to understand how the interplay between ethics and aesthetics (of interaction) contributes to eliciting a type of moral reasoning in users such as to influence their beliefs and behaviours in everyday life.

The results illustrated are incipient, mainly based on a critical review of relevant studies conducted in the area of *aesthetics of interaction*. Although preliminary, these findings shed light on the relationship between ethics and aesthetics in the interaction with smart systems, suggesting that they are interdependent. The various forms that such an interdependence can take determine depth and breadth of the impact on people's beliefs and behaviours, in the context of everyday practices.

At this stage of the research, the findings seem to indicate that moral reasoning can be integrated in the framework of design for behaviour change by working on the way ethical constructs are embodied in aesthetics (i.e., aesthetics *in* interaction). A deeper investigation is needed to understand how to design for an aesthetics of moral reasoning.

References

- Bardzell, J. (2009). Interaction Criticism and Aesthetics. *CHI '09: Proceedings of the SIGCHI Conference on Human Factors and Computing Systems* (pp. 2357-2366). ACM.
- Darlaston-Jones, D. (2007, 5). Making Connections: The relationship between epistemology and research methods. *The Australian Community Psychologist*, 19(1), 19-27.
- Desmet, P., & Hekkert, P. (2007). Framework of product experience. *International Journal of Design*, 1(1), 57-66.
- Dewey, J. (1980). *Art as Experience*. New York: Perigee Books.
- Djajadiningrat, T., Overbeeke, K., & Wensveen, S. (2002). But How, Donald, Tell Us How? On the Creation of Meaning Through Feedforward and Inherent Feedback. *DIS '02 Proceedings of the 4th conference on Designing interactive systems: processes, practices, methods, and techniques*. (pp. 285-291).
- Frens, J. (2006). *Designing for Rich Interaction: Integrating Form, Interaction, and Function*. Eindhoven University of Technology, Industrial Design Engineering.
- Gaver, B., Dunne, T., & Pacenti, E. (1999). Design: Cultural probes. *Interactions*, 6(1), 21-29.
- Giaccardi, E., & Stappers, P. (2017). Research through Design. In E. Giaccardi, P. Stappers, & I. Foundation (Eds.), *The Encyclopedia of Human-Computer Interaction* (2nd ed.).
- Goodman, E., Kuniavsky, M., & Moed, A. (2012). *Observing the User Experience: A Practitioner's Guide to User Research* (2nd ed.). Elsevier.

- Hallnäs, L., & Redström, J. (2002). From use to presence: on the expressions and aesthetics of everyday computational things. *ACM Transactions on Computer-Human Interaction*, 9(2), 106-124.
- Hassenzahl, M. (2008). *Aesthetics in interactive products: Correlates and consequences of beauty*. Elsevier Ltd.
- Hassenzahl, M. (2010). *Experience Design: Technology for All the Right Reasons*. Morgan and Claypool.
- Hassenzahl, M., Heidecker, S., Eckoldt, K., Diefenbach, S., & Hillmann, U. (2012). All you need is love: Current strategies of mediating intimate relationships through technology. *ACM Transactions on Computer-Human Interaction*, 19(4), 1-19.
- Hummels, C., & Frens, J. (2011, 11). Designing Disruptive Innovative Systems, Products and Services: RTD Process. *Industrial Design - New Frontiers*, 147-172.
- Iannilli, G. (2015). The Aesthetics of Everyday Life: Suggestions for a Reconsideration of Aesthetics in the Age of Wearable Technologies. In F. Dorsch, & D.-E. Ratiu (Eds.), *Proceedings of the European Society for Aesthetics*, 7, pp. 280-296. The European Society for Aesthetics.
- Jacucci, G., Spagnolli, A., Freeman, J., & Gamberini, L. (2014). Symbiotic Interaction: A Critical Definition and Comparison to other Human-Computer Paradigms Giulio. In G. Jacucci, A. Spagnolli, J. Freeman, L. Gamberini, G. Jacucci, L. Gamberini, J. Freeman, & A. Spagnolli (Eds.), *Symbiotic 2014. LNCS (Vol. 8820, pp. 3-20)*. Heidelberg: Springer.
- Koskinen, I., Zimmerman, J., Binder, T., Redstrom, J., & Wensveen, S. (2013). *Design Research Through Practice: From the Lab, Field, and Showroom* (1st ed., Vol. 56). Morgan Kaufmann.
- Krippendorf, K. (2005). *The semantic turn. A new foundation for design*. CRC Press.
- Latour, B., & Venn, C. (2002). Morality and Technology: The End of the Means. *Theory, Culture & Society*, 19(5-6), 247-260.
- Lessiter, J., Freeman, J., Miotto, A., & Ferrari, E. (2014). Ghosts in the Machines: Towards a Taxonomy of Human Computer Interaction. In J. Lessiter, J. Freeman, A. Miotto, E. Ferrari, G. Jacucci, L. Gamberini, J. Freeman, & A. Spagnolli (Eds.), *Symbiotic 2014. LNCS (Vol. 8820, pp. 21-31)*. Heidelberg: Springer.
- Lilley, D. (2009). Design for sustainable behaviour: strategies and perceptions. *Design Studies*, 704-720.
- Lim, Y.-k., Stolterman, E., Jung, H., & Donaldson, J. (2007). Interaction Gestalt and the Design of Aesthetic Interactions. *Designing Pleasurable Products and Interfaces* (August), 22-25.
- Löwgren, J. (2009). Towards an Articulation of Interaction Aesthetics. *The New Review of Hypermedia and Multimedia*, 1-18.
- Lukes, S. (2010). The Social Construction of Morality? In S. Lukes, S. Hitlin, & S. Vaisey (Eds.), *Handbook of the Sociology of Morality* (pp. 549-560). Springer Science+Business Media.
- Martin, B., & Hanington, B. (2012). *Universal Methods of Design. 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions*. Beverly: Rockport Publishers.

- Muller, M., & Kogan, S. (2010). Grounded Theory Method in HCI and CSCW. *Cambridge: IBM Center for Social Software* (January 2010), 1-46.
- Petersen, M., Iversen, O., & Krogh, P. (2004). Aesthetic Interaction — A Pragmatist's Aesthetics of Interactive Systems. *DIS '04 Proceedings of the 5th conference on Designing interactive systems: processes, practices, methods, and techniques, 1*, 269-276.
- Rapley, T. (2014). Sampling Strategies in Qualitative Research. In T. Rapley, *The SAGE Handbook of Qualitative Data Analysis* (pp. 49-63). SAGE Publications Ltd.
- Redström, J. (2006). Persuasive Design: Fringes and Foundations. In J. Redström, *Persuasive technology* (pp. 112-122).
- Ross, P., & Wensveen, S. (2010). Designing Behavior in Interaction: Using Aesthetic Experience as a Mechanism for Design. *International Journal of Design, 4*(2), 3-13.
- Ross, P., Trotto, A., & Overbeeke, K. (2009). Ethics through aesthetics: a trefoil design research agenda. In *Proceedings of the International Association of Societies of Design Research '09*, (pp. 1-10).
- Russo, A., & Ferrara, M. (2017). Smart Solutions, "Smart Aesthetics"? *The Design Journal, 20*(sup1), S342-S353.
- Saito, Y. (2007). *Everyday Aesthetics*. New York: Oxford University Press.
- Shusterman, R. (1992). *Pragmatist Aesthetics: Living Beauty, Rethinking Art*. Rowman & Littlefield Publishers.
- Shusterman, R. (1999). Somaesthetics: A Disciplinary Proposal. *The Journal of Aesthetics and Art Criticism, 57*(3), 299-313.
- Tromp, N., Hekkert, P., & Verbeek, P.P. (2011). Design for Socially Responsible Behavior: A Classification of Influence Based on Intended User Experience. *Design Issues, 27*(3), 19.
- Verbeek, P.-p. (2008). Morality in Design: Design Ethics and the Morality of Technological Artifacts. In P.P. Verbeek, P. E. Vermaas, P. Kroes, A. Light, & S. A. Moore (Eds.), *Philosophy and Design: From engineering to architecture* (pp. 91-103). Springer Netherlands.
- Zimmerman, J., Forlizzi, J., & Evenson, S. (2007). Research through design as a method for interaction design research in HCI. In *Proceedings of the SIGCHI conference on Human factors in computing systems - CHI '07*, (pp. 493-502).

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