Lin-Lin Chen, Tom Djajadiningrat, Loe Feijs, Jun Hu, Steven Kyffin, Lucia Rampino, Edgar Rodriguez, Dagmar Steffen

Design and semantics of form and movement

DeSForM 2015

Aesthetics of interaction: Dynamic, Multisensory, Wise

DeSForM 2015 is supported by:

POLITECNICO
MILANO 1863
DIPARTIMENTO DI DESIGN

PHILIPS

TU/e

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

JIANGNAN UNIVERSITY

northumbria
UNIVERSITY

Lucerne University of
Applied Sciences and Arts
HOCHSCHULE
LUZERN

TAIWAN TECH
National Taiwan University of
Science and Technology

DESIS
NETWORK
Design for
Social Innovation
and Sustainability

LE UNIVERSITÀ
PER EXPO 2015
COMITATO SCIENTIFICO
DEL COMUNE DI MILANO

DOTTORATO DI RICERCA IN DESIGN
POLITECNICO DI MILANO, DIPARTIMENTO DI DESIGN

金印良品
JINYINLIANGPINPAPER

荷丰文化
Hyphen Culture

SHU HUA
无锡
书画博物馆

ifip

cumulus
creative linking

SCHOOL·OF
DIGITAL MEDIA
JIANGNAN UNIVERSITY

Design and semantics
of form and movement

DeSForM 2015

Aesthetics of interaction:
Dynamic, Multisensory, Wise

Edited by

Lin-Lin Chen

Tom Djajadiningrat

Loe Feijs

Jun Hu

Steven Kyffin

Lucia Rampino

Edgar Rodriguez

Dagmar Steffen

General conference chair
Lucia Rampino,
Politecnico di Milano, Italy

Topic 1
Tangible, smart and dynamic objects: how the new aesthetics affects meaning and experience
Chair
Lucia Rampino,
Politecnico di Milano, Italy
Co-Chairs
Sara Colombo,
Politecnico di Milano, Italy
Tom Djajadiningrat,
Philips Design,
The Netherlands

Topic 2
Design and virtualization of multi sensory experiences with products
Chair
Monica Bordegoni,
Politecnico di Milano, Italy
Co-chair
Marina Carulli,
Politecnico di Milano, Italy
Steven Kyffin,
Northumbria University
School of Design, UK

Topic 3
From smart to wise: toward a new conception of digital products and services
Chair
Margherita Pillan,
Politecnico di Milano, Italy
Co-chair
Elisa Giaccardi,
Delft University of
Technology, The Netherlands
Edgar Rodriguez,
Victoria University of
Wellington, New Zealand

Seminar
Capturing value in design intensive startups
Chair
Cabirio Cautela,
Politecnico di Milano, Italy

Demo Session
Chair
Alessandro Biamonti
Politecnico di Milano, Italy
Exhibition design
Alessia Viano
Martina Sartor
Lab.I.R.Int. Research Group
Politecnico di Milano, Italy

DeSForM Committee
Lin-Lin Chen,
National Taiwan University
of Science and Technology,
Taiwan
Tom Djajadiningrat,
Philips Design Eindhoven,
The Netherlands
Loe Feijs,
Eindhoven University of
Technology, The Netherlands
Jun Hu,
Eindhoven University of
Technology, The Netherlands
Steven Kyffin,
Northumbria University
School of Design, UK
Lucia Rampino,
Politecnico di Milano, Italy
Edgar Rodriguez,
Victoria University of
Wellington, New Zealand
Dagmar Steffen,
Lucerne University of
Applied Sciences and Arts,
Switzerland

DeSForM 2015 Scientific
Committee
Monica Bordegoni,
Department of Mechanical
Engineering, Politecnico di
Milano, Italy
Marina Carulli,
Department of Mechanical
Engineering, Politecnico di
Milano, Italy
Sara Colombo,
Department of Design,
Politecnico di Milano, Italy
Margherita Pillan,
Department of Design,
Politecnico di Milano, Italy
Lucia Rampino,
Department of Design,
Politecnico di Milano, Italy

DeSForM 2015 Local
Committee
Sara Bergamaschi,
Ilaria Mariani, Marco
Spadafora, Annamaria
Andrea Vitali
PhD Students, Department
of Design, Politecnico di
Milano

M. Bordegoni, S. Colombo, M. Pillan, L. Rampino
Politecnico di Milano

Exploring aesthetic interactions through prototyping

The role of experiential prototypes in design knowledge generation

"Writing and thinking have their limits when it comes to exploring the perceptual-motor fit and the beauty of interaction with things: the only way to evaluate these is to make experiential prototypes." [1, p. 297]

In design research, concepts, models and prototypes help to envision unforeseen possibilities by suggesting future scenarios and by making them embodied, tangible, and, therefore, also testable. Moreover, models and prototypes can be useful in explorative studies to foster dialogue between experts with different backgrounds as well as between users and researchers. The ability of the prototype to foster dialogue has been pushed to the extreme by Boer and Donovan [2], who propose the use of "provotypes", i.e. provocative prototypes that embody the tensions that often surround a field of interest. The "provotype" aims to support collaborative analyses and collaborative design explorations across stakeholders. In brief, prototypes can be seen as (design) research tools to investigate future scenarios.

The presence of "a series of artifacts – models, prototypes, products" [3, p. 497] is the main feature of the research through design process. Indeed, such process peculiarity lies in the fact that the generated knowledge is based on producing "design exemplars" [4] or "epistemic objects" [5], in the form of artifacts that "can be seen as the solid form of knowledge to be disseminated" [6, p. 7]. Of course, producing design prototypes is not equivalent to producing design knowledge per se. As some scholars already argued, a research through design process is typically characterized by two different forms of output [3, p. 497]: "a concrete problem framing" and "a series of artifacts – models, prototypes, products" as well as interfaces, drawings, storyboards, videos etc. These two kinds of output are intrinsically correlated; for, together, they represent two complementary facets of the same knowledge outcome.
The "problem framing" is the knowledge the researcher took pains to make explicit. Zimmerman, Stolterman, and Forlizzi [7, p. 313] clarify that such knowledge may become concrete in a "theory on design" or, more often, in a "theory for design" in the form of implications, of guidelines, of "design specifications for future products" [8, p. 140], which can be objects, interfaces, graphics, or services, or of new design processes and methods.
From the epistemological point of view, the role of the prototype as knowledge generator is a sensitive and still debated issue. As Stappers [9] affirms: "The designing act of creating prototypes is in itself a potential generator of knowledge (if only its insights do not disappear into the prototype, but are fed back into the disciplinary and cross-disciplinary platforms that can fit these insights into the growth of theory)." (p. 87)

The peculiarity of the design prototype is that of being, at the same time, object d'art, technical object and object of use. Indeed, as an art object, the design prototype represents an aesthetic solution that can be inspirational for other designers (here, we mean by aesthetics the sensory appearance). As a technical object, the design prototype represents the feasibility of a given solution. As an object of use, it makes the set-up (and test) of a real interaction with the user possible. Of course, these three aspects are not independent, but interrelated and constantly overlapping. Indeed, in judging the usability of the prototype, also its appearance has an important role.

In summary, the design artefact, differently from the engineering prototype, should be evaluated mainly on the basis of qualitative parameters. It is exactly its nature, in between arts and technology, which makes the role of the prototype problematic from the epistemological point of view. "Issues involving aesthetic judgments and design references are necessary elements of design, but from a scientific viewpoint, they are uncontrollable impurities. Yet, it is exactly this kind of knowledge that is at the heart of design as a discipline." [10, p. 124].

To take into consideration the typical dual form of research through design, already in 1997 the Sheffield Hallam University (UK) renewed its PhD regulations, allowing a more open definition of the thesis: "one in which artefacts are pre-eminent as the main evidence of investigation and outcomes and there is sufficient text to ensure that artifacts communicate appropriately". [11, p. 365].

Recent years have seen the design-research world moving in this direction, both with the rise of journals dedicated to the findings of research through design (the International Journal of Design, for example, cf. [12]) and with certain changes in the structure of design conferences (i.e. the Research Through Design Conference).

The DeSForM section dedicated to demos follows this approach: interactive demos consist of prototypes exhibited during the conference. In order to be accepted, each demo has to be accompanied by a short commentary paper, which is evaluated through a double blind peer-review process. This reinforces the view that, as previously argued, presenting a design outcome is inseparable from making an explicit claim of knowledge. At the DeSForM 2015 conference, the main objective of prototypes is to demonstrate and test new interaction modalities between users and systems, in order to show both their usability and technological feasibility. Demos have been clustered according to four main themes, where aesthetics of interaction comes at stake to shape new relations between users and products, services, and tools.

Smart and active devices for health and well-being

Health and well-being represent an ever-growing issue in the field of research in general, and, therefore, in the specific field of design research too. Indeed, in developed countries, there is a strong interest in contributing to the sustainability of the health and care systems, above all because of the trend towards an ageing population.

In the transition from the idea of "health" to that of "well-being", we can trace an important reason for valuing the contribution that design can offer to the humanization of technology. Indeed, as stated by Alberto Ardissone [13] "in the existing literature while the concept of health is linked to a negative meaning […] interpreting it as a lack of illness, the concept of well-being on the contrary is elaborated in a positive way" (p. 173) From this perspective, Pullin (cited in [14, p. 49]) shows how design can broad the traditional medical and engineering perspective on illness by including qualities related to the user's emotions, identity, and desires in the design of medical devices. Moreover, design often encourages a non-pharmacological approach, which also is obtaining a raising interest in the medical field. According to this growing interest in well-being within the design community, five out of fourteen demos presented at DeSForM 2015 reason around it.

The demo "Family Arizing" by Croes and Feijs is a system that allows parents to "stay in contact" with their premature born babies and, in cases of child distress, provide them with a remote comforting hug. The system is made up of two components: an active necklace and the active snuggle. The child's movement is communicated

to a necklace worn by one of the parents. If the parent decides to 'comfort' the necklace, an intelligent mattress inside the child's incubator will warm up and physically hug the child.

"Aires" by Hoogeweegen1, Toeters, and Feijs is an underwear collection designed to support women in their menopause, contrasting one of the most common symptom: hot flashes. This is a sensitive issue, since according to Utian [15], cited by the Aires authors: "Women confronted with menopausal hot flashes make more use of the health care system and are confronted with other extra expenses". Aires is an active bra that proposes a non-pharmacological approach, simply cooling the woman upper-chest area by ventilation.

The demo "Sofi" by Arquilla and Fiorinelli presents a smart product-service-system for the management of Asthma, which is the most common respiratory disease in Western countries and is seriously affecting the cost of healthcare systems. SOFI consists of two medical devices (an inhaler used both for emergency and daily therapy, and a tool for DIY lungs' monitoring) and a mobile application. The two devices aim at showing patients what they need and when they need it in a user-friendly way; the application aims at improving the asthma control by the doctor, thus reducing the user's anxiety and the need for doctor-user direct interaction.

The demo "Light Bird" by Yu, Song, and Feijs deals with stress, as an important cause of several illnesses like heart disease, hypertension and stroke. In stress mitigation, biofeedback-assisted breathing training is nowadays increasingly applied. According to the authors, the majority of biofeedback systems offer the average users a 'medical style' interface, which is too task-oriented to feel relax using it. On the contrary, Light Bird is a paper-crane shaped interface. The crane's body fluctuates up and down periodically, providing the targeted breathing rate. The aim is to improve the effectiveness and the experience of breathing-training.

The last demo, "Activating Wearables" by Daems, Toeters and Feijs is an active scarf that detects the wearer's heartbeat and moves accordingly. The aim is to help the wearer to perceive his heartbeat, which helps him to express his emotional state to others. This demonstrator shows the marriage of 'hard' technology with 'soft' textiles in a subtle moving wearable product.

Engagement in arts by new media

Design has often been defined as the middle earth between arts and technology. Design and arts have many common points, among which the attention to aesthetics (intended as senses delighting) and to meaning transfer by such aesthetic features. For this reason, it is common for arts and design to overlap and contaminate each other, giving birth to "artistic" design pieces, or to "functional" artworks. Recently, the boundaries between arts and design have become even more blurred, as new forms of artistic expressions, like digital arts, emerged, mixing up artistic and design approaches. Indeed, the world of arts has been significantly affected by the development of new technologies and new media. Not only has technology changed the nature of artworks (which started to include new communicative media, like sounds or animations), but it also has affected the way people enjoy and interact with artworks. As a consequence, also the space that once contained art pieces has to be redesigned and adapted to the features of these works and to the needs of a new kind of public. "Designers and artists have integrated recent advances in interactive, tangible and ubiquitous computing technologies to create new forms of interactive environments in the domains of work, recreation, culture and leisure" [16, p. 509].
Interactive installations and exhibitions are becoming a natural way to experience arts, by the integration of smart systems, movements, communication media, videos, sounds, projections, etc. "Nowadays, the focus in museums is shifting towards the use of artefacts for providing an interactive experience to visitors, in contrast to the traditional museum approach, where the focus was on the collection, display and storage of objects." [17, p. 104].

For this reason, interacting with arts becomes a multi-dimensional and multi-sensory experience, where many design competences come at stake.

Technology can be used both to create new pieces of arts (interactive, smart or generative artworks), and to provide deeper and more engaging experiences with ancient artworks, which are reinterpreted, displayed and explained in a new way.

Three of the demos presented at DeSForM 2015 discuss this wide issue, by addressing different ways in which design, arts, aesthetics and technology are blended together to create engaging interactive experiences.

Nowadays, digital media can reproduce artworks, can create a dialogue between the user and the work, or can provide additional information [18]. Indeed, technology can be used to provide information on single art pieces or on whole art periods, contexts, and artists' lives by the creation of immersive and emotional experiences. In their demo "Visualising Vincent's life: An engaging experience into Van Gogh's heritage", Calvi, Hover, Ouwens, and van Waalwijk exemplify this approach by presenting an interactive experience where the places and landscapes where the young Van Gogh lived are represented by "immersive mixed media experience combining physical and digital elements". This experience was designed in order to "connect Vincent's works with the locations where the paintings were made and [to] motivate tourists to visit those locations in person". Technology thus becomes a means to emotionally immerse the user into the painter's life, making him become the artist himself and engage into a deep experience of the painter's heritage.

Arts and design (especially some design strands, like critical design) are domains that are constantly in dialogue with society and where social issues are often discussed. In this view, aesthetics is used as means to trigger reflection over relevant questions, by acting as a provoking expressive language. By leveraging the ability of new technologies to create engaging and interactive aesthetic experiences, such provoking and reflective side of arts can be made much more effective and meaningful. The paper by Marti, Peeters and Trotto, "Ethics in Aesthetics: Experiencing Women's Rights", well expresses how the interaction design's perspectives and skills can overlap with arts and society to create immersive experiences about social issues. The demo presents an interactive exhibition that fosters the user reflect on women's rights, by using famous paintings that are reinterpreted and made dynamic.

New technologies allow the creation of new forms of visual aesthetics. Dynamicity and time become elements to create non-static and interactive artworks. These can either be re-interpretations of famous paintings or can be especially generated to exploit the potential of new technologies. The paper "Dynamic aesthetics of generative two-dimensional geometric art" by Fejis and Hu presents generative art examples based on famous visual references (Mondrian's compositions and pied de poule patterns), which are reinterpreted in a dynamic way by the use of algorithms. The artworks can be modified by the visitors, who interact with the work by changing the parameters of the algorithm generation.

Experimenting new interaction modalities

"As user interfaces have turned into increasingly diverse physical forms, it becomes relevant to discuss how this shapes the way we look at user interaction, and especially the models that we use to describe such forms of interaction" [19, p. 251].

As technology is always more merged with the physical world, new paradigms for the interaction between people, computers and objects are to be defined, concerning the notion of perception, information sharing, human cognitive skills and bodily actions [19].

Recent research in interaction and industrial design has focused on conceptualizing, developing and testing new forms and modalities of interaction with computer devices and products. By focusing on the product/interface's behavior on the one side and on the user's actions on the other, designers and scholars explore how meaning is

created in interaction. Indeed, traditional forms of interaction need to be reframed and redesigned as technology merges with physical reality and new technologies allow the development of more natural, intuitive and gestural interfaces for accessing the virtual and digital world, or for controlling the products' functions. This attention towards user's actions and smart system's behavior, typical of interaction design, has been defined as the "action centric" approach, as opposed to the "data centric" approach of Human Computer Interaction. These interactive experimentations across virtual and physical can be gathered under the name of Tangible Interactions. Such approaches have different aims and features, but they all try to find new modalities for i) controlling and manipulating virtual data, by developing more natural and physical interfaces; ii) interacting with product's smart functions, by avoiding buttons and keyboards; iii) conveying digital information to users in physical ways.

Four demos presented at DeSForM 2015 fit this cluster. They show how the investigation of user's or product's "behavior" can be explored by different viewpoints and can suit different tangible or intangible solutions in the design domain.

Two demos deal with the investigation of the behavior of smart and dynamic interactive products. The demo "Animism Expression: Materializing Basic Principles of Animation for Interaction Design", by Lin, Liang, Wang and Hsu explores how to create more "natural interaction experiences" by exploiting the methods, principles and approaches of animation. Authors present eight principles derived from animation that can be applied to the design of interactive living things. They demonstrate how to leverage them by designing interactive cubic prototypes showing light and physical transformations.

The demo by Elderman and Hur, titled "Exploration of Interaction Methods for Shape-Changing Interfaces", illustrates a toolkit developed to help designers to prototype shape-changing physical interfaces, without the need of hard technical or programming skills. This work shows how important prototyping is in the design process, especially when interaction modalities need to be assessed.

The other two demos focus on the actions performed by users while interacting with an electronic product (the first demo) and a digital interface (the second one). The demo "An Exploration In Kitchen Blender Interactions Aimed At Designing For Higher Levels of Engagement" by van Rheden and Hengeveld investigates how to redesign current interaction modalities with a kitchen blender, in order to generate more engaging experiences. Authors attempt to overcome the "standardization" of operational modes of electronic products (mainly consisting in buttons and menu screens) to reach richer forms of interaction, based on physical gestures inspired by the use of physical and mechanical objects.

The second demo "Unify: Sharing Digital Media Content from the Cloud through Physical Interaction" by Zoontjens, Oogjes and Hu explores new ways to interact with intangible media using digital devices. The demo illustrates how affordances of the physical world can be introduced in the interaction with cloud-based services to share digital media. Intangible media are treated as tangible elements that are subject to the law of physics, thus requiring the user to adopt natural gestures to control and manipulate them.

3D printing for designing enhanced interactions

Nowadays, a widespread debate is going on about how much the possibilities offered by new digital manufacturing technologies are affecting the way in which product design is perceived, practiced, manufactured, traded, taught, and learned. Fab-labs, makers, new-craftsmanship, Do-It-Yourself, micro-production are just a few of the related topics. "It is an emerging socio-technical paradigm characterized by new forms of advanced, open and distributed manufacturing." [20]

In parallel to the theoretical debate - and in order to nurture it - several experimentations are occurring. Their aim is to test both the limits and the possibilities offered by 3D printing.

Two of the demos presented at DeSForM 2015 belong to this category, both proposing an approach to integrate digital manufacturing in the design process in order to design enhanced interactions. The first demo focuses on how to test the aesthetic appreciation of a tangible product, the second one on how to translate data coming from the product use in its form, in order to create a unique and personalized user-product interaction.

In the demo "A Design Research Methodology using 3D-Printed Modular Designs to Study the Aesthetic Appreciation of Form and Material" Post, Saakes and Hekkert study how small changes in form and material properties influence the aesthetic appreciation of a product. In this appreciation, both visual and tactile properties strongly interact. Indeed, while our first impression of a product is often visual, later on tactile exploration of the product's qualities such as weight, texture, and temperature becomes essential. In their previous research, the authors of this demo have shown that the principle of "unity-in-variety" applies not just to visual aesthetics, but also to tactile aesthetics. To explore this principle, the possibility to create detailed and customizable haptic stimuli offered by 3D printing has been exploited, designing and manufacturing a set of car keys that systematically change in form and material.

In the demo "Exploring computational aesthetics for golf club design", Neu and Irvine describe a design process in which the integration of an interactive application, parametric modelling and additive manufacturing allows to personalize the design of golf clubs heads, resulting not only in an innovative object but also in a unique golf playing experience. According to the authors, "There is substantial research into parametric modelling, individual digital data collection and additive manufacturing independently in design. However, very little research exists which investigates the combination of these tools as an adapted design process". The integration of these three elements offers a new approach to the mass customization of golf clubs, envisioning a completely new way of designing and manufacturing them.

References

[1] Djajadiningrat, T., Wensveen, S., Frens, J., and Overbeeke, K.: Tangible products: redressing the balance between appearance and action. Personal and Ubiquitous Comp. 8, 5 (2004), 294-309.

[2] Boer, L., Donovan, J. (2012), Provotypes for participatory innovation in: Proceeding DIS '12 Proceedings of the Designing Interactive Systems Conference, 388-397

[3] Zimmerman, J., Forlizzi, J., & Evenson, S. (2007). Research Through Design as a Method for Interaction Design Research in HCI. In CHI '07 Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 493-502). doi: 10.1145/1240624.1240704.

[4] Zimmerman, J., & Forlizzi, J. (2008). The Role of Design Artifacts in Design Theory Construction. From Human Computer Interaction Institute, Paper 37, Web site http://repository.cmu.edu/hcii/37/

[5] Mareis, C. (2012). The Epistemology of the Unspoken: On the Concept of Tacit Knowledge in Contemporary Design Research. Design Issues, 28.2, 61-71.

[6] Bang, A. L., Krogh, P. G., Ludvigsen, M. & Markussen T. (2012). The Role of Hypothesis in Constructive Design Research. In The Art of Research 2012: Making, Reflecting and Understanding. Helsinki : Aalto University School of Arts, Design and Architecture. Retrieved September 30, 2013, from http://designresearch.aalto.fi/events/aor2012/download_content/selected_papers/anne_louise_bang.pdf

[7] Zimmerman, J., Stolterman, E., & Forlizzi, J. (2010). An Analysis and Critique of Research through Design: towards a Formalization of a Research Approach. In Proceedings of the 8th ACM Conference on Designing Interactive Systems, 310-319. doi: 10.1145/1858171.1858228

[8] Frens, J. (2007). Research through Design: a Camera Case Study. In R. Michel (Ed.) Design Research Now: Essays and Selected Projects, 135-155. Basel: Birkhäuser

[9] Stappers, P. J. (2007). Doing design as a part of doing research. In R. Michel (Ed.), Design research now (pp. 81-91). Basel, Switzerland: Birkhäuser

[10] Koskinen, I., & Krogh, P. G. (2015). Design accountability: When design research entangles theory and practice. International Journal of Design, 9(1), 121-127.

[11] Rust, C., Roddis, J, & Chamberlain, P. (2000). A practice-centered approach to research in industrial design, in Pizzocaro, S. Arruda, A., de Moraes, D. (eds.) Design Plus Research: Proceedings of the Politecnico di Milano Conference, May 18-20, 2000 (pp. 358-365)

[12] Chen, L. (2007). International Journal of Design: a Step Forward. International Journal of Design 1.1, 1-2.

[13] Ardissone, A. (2014) ''From health to well-being, from government to governance: epochal transitions'' in SALUTE E SOCIETÀ, Fascicolo: 2EN Lingua: Inglese, pp. 173-177 DOI: 10.3280/SES2014-002013EN

[14] Kanstrup, A. M. (2014). Design concepts for digital diabetes practice: Design to explore, share, and camouflage chronic illness. International Journal of Design, 8(3), 49-60.

[15] Utian, W.H. (2005): Psychosocial and socioeconomic burden of vasomotor symptoms in meno-pause: a comprehensive review. In: Health and Quality of Life outcomes, Vol. 3, No. 1. Health and Quality of Life outcomes, London

[16] Morrison, A. J., Mitchell, P., & Brereton, M. (2007, September). The lens of ludic engagement: evaluating participation in interactive art installations. In Proceedings of the 15th international conference on Multimedia (pp. 509-512). ACM.

[17] Danks, M., Goodchild, M., Rodriguez-Echavarria, K., Arnold, D. B., & Griffiths, R. (2007). Interactive storytelling and gaming environments for museums: The interactive storytelling exhibition project. In Technologies for E-Learning and Digital Entertainment (pp. 104-115). Springer Berlin Heidelberg.

[18] Baldissini, S. (2015). Digital media and architectural drawings: a case study from Bramante. SCIRES-IT, 5(1), 25-30.

[19] Fernaeus, Y., Tholander, J., & Jonsson, M. (2008). Beyond representations: towards an action-centric perspective on tangible interaction. International Journal of Arts and Technology, 1(3-4), 249-267.

[20] Menichinelli M., Bianchini, M., Carosi, A., and Maffei, S. (2015) ''Designing and making at school. A first systemic overview of Makers in Italy and their educational contexts'' in L. Collina; L. Galluzzo; A. Meroni (eds.) ''The Virtuous Circle. Design Culture and Experimentation'', Proceeding of The Virtuous Circle. Cumulus Conference 2015. Milano. McGraw Hill