PROCEEDINGS

DRS LEARN X DESIGN 2019

insider knowledge

Fifth International Conference for
Design Education Researchers
9-12 July 2019
Middle East Technical University
Ankara, TURKEY

Editors
Naz A.G.Z. Börekçi
Dalsu Özgen Koçyıldırım
Fatma Korkut
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Section 4. Making and Prototyping

Editorial

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Learn X Design is the biennial conference series organised by the Design Research Society Pedagogy Special Interest Group (PedSIG), cultivating symbiotic exchanges between design education and design research. The first symposium in the series was held in Paris in 2011 and included a number of invited presentations. The Oslo 2013 and Chicago 2015 conferences were embraced by the design education research community at large and involved an impressive number of contributions across design disciplines and educational levels. The fourth conference was hosted by Ravensbourne University London in 2017, continuing to represent diverse traditions in research and education. The history of the series and all publications can be found on the PedSIG website (www.designresearchsociety.org/cpages/design-pedagogy-sig).

The Fifth DRS Learn X Design International Conference for Design Education Researchers took place July 9-12, 2019 with the main theme "Insider Knowledge" at Middle East Technical University, Ankara, Turkey. In over sixty years, Middle East Technical University (METU) has built an outstanding educational and research environment in many fields including engineering, natural sciences and humanities. METU's impact as a research university has increased with its alliance and collaboration with major industries in Turkey, through its top-ranked technopole. METU also played a pioneering role in industrial design education. The first course on industrial design in Turkey was offered at the Faculty of Architecture in 1969 by the American industrial designer David K. Munro, marking its 50th anniversary in 2019. METU Department of Industrial Design was established as a separate academic unit in 1979, making this year its 40th anniversary. The DRS Learn X Design 2019 conference has provided us with an excellent opportunity to contribute to the celebration of this significant year by sharing our knowledge and experience with the international community, which inspired us to choose "Insider Knowledge" as the theme of this year's conference.

By bringing together the local and international design education community in Ankara, the capital of a country representing a passage from war-torn countries of the Middle East to the borders of a concerned Europe, we also hoped to make a call for peace and dialogue. Furthermore, we believed that having METU as the venue for the conference would be meaningful regarding emerging discussions about the decentralisation of design and be an incentive for a more diverse participation. The particular history of METU itself inspires conversations about the interaction of education, design, environment, urban development and policy, thanks to its award-winning campus and its on-going afforestation project of almost 60 years.

The visual identity of the conference was inspired by the motifs of the Anatolian carpets. The traditional symbols in these carpets communicate the dreams and wishes of the weavers or mark significant events in their lives. The eight-point star, one of these symbols, was interpreted to stand for the "X" of Learn X Design and has become the main reference for the conference identity. Its festive colours weaved together act as a reminder that Turkey stands at the crossroads of continents and cultures.

We first made a call for tracks 14 months ahead of the conference. Eighteen tracks were announced in the call for papers made to the design education community. The conference accepted papers submitted to 17 track themes. Forty-two track chairs were involved in the building of the conference scope, also taking responsibility in the review process and chairing of the paper sessions. A total of 111 paper submissions, 11 workshop proposals, and 28 PhD Pit-Stop applications were received. In all, 86 papers were presented and six workshops were conducted in a variety of topics, ranging from emerging practices in design education to innovative approaches in bridging design education and society. The conference hosted 150 delegates from 81 institutions in 31 countries.

The conference began on 9 July 2019 with a one full-day PhD Pit-Stop event hosting 24 PhD researchers and eight mentors. The presentations by the PhD researchers and the feedback by the mentors took place in the morning session. In the afternoon, the PhD Pit-Stop workshop was carried out in small groups guided by the mentors. The event was supported with four short lectures by Gülay Hasdoğan, Owain Pedgley, Peter Lloyd and Gülşen Töre Yargın, open to the conference audience and PhD Pit-Stop participants. The conference papers were presented over three days between 10 and 12 July, organised under 27 paper sessions. The range of research methods was similarly broad: from large-scale statistical analyses of data sets to rich descriptions and dramaturgical approaches of analysing the studio. The range of subjects of study expanded the anthropocentric to include, for the first time, both cats and squirrels! Questions from delegates on methods and approaches were as common as queries on results. The concluding panel titled "Design Education for Future Generations" brought together five academics in the field of design education, İpek Akpınar, Aykut Coşkun, Emre Çağlar, Stan Ruecker and Yasuko Takayama, representing

perspectives from different design fields, academic positions and cultural contexts, under the moderation of Derek Jones, PedSIG Convenor.

Three keynotes addressed the conference. The first keynote speech titled “Disciplinary Knowledge and the Design Space” was given by Gabriela Goldschmidt, who presented her work on design cognition and its inherent spatiality through theories such as Vygotsky’s Zone of Proximal Development. Goldschmidt argued strongly for the value of such spatialities to develop design expertise, not simply design-like behaviours and actions. The second keynote speech titled “Drawing Circles” was given by Zeynep Çelik Alexander, who gave an in-depth analysis of the pedagogical roots of the Bauhaus, arguing strongly that the design curriculum that has influenced a significant proportion of contemporary design education had prior pedagogical research roots. The final keynote speech titled “Learning and Knowledge Building Skills in Design Education” was given by Halime Demirkan on the subject of learning styles and their applications to student-tutor interaction. The speech highlighted the unique position of design education research in the intersection of theory, research, practice and design itself.

The conference experience was enriched with two exhibitions. The Nurus exhibition “Contemporary Turkish Architecture after 2010” took place at the conference venue, with photographs by Cemal Emden, displaying recent examples of architecture in Turkey. Nurus also furnished the conference main hall and foyer with examples from its product range, designed by the Nurus d.lab and Ece Yalım Design Studio. The “Nude… Simple is Beautiful” exhibition by Nude, also at the conference venue, displayed exquisite examples of glass work by local and international designers. We also experimented with a “Confessions of Design Educators” board for delegates to share with us their memorable teaching experiences, whether slightly embarrassing or soul-shattering.

The conference also gave the participants a chance to get together and strengthen the design education community through its social programme. Our Welcome Reception took place on the evening of 9 July by the pool at the Faculty of Architecture garden, which gave our delegates the chance to visit the faculty building and the 50/40 exhibitions on display. The reception was followed by the PhD Pit-Stop party in downtown Ankara. The social events planned for the evening of 10 July included the options of a Turkish traditional dinner at the Ankara citadel and a genuine Turkish bath experience at a historical hammam in the old city centre, allowing the participants to get a brief insider look at local cultural practices. The conference dinner took place on 11 July, during which the delegates had the chance to try out their belly dancing skills in a participatory dance show!

It was a busy conference, but one that allowed the community to reconnect, create new links and engage in discussion. By undertaking the responsibility of organising this conference, we hoped to contribute to the growth of the design education community and inspire others to continue the series. As we now arrive at the end of our journey by finally publishing the conference proceedings, we would like to thank everybody involved in the realisation of the conference. We would like to thank the former DRS PedSIG convenor Michael Tovey for his encouragement in our hosting of the conference and the Chair of the DRS Council Peter Lloyd for his unfailing support. Our thanks also go to the Conference Programme Committee members and the members of the administrative, editorial, visual communication and conference support teams for their dedicated hard work. We sincerely hope that all participants enjoyed both the academic content and the social activities, as well as the METU campus characterized by its unique natural and built environment as well as by its egalitarian culture and open intellectual milieu.

The proceedings book has been organised under two major parts reflecting the structure of the conference programme: Part 1 covers the double-blind peer-reviewed papers presented by the delegates, and Part 2 covers the PhD Pit-Stop short papers presented by the PhD researchers. Looking at the scope of the conference papers, we organised Part 1 under five sections, namely, Approaches and Attitudes, Educational Milieu, Tools and Methods, Making and Prototyping, and Social Contexts and Sustainability.

As we approach the end of our two-year conference journey, selective amnesia sets in. The gentile push by Michael Tovey at Ravensbourne back in 2017, and the sheer joy of being among friends for the farewell drinks at the neighbourhood pub on the last day of the conference loom larger. We thank you all for the companionship and support you provided at different stages of this journey. We look forward to exchanging warm greetings with you all in the next conference in 2021.

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DRS LEARN DESIGN
PART 1
Conference Papers

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Bundles of Spatial Ingredients: Designing Through the Prototype

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Abstract: Learning by doing has proven its efficacy in the educational field and, in this context, prototypes may play a key role. If used in an active way, provocatively diverging from their representative function design models can lead to different and lateral thinking modalities. They can provide inspiration for unpredictable paths and, potentially, innovation. A similar approach towards the purpose of prototypes in the design process has already been undertaken by professionals, from renowned Italian designers to contemporary architects. Yet, this contribution is based on a daring contamination from literary experimenters whose methods originate from strict and almost absurd rules. Their aim is to stimulate creativity in an apparently playful and even serendipitous activity. In particular, the paper refers to a three-year educational experience assessed in a *Project Foundations Studio* of an Interior Design course at Politecnico di Milano. Hence, the developed and employed approach is described and its results discussed, outlining how effectively the use of prototypes as active tools of the design process can liberate students' imagination and change their attitude towards the designing of interior spaces. Even though the described approach may present some limits, the aim of this argumentation is to illustrate the different contribution a prototype can make in future applications.

Keywords*: subversive prototypes; learning by doing; design method; design through the prototype; thinkering*

1 Introduction

1.1 Towards a *Thinkering Thinking*

Educational methodologies fostering a *learning by doing* approach and ascribed to the *activism pedagogy* are characterising the contemporary paradigm to be pursued in educational, professional and corporate processes.

In learning by doing, education is induced through a concrete and meaningful experience. In problem-based learning, the pursuit of a solution is the starting point of the instructive process. For project work, learning is a direct confrontation with a real project, usually to be developed in classroom. Business games transform education in a simulation of marketing or company activities. In role playing, learning is provided by the interaction of students/characters within a fictional world, inspired by narrative or cinematography. Didactic fab labs bring experimentation to a tangible level through digitally fabricated models. Creative ateliers are workshops aimed at valorising the discrete charm of crafts with an integration with modern digital technologies and where artistic, musical or visual – and often ludic – artefacts are realized. Nowadays those are embodiments of the multifaceted current representation of activism pedagogy. The discipline is not about action for its own sake, on the contrary, the concept of metacognition (Dunlosky & Metcalf, 2009) is strengthening. It intends to gather operative and reflective dimensions: it is necessary to think and to acquire awareness of one's actions, but also to discuss with oneself and with others (Moura, Fahnstrom, Prygrocki & McLeish, 2009, p. 52; Dillengourg, Baker, Blaye & O' Malley, 1996) in a vision indissolubly connecting learning by doing and learning by thinking.

In this framework, the paper focuses on a design-oriented research and on the role that prototypes have achieved and may gain in the design process for internal spaces, specifically in the Italian and Polytechnic practice. In particular, some methodological reflections derived from other disciplinary fields. Designers are usually trained to express their ideas in a visual and practical way (sketching or prototyping), a practice that Basapur and Mathew (2010) define as thinkering. In this sense, proactive exercises –which can be free expressions or works developed from firm rules– are important for stimulating creativity as well as for testing or reflecting on ideas. Even if the word prototype comprehends a wide range of artefacts –such as sketches, low-fidelity paper prototypes, software simulations or hardware diagrams in the early design process, and full or partially functioning software or hardware, reaction-eliciting and high-fidelity objects later in the process (Scaletsky, Ruecker & Basapur, 2014, p. 3084)– in the following dissertation, it will strictly be referred to as physical, three-dimensional and scaled prototypes that will be indifferently addressed as prototypes, models (from Latin modellus, which means measure or module), or maquette (French term from the *Beaux Arts Grand Dictionnaire de Trévoux* indicating the first visualisation of the artist's formal intention (Crippa & Di Prete, 2005b, p. 7)).

The presented research depicts an experimental didactic approach to the employment of prototypes, which aims to be innovative in its context. Though it may appear rash, it has been assessed from a three-years period in a Project Foundations Studio at the School of Design of Politecnico di Milano. As a matter of fact, the studio propositions are based on a series of prestigious explorations which have been visionarily fulfilled in both literary and artistic fields. It is an original and ludic process, intendedly provocative and aimed at the construction of knowledge.

1.2 The Background: Designing Through the Maquette

Traditionally, interior design had to deal with the dimension of *doing*, specifically with spatial manipulation and simulations. Accordingly, Bruno Munari used to quote an ancient Chinese proverb:

> I hear and I forget. I see and I remember. I do and I understand. (Confucius, 500 B.C.)

This clearly underlines how physical exploration is fundamental for a deeper comprehension of an object, a space or a process. In particular, in the field of interior design, this sort of investigation is fulfilled by scaled prototypes which are able to convey formal, perceptual and emotional features of an environment.

Whether they are aesthetic, functional or structural prototypes, their contribute in the design process is indeed essential, as the 1998 *ADI Compasso d'Oro Award* to Giovanni Sacchi –one of the most renowned Italian modelists– demonstrates. He was honoured with this reward for his career. Specifically, his contribution to the discipline has been acknowledged as *the other side of design* (Polato, 2000) to stress his role as project counterpart. All of the most famous Italian designers and architects of the second post-war period passed by his workshop, in Milan, *via Sirtori n. 10*: from Castiglioni to Zanuso, from Rossi to Sapper, from Botta to Piano. That atelier –like the one of Pierluigi Ghianda, Sacchi's friend– represents one of the places where the history of Italian design has been *done* and *thought.*

It may not surprise that for all the above-mentioned designers the prototype was a moment of analysis and test, indispensable in the design process. A maquette can express a *sense of possibility* (Tagliagambe, 1998, p. 3) that simplifies and, sometimes, encourages the design work and the architect's imagination. It is an artefact which stands in-between an itinerary of desire and research, it is projection and utopia (Celant, 1987, p. 79). The model allows a constant effort for improvement that gets always closer to the optimal result; definitely it is possible to *learn from the prototype*, as it *communicates*: it denounces errors, it makes lacks patent, it emphasizes the tiniest incongruity, it suggests alternatives and fosters creativity.

In this perspective, some experimentations developed by masters of contemporary architecture are relevant, as they interacted with the prototype in a dialogical way, giving models a proactive role and not treating them just as *pre-visions* of spaces or as objects anticipators. Some instances are the sculptural compositions by Frank O. Gehry (Bruce, 2001, p. 49): assemblies of pure forms aimed at establishing a dialogue with the client and then covered, deformed, and assumed as functional matrix of the project development. Less renowned is the case of Coop Himmelb(l)au's *psychogram*: a *three-dimensional sketch* drawn instinctively, with poor and common materials, in the early phase of the creative process, which guides the entire definition of the project. The *psychogram* is the reference in moments of doubt, it is the goal and the unconscious track of the design process (Crippa & Di Prete, 2005a).

Models may represent different values: inspiring, verifying or conveying design contents. Actually, Scaletsky et al. (2014, pp. 3082-3084) state that designers use prototypes as generation, communication, testing, research and even theory-builder tools for ideas. They can lead to different results, such as: invention, meaning-making, reification of concepts and mediation among different interlocutors. Therefore, an overtaking of the deeply-rooted model based on the "research, analyze, ideate, build and communicate" approach (Agogino et al., 2015, p. 3) is required, and more often it demands to recur to a *cross pollination*. Indeed, the purpose of this contribution is to reorientate the current predominant methodology in the Italian design education. Prototypes are to be investigated as essential means for the design ideation and development, and as temporary shelters in a serendipity-driven explorational journey. In this context, models are no longer depicted as progressions in a linear and consequential process, yet they become extraordinary objects for conceptual rather than physical manipulation. The prototype will be finally presented as an irreplaceable tool to trigger short circuits between *provocation and feasibility*.

2 Ingredients for an *Imperfect* Recipe: A Design Approach

2.1 Inspirations and Theoretical Foundations

A space is nothing but a blank page. This interesting assimilation has been developed by the French writer Georges Perec in his work: *Espèces d'Espaces* (1974/1989). The opening of the essay is an emblematic map of the ocean, derived by Lewis Carroll's *Hunting of the Snark* (L. Carroll, 1874/1981). The map is necessarily a white square, a space where the infinite imagination lays, a common starting point for those who *travel through themselves* in their writing (Michaux, 2012), and for those who invent spaces out of a design process. As a matter of fact, for both the writer who tries to define what space is and the designer who traditionally works with it, the blank page represents the first place they have to manage. With a – perhaps unconscious – designerly attitude, the author affirms that a space begins with some marks on a blank page (Perec, 1974/1989, p. 19). Obviously, those marks assume different meanings in Perec's work and for the designer. The former identifies *words* as ordinating tools, while the same purpose is conveyed by drawings for the latter. Though, the similarities that put writing and designing, words and space, in contact are the trigger for the following dissertation.

In literature like in design, the whiteness of the page – the first indistinct matter – is the blank to be filled with one's creativity. It is a place with plenty of possibility, to express even the same concept or narrative. Indeed, another eminent source of inspiration for the development of a design approach based on direct experimentation, trial and error, is Raymond Queneau's *Exercices de Style* (Queneau, 1947/2007): a collection of 99 narratives of the same short story, each time written with a different linguistic strategy. Other similar exercises have been conducted by other writers, such as Perec with his lipograms (texts in which a particular letter is avoided) (Perec, 1969/2007) or Umberto Eco in *Il secondo diario minimo* (1992), in which he rewrites the same poem, each time excluding a different vocal. A strong characteristic, shared by all the previous examples, is the definition of a method which starts from a constraint, may this be difficult and apparently absurd. From this, imagination needs to be freed from conventions in order to find new solutions, hence conveying surprising results.

A similar approach, drawn from this exploratory literature, has already been experimented in the design field, searching for innovation. For instance, Martino Gamper designed *100 chairs in 100 days*, created by the recovery and hybridisation of discarded ones; while the master, Bruno Munari, adopted some principles translated from writing

methods into his own work, to investigate new forms of communication. His booklets, as *Contanti Affettuosissimi Auguri* (1994/2016), *Libri Illeggibili* (1984/2017), or *Prelibri* (1980/2018) basically shift the focus from the content – of a book, of education, of design – to the *modalities* of creating knowledge or products, thus transferring great importance to physicality from the point of view of the *experience* (echoing the Chinese proverb according to which we learn by doing), and to *fantasy* (as an essential element of the design process). Actually, from his experimentations, Munari summarises a design method (1981/2013) that insists on lateral thinking and tries to detach the designer from mere function and feasibility, letting *fantasy* imagine even the more absurd, incredible and impossible solution (Munari, 1977/1998).

Once again, in the attempt to reach freedom and stimulate creativity, rules are needed. Munari depicts them in his work Fantasia (1977/1998), while another master of Italian Design, Enzo Mari, aims at reversing them by questioning the role of the designer, of the consumer and of the designed product itself. In fact, in *Proposta per un'autoprogettazione* (Mari, 1974/2010), he offers the user a manual to self-create his/her own furniture, destabilising the mutual designer-customer relationship and the market mechanics. Similarly, a contemporary (ex-) designer can be regarded as a rule-challenger: Martí Guixé is not enslaved by the traditional design logics. He seems to embrace Munari's *fantasy.* He brings it to the real world, realizing destabilizing yet brilliant objects, such as *Football Tape*, adhesive tape with a football pattern that allows to create an actual football when it is balled up; or *Blank*, a wall clock made of whiteboard that inverts the definition of time: it is no longer the object yet the user who defines his/her time.

As these last examples testify, whether it is starting from a rule or a pure concept, if the design process has no cultural constraints and includes *fantasy*, then the results will be unpredictable, and even out of the designer's complete control. In a way, it reminds serendipitous surrealists' games. Serendipity lays on the exploitation of chance while something different from the final result was being searched for. Through ludic components as a human common language (Huizinga, 1938), techniques of surprise and methodologies of the fantastic, surrealists undermined the certainties of the reasonable and respectable (Brotchie, 1995). In particular, they recurred to well-defined procedures, like Automatism, to set the beginning of their creative activities (from writing to visual arts). From strict rules they encouraged spontaneity to produce unexpected material which they used as the basis for further composition.

To sum up, from surrealists' approach, from games and rules, from challenges and serendipity, from physical experimentation and conceptual investigation, a provocatively prototype-based design approach has been developed. It attempts to translate all of these elements in a unique recipe, as they appear to be of paramount importance for triggering original results. In particular, the influence of the experimentations in the literary and artistic fields is reflected in the premises of the design approach. The cited writers and surrealists base their reasonings on the foundations of the matter they have to express themselves: language and composition. They question the principles of their disciplines, putting unnecessary limits on their use. Similarly, the proposed approach takes root in predefined rules limiting the designer's possibilities through the materials on which design is founded. According to the experimental nature of the described literary and artistic experiences, it is not a rigorous approach, yet it sets some fixed points, some ingredients to discover unknown and unpredictable paths, hopefully the recipe of creativity.

2.2 Designing Through the Prototype: Between Rules and Chance

To better understand the impact of the proposed approach, it is necessary to consider the environment in which it has been generated. Current Italian design education gives great importance to speculation and abstract thinking in the development of the project. Specifically, it is the prevalent tendency in Politecnico di Milano – department of Interior Design. At the beginning, a substantial work looking for theoretical and cultural references, original parallelisms, evocative images, and developing a concept is conducted. Then, the idea materializes and evolves mainly through conceptual and functional diagrams, in-plan space organisation and digital 3D visualisations. The physical model only comes at the end of the design practice and with a mere representative function. It is a communicative item among many others. In addition, Interior Design students approaching space planning for the first time are conditioned by common practices and misconceptions about this activity. They need to free their minds from preconceptions and leave space for creativity, or, in Munari's terms, for *fantasy*. These are the moving reasons for the development of a prototype-based design approach, assessed in a first-year *Project Foundations Studio* at Politecnico di Milano and addressed to a class of about 50 students.

The objective of *Bundles of Spatial Ingredients*, an assignment intended to educate future open-minded designers, is to design a minimal living-space – 110 m^3 – for a single person, that has to include another specific public function. Here, the conception of space reflects Perec's definition of it (1974/1989): just from its delimitation (the blank square or, in this case, a metrical surface) students will discover how space can be incrementally expanded (into a universe of

qualities or, in the author's work, an actual one). The residential topic, instead, has been chosen as it is something they all can easily refer to according to their own personal experiences, and can assimilate in a common yet differentiated background.

For the development of their projects, students are divided in groups from two to three people and they are guided by bundle of cards portraying all the fundamental ingredients to take into account during the design of interiors. A ludic approach is at the basis of the experimentation. In fact, the form of game has proven to be effective in terms of setting rules that people are inclined to favourably accept (Bertolo & Mariani, 2013), as they enter in a parallel dimension where they free themselves from cultural and social expectations (Csikszentmihalyi, 1990). During a four-weeks period, students are called to undertake a progressive and practical design process. They primarily need to identify and meticulously describe their target user – in order to have a very rich source of inspiration for their interior characteristics and functions – and then, once a week, they have a bundle of cards to pick up, which determines the unpredictable and serendipitous final result. The first one defines the typology of space, and the relationship between private and public into the residential space; the second week, they will receive information about space exits (according to an introverted point of view), natural and artificial lighting affecting their interior area; while their third and last pick reveals materials, colours and furniture they must use to characterise their space. To add more game dynamics and unpredictability some limiting and wild cards are provided. By the way, the fundamental and peculiar aspect of this approach lies in the *modality* students are required to develop their project. As a matter of fact, after an aesthetic research about the ingredients they have been casually assigned, the only mean students have to visualise, test and explain their ideas is the prototype. From the very beginning, they are not allowed to use drawings or computer programs to express themselves. On the contrary, they are forced into a practical step-by-step construction of a physical temporary model that needs to be implemented, revolutionized, set aside and perhaps taken back, to finally get to the final solution. Whether it may seem an easy task to fulfil, this approach is actually in opposition to the conventional bidimensional definition of spaces but, thanks to its physicality, it provides richer and more immediate information in the representation of choices. Moreover, the central focus throughout the entire design phase is the action, the tangible experience and the overall method through which they understand how to investigate, set and select different design solutions. Refined materials are not required (students can use paper, recycled cardboard, or whatever facilitates their creation process). In this way, they actually learn how to manage space by physically manipulating it in a reduced scale.

During the development of the assignment, students have a weekly revision of their work – which has to be implemented with the freshly-picked new ingredients. It is useful to help them overcome the obstacles represented by the often-challenging combinations of ingredients; better interiorize the method; leave all of their preconceptions and eventually dare to explore unconventional paths. Revisions are also essential to closely monitor and assess the validity of the approach and its outcomes, in terms of the evolution of students' attitude towards the design process and their improvements in handling spaces. Lastly, the final project is presented by the research outputs, technical drawings and the ultimate model, which comes back to its representative role.

3 Reflections on the Prototype as an Active Educational Tool

Directly working with a prototype, without moving from a preconditioned theory, makes failure a key moment in the design process. Then, the prototype the opportunity to begin again, and more intelligently, as Henry Ford used to say (Ford & Crowther, 1922). Revision after revision, card after card, students are called to build, dismantle, rethink, reconstruct, shape and refine the model, which is an actual and active tool, and not just an exhibition object, as it is usual in our context. The evolving prototype, therefore, represents a source of continuous inspiration and a moment of constant research. In particular, four main reasons resulted to be relevant for students' education, and they are about the prototype being *in-progress*, *introverted*, *subversive* and *de-contextualized*.

3.1 The *In-Progress* Prototype

As it has already been explained, the proposed approach is characterised by a step-by-step development of a prototype, which can be assimilated to a travelling companion in the design process, not just its final result. The great challenge is to encourage the students to deal with weekly added, unpredictable, new ingredients that are able to corroborate or even subvert their previous assumptions. Design requests are always different, progressively turning down the scale while augmenting the detail level and continuously questioning past, present and future directions. From the second card pick, students clearly realize how temporary and ephemeral their reasoning and propositions may be. In opposition to the human tendency of assuming guidelines that seem unchangeable and deeply rooted in the design process, in this case, students necessarily have to learn to quickly adapt and to be open to changes. They have to accept failure as part of the process, and inferring new stimuli and unexpected opportunities from it.

Handiwork, the direct manipulation of materials and the creation of actual spaces allow future designers to gain an increased awareness from a greater experience, attention and – in Ford's words – intelligence towards the project. The weekly challenge, trains the students' dynamic and lateral thinking. As a matter of fact, while the second card pick may represent an insurmountable problem, already the third one is accepted in a more positive and constructive way, even if, at that time of the process, the students have comprehensibly maturated preferences towards the directions of their project. Nevertheless, this kind of consciousness and ability to manage the space are exclusively derived from the hands-on experience, in a way that a traditional, bidimensional attitude cannot pursue.

3.2 The *Introverted* Prototype

This prototype-centred approach also allows to develop another fundamental skill: the ability to imagine and generate spaces uniquely from an interior, three-dimensional point of view. In fact, students do not have to take care of the external sides of the architecture, nor perspective drawings are required. Their only aim is to learn the *foundations* of interior design, as the name of the course already depicts. Even if the process begins with the shaping of volumes, the spatial distribution and characterisation are to be figured out from the interior living dimension. The provided materials are also defined to favour this attitude (entrances are referred to as exits, openings are described in relation to the types of lighting they allow, etc.) but still, as the revisions pointed out, it does not seem to be a very intuitive approach. That represents an additional reason to encourage students to actively use their prototype and project themselves inside the space they are designing.

Ultimately, the external façades are not specifically designed, yet they are configured as the result of the choices operated according to interior necessities. Thus, on the threshold in-between inside and out, they attest a precise design will. The indifference towards the exteriors does not stand as a didactic lack, on the contrary, it underlines the effectiveness of a good interior design that reflects on a valid and qualitative appreciable outside perspective.

3.3 The *Subversive* Prototype

Throughout the entire experimentation, students are asked to approach the design of a space with a diametrically opposed point view in relation to what their academic experience will teach them. Instead of starting from the preconception of a fixed, bidimensional space to fill in and then translate it into three-dimensional views; they are required to shape the space according to the necessities dictated by the cards and by their own preferences. Only at the end, they will transpose their project into technical drawings and sketches. This attitude not only reverses the design perspective, configuring it from inside-out as it was previously discussed, but it also defines the prototype as a *subversive* component of the design process. Therefore, simultaneously, students have to manage functions, requirements, spatial constrains, aesthetics, and personal values. All of this, while directly reasoning in terms of generation of a space. Especially at the beginning of the experimentation – when they firstly have to delineate their space according to its typology, its relationship with the exterior and between public and private areas – the opportunity of testing and expressing their ideas through the prototype allows the students to increase their awareness about spatial dynamics as well as about human and functional dimensions. Practical and tangible work provides clear and quantifiable results that lead to a rapid assessment throughout the iterative process: in a development made of doing and redoing, the model becomes the protagonist of the design method, representing an ally for both sustaining and discouraging decisions on a concrete base.

3.4 The *De-Contextualized* Prototype

As a reflection of a de-contextualized approach, the (future) designers practically understand that they do not need to be submitted to space, yet they are empowered to manipulate it to their own will (Figure 1). A deficit of this attitude is that this statement may be too strong and not always feasible in the professional experience. By the way, the aim of the experimentation, in an educational context, is to free student's minds from conventions and let them free to explore the most creative and even absurd paths to better comprehend their role and purpose in the design process. This has been demonstrated by the following exercise they had to develop. For the final exam, in fact, students had to deal with a complete interior design project, redesigning the functional organization and aesthetic connotation of an existing minimal living-space. The task could be fulfilled with a more traditional approach – according to the Polytechnic tendency previously described – but in light of what they apprehended during the experimentation, they changed their approach. First, they still used prototypes as tools of the process, in addition, they were more confident at handling the space, they were able to better detect the space characteristics and potentialities and manage them according to their needs; and eventually they explored and evaluated their solutions in a more conscious way as compared to their first intuitive approach. The space was no longer a box to be filled with objects and functions, nor a blank square to be filled with abstract words and ideas. Through a scaled version of it, the space was actually recognised as a resource to exploit to express a clear and even bold concept. Thanks to a de-contextualized

environment, with no auto-imposed restrictions deriving from the context, students felt free to dare in the manipulation of space, with absolute creative freedom. They used Munari's *fantasy* as an ingredient for their recipe, and the prototype as an active tool. They developed their ideas, demonstrating their awareness of space.

Figure 1. Final prototype of the experimentation - Project Foundations Studio, professors: Luciano Crespi, Barbara Di Prete, Emilio Isgrò (Brusoni, Nunziata, Pronzati, A.Y. 2017/2018).

4 Discussion

Academic institutions have to be places for experimentation, where theories are formulated, skills are developed and innovation is pursued. They are the perfect sites where to dedicate time to *exercises in style* and games as forms of higher and unrestricted learning. Therefore, tools and methods provided to students should necessarily respond to such a dynamic context. That is the reason why prototypes, having an innate versatile nature, are to be exploited for the meaningful experience they can provide and must not stand as merely representative tools. Hartmann et al. (2006, p. 299) efficaciously state that "[…] prototyping is the pivotal activity that structures innovation, collaboration, and creativity in design." Still, to reach that point, values traditionally related to models have to change. A prototype may not be just an accurate depiction of a design, a portrait of functionality or a concept mediator between designers and users (Scaletsky et al., 2014, p. 3085). As the illustrated on-field research outlined, models may become:

- *Brainstorming triggers*, tools to generate ideas, discussions and suggestions more rapidly as they are already reflected in a three-dimensional space;
- *Provocative devices*, as they give occasion to encourage students to break new ground, to explore personal and unpathed directions;
- *Experimental tools*, which allow investigations in-between fantasy and concreteness, freedom of expression and liberation from past heritage, innovation and balance;
- *Sensemaking prototypes*, objects that are not only representative and informational, but that also generate meaning;
- *Playful artefacts*, as the ludic characterisation has proved to be one of the most effective qualities of the assessed approach. If doing is associated with playing, then the resulting activity will be more positively connotated and involving a more open-minded attitude, despites all the encountered difficulties and obstacles.

Perhaps, the best picture of a maquette can be illustrated by a secant, underlining its cross-value between the creative process and its complex results. In fact, if in the design-oriented research "[…] the resulting artefact is considered more a mean than an end" (Fallman, 2003, p. 21), in this case, the prototype assumes a double meaning which becomes clear both in the procedure and in the outcome.

Certainly, the method portrayed in this paper does not aim at perfection, as it mostly refers to an exercise in style and may not seem grounded on real-life problems. On the contrary, it makes of imperfection, unpredictability and margins of error its strength points. In fact, the exercise may represent the beginning for further implementation, like automatic surrealist games were. In this sense, formal precision, standardised functionalities and uniform representations are a prelude to monotony and homologated thinking, while intended inaccuracy and possibly unproductive impositions may be the openers for a divergent thinking with results inspired by creativity and adaptive spirit.

Finally, this approach, as successfully experimented in small working groups of interior design students and teachers, may be further investigated and implemented in different fields, and even include a wider plurality of actors (intended as end-users, managers, engineers, etc.). In fact, its provocative nature and generative role can insert it among some unusual forms of participatory prototyping (Youn-Kyung, Stolterman & Tenenberg, 2008).

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