

Abstracts

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DESIGN 2019

Fifth International Conference for
Design Education Researchers

9-12 July 2019

Cultural and Convention Center
Middle East Technical University
Ankara, Turkey



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Welcome, *hocam!**

It is with great pleasure that we welcome you to Ankara and to METU campus for the Fifth International Conference for Design Education Researchers. METU Department of Industrial Design community is delighted to host this inspirational gathering of young and senior researchers. We have been in touch with you all for more than a year, and it is finally time for meeting in person!

DRS Learn X Design is a biennial conference series by DRS Special Interest Group in Design Pedagogy (PedSIG), cultivating symbiotic exchanges between design education and design research. The first symposium in the series was held in Paris in 2011 and covered a small 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 representing diverse traditions in research and education. And the fourth conference was hosted by Ravensbourne University London in 2017. Michael Tovey, the past convenor of DRS PedSIG, encouraged us to host the 2019 conference at the last conference; we owe him warm thanks for his encouragement and support. We also thank Peter Lloyd, the DRS Acting Chair, and Derek Jones, the new PedSIG Convenor, for their unfailing support. Hopefully, this gathering will inspire others to continue the series.

We did our best to create a conference that is both engaging and joyful. The conference this year promises an exciting array of 87 full papers, three keynote speeches, five workshops, a concluding panel and a full-day pre-conference PhD Pit-Stop event with four short lectures. The social events dare to focus on local experiences and skills: raki table as a socializing ritual, cleaning in a hammam as a collective practice and belly dancing as a celebration of bodily energy!

We hope you enjoy METU campus characterized by its unique natural and built environment as well as by its egalitarian culture and open intellectual milieu; do not hesitate to explore the campus and join our diverse community at Devrim ("revolution", the METU stadium). Our department has quite a few occasions to celebrate this year. The year 2019 marks the 50th anniversary of the first course on industrial design offered in Turkey, at METU Faculty of Architecture by the American industrial designer David K. Munro. This year we are also celebrating the 40th anniversary of the establishment of our department as a separate academic unit at METU. We have set up several exhibitions to celebrate these occasions at our base, the Faculty of Architecture, one of the finest examples of modern architecture in Turkey. Do not miss the welcome reception at the Faculty of Architecture poolside on the evening of the 9th of July.

We have been looking forward to welcoming you all. Fingers crossed for no (un)foreseen political and/or economic crises!

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Naz A.G.Z. Breki

Fatma Korkut

Dalsu zgen Koyıldırım

(*) "Hocam" is commonly used within the METU student community to address everyone, overlooking gender, profession and rank.



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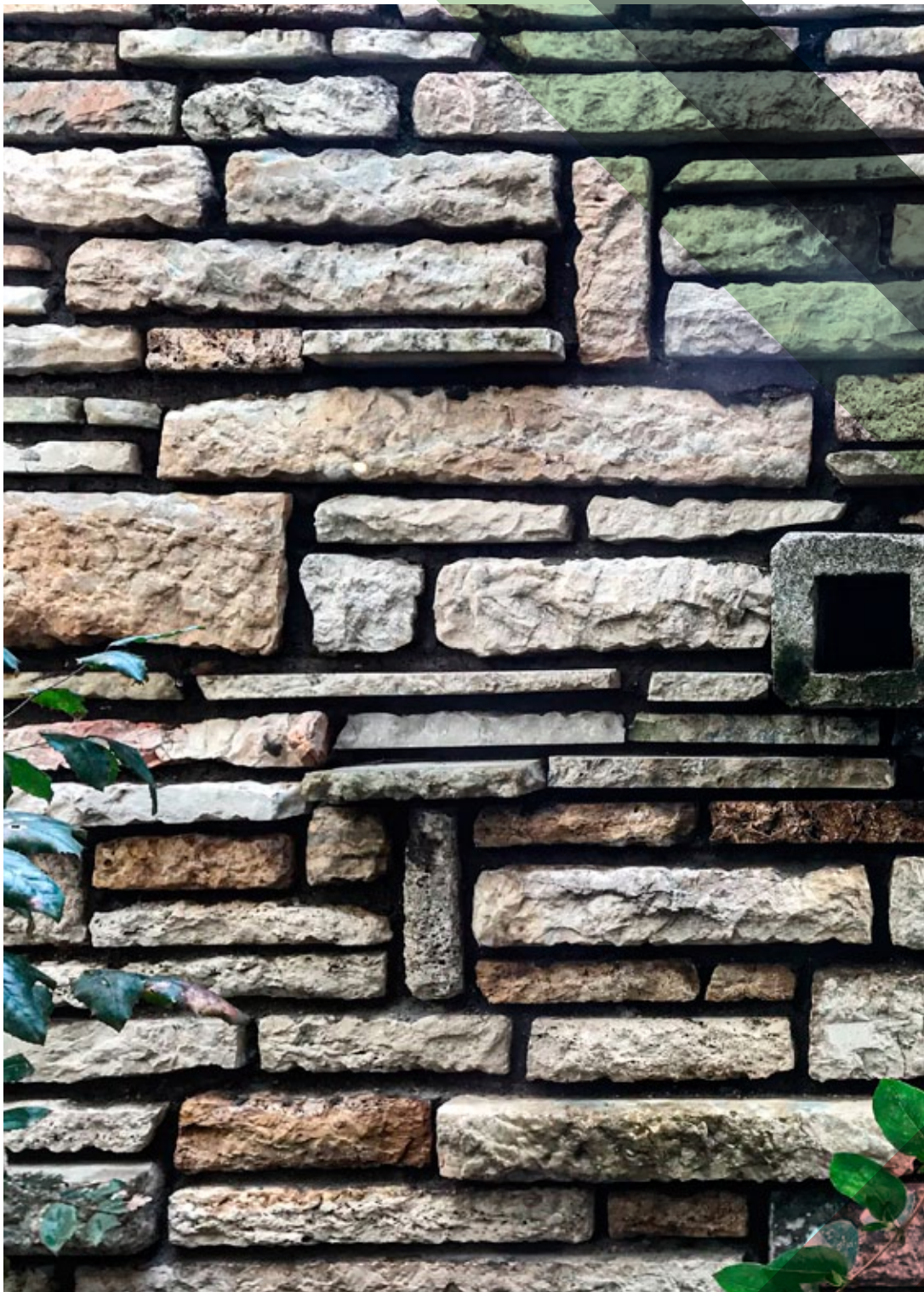


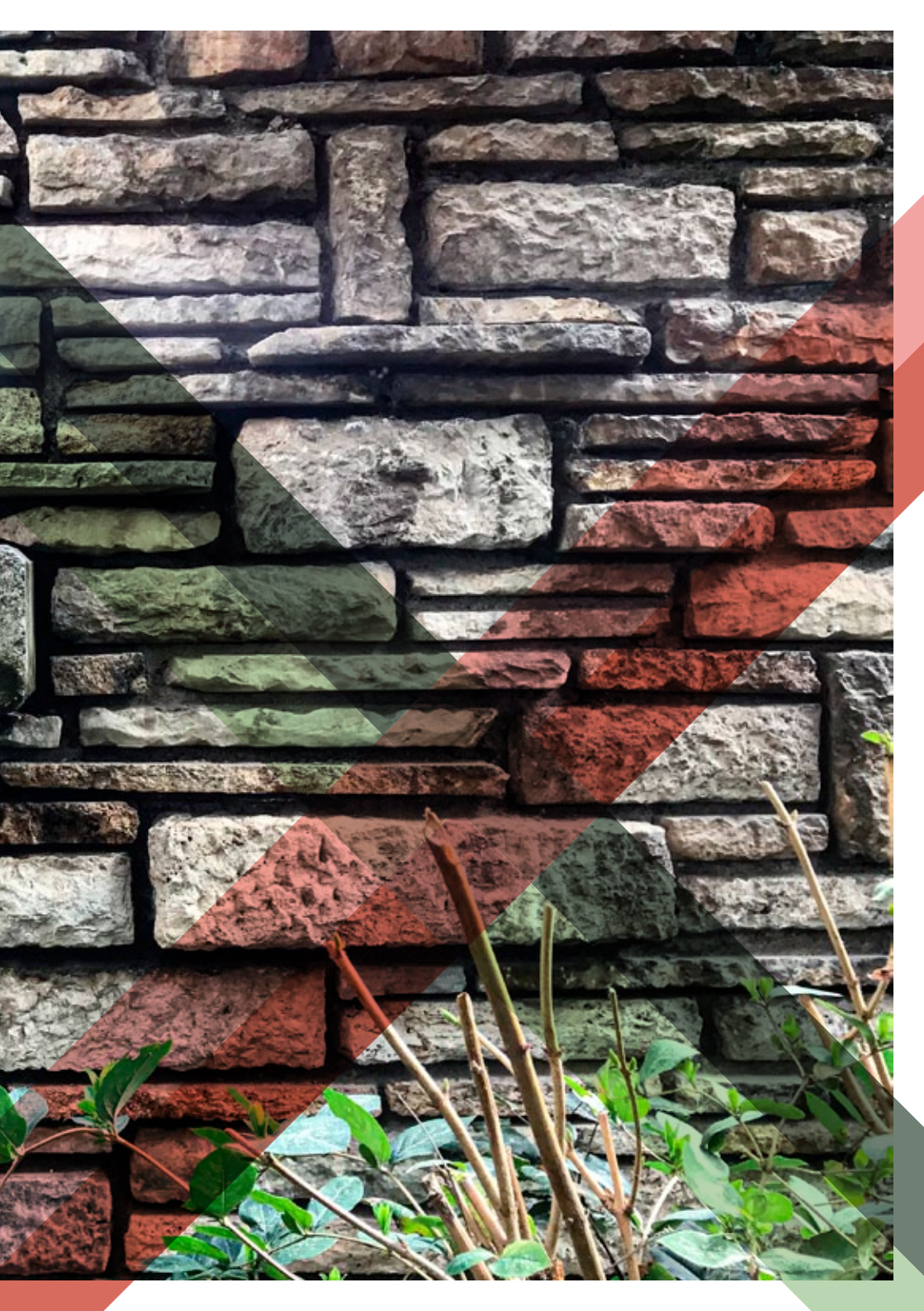
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Gabriela Goldschmidt



Gabriela Goldschmidt is a graduate of the School of Architecture at Yale University. She worked as a practicing architect in the USA and Israel and had her own practice in Haifa until the mid-1980s, at which time she joined the Technion in a full-time capacity. Since the end of 2010 she is a professor emeritus. She taught a large number of design studios and theoretical seminars that reflect her research areas: design cognition, visual thinking and sketching, analogy, and design education. She served as a visiting professor or visiting scholar at MIT, Stanford, TUDelft, the University of Montreal, UNIST, and Bezalel Academy of Art and Design. Her publications include dozens of refereed journal papers, book chapters, papers in conference proceedings, and two books: an edited volume (with Prof. William Porter of MIT), *Design Representation* (Springer 2004), and *Linkography: Unfolding the Design Process* (MIT Press 2014). She continues to lecture around the world and supervise PhD students at the Technion.

→ Disciplinary Knowledge and the Design Space

When faced with a design assignment, designers –novice and experienced alike– conduct a search in a design space that comprises different types of knowledge that is relevant to the assignment. For experienced and certainly expert designers, this knowledge can be divided into three categories: general, cognitive, and disciplinary (professional). Novice designers often have similar general knowledge, they have cognitive knowledge, but they lack disciplinary knowledge, which is acquired with experience and with guidance, mostly as part of a professional education. Disciplinary (professional) knowledge is embedded in a disciplinary world into which the novice designer must be initiated. Disciplinary knowledge, both declarative and procedural, affects the way cognitive knowledge is implemented. The disciplinary world one is a *member* of, shapes the design spaces one constructs. In this talk we look at examples of design solutions generated by novices (children) and by professionals in different design disciplines, to see how they incorporate (or do not incorporate) disciplinary knowledge into their solutions. We then briefly touch on the learning processes that enable novices to benefit from input by their elders and develop independent design thinking skills and knowledge.

Zeynep Çelik Alexander



Zeynep Çelik Alexander's work focuses on the history and theory of architecture since the Enlightenment. After being trained as an architect at Istanbul Technical University and Harvard Graduate School of Design, she received her PhD from the History, Theory, and Criticism Program at MIT. Çelik Alexander is the author of *Kinaesthetic Knowing: Aesthetics, Epistemology, Modern Design* (Chicago and London: University of Chicago Press, 2017), recipient of the Charles Rufus Morey Award from College Art Association. The book is a history of an alternative mode of knowing -non-propositional, non-linguistic, and based on the movements of the body- that gained saliency in the nineteenth century and informed the epistemological logic of modernism in the German-speaking world. A second volume, *Design Technics: Archaeologies of Architectural Practice*, co-edited with John J. May (Harvard University) and forthcoming from the University of Minnesota Press in 2019, examines the histories of a series of techniques that have come to dominate contemporary design disciplines. Çelik Alexander has published in numerous venues, including *Journal of the Society of Architectural Historians*, *New German Critique*, *Harvard Design Magazine*, *Log*, *e-flux*, *Grey Room*, *Journal of Design History*, and *Centropa*. She is currently at work on a new book that explores nineteenth-century architectures of bureaucracy from the Kew Herbarium to the Larkin Administration Building. Çelik Alexander is a member of the Aggregate Architectural History Collaborative and an editor of the MIT Press journal *Grey Room*.

→ Drawing Circles

What kind of knowledge is produced at a design school? This talk inquires into the late-nineteenth century German context out of which schools such as the Bauhaus emerged in an attempt to make sense of the epistemological ideals still pursued in design schools today. The Bauhaus here appears less as the beginning of a modernity and more as the last manifestation of an epistemological project that was marked by faith in non-propositional and non-linguistic knowledge. Even though this project lost its credibility in the early twentieth century its techniques survived. Discussing these techniques as they were forged at the Bauhaus, this talk poses questions regarding the epistemological history of modern design education.

Halime Demirkan



Halime Demirkan is Professor of Architecture at the Faculty of Art, Design and Architecture, Bilkent University, Ankara. She currently is the Director of the Graduate School of Economics and Social Sciences. She holds bachelor's and master's degrees in industrial engineering and a doctoral degree in architecture from Middle East Technical University. Her previous professional experience has included appointments as research assistant and instructor in the departments of Industrial Engineering and Industrial Design, Middle East Technical University; and as a researcher at the Building Research Institute, Scientific and Technological Research Council of Turkey. Her publications include articles in various refereed journals, book chapters and papers in conference proceedings. Her current research and teaching include creativity in architectural design process, design education, and design for an aging population.

→ Learning and Knowledge Building Skills in Design Education

Learning as an interactive process is an important issue in design education. An individual's preferred method for receiving information in any learning environment is the learning style of that individual. Learning style is the most widely used concept in Experiential Learning Theory (ELT). ELT considers learning as a cycle that begins with experience, continues with reflection and later leads to action that becomes a concrete experience for reflection. In the design process, information processing and decision making is very intensive in the conceptual design phase, as a consequence of generating and evaluating alternative ideas. An epistemological and methodological approach guides the designer to capture, describe, prioritize, act and evaluate alternative design solutions. Therefore, it is important that methods and knowledge are linked in designers' cognitive strategies. With the emergence of digital technology, the design studio has changed from a studio-based learning environment to a technology enhanced active learning space. Educator's role in the application of the ELT concepts of the learning style should match with the dynamic model of teaching around the learning cycle. Considering the learning and knowledge-building skills of students in design education, the educator should not only be a conveyor of knowledge but also a facilitator, encouraging students to develop their academic and artistic skills.

Gülay Hasdoğan

→ Formulating Research Goals and Questions



Gülay Hasdoğan is a professor at METU Department of Industrial Design. After completing her PhD on the role of user modeling in design process at Central Saint Martin's College of Art and Design in London (1993), she took part in the establishment of graduate programs at the Department of Industrial Design at METU. Her research interests are research and design methods in design practice and education.

Owain Pedgley

→ Conducting Research through Design



Owain Pedgley is full Professor of Industrial Design at METU Department of Industrial Design. His academic expertise centres on design for product interaction and experience, notably within the emerging domain of materials experience. Between 2014-2017 he was a founding member of the Industrial Design programme at the University of Liverpool, UK. Owain is a strong advocate and early practitioner of academic research conducted through designing.

Peter Lloyd

→ Quality in Design Research: Tales from a Journal Editor



Peter Lloyd is Professor of Integrated Design Methodology in the Faculty of Industrial Design Engineering at Delft University of Technology. Peter is also Acting Chair of the Design Research Society, and Editor-in-Chief for the journal Design Studies. He teaches in the areas of design methods, design thinking, and design ethics and his research looks at all aspects of the design process. He was previously Professor of Design Studies at The Open University, UK and Professor of Design at the University of Brighton, UK.

Gülşen Töre Yargın

→ Communicating Design Research: Evolution of a Research Framework from a PhD to Postdoctoral Research



Gülşen Töre Yargın is an assistant professor at METU Department of Industrial Design and director of UTEST Product Usability Unit. After completing her PhD on effective communication of user research knowledge to design process, she conducted post-doctoral studies at University of Cambridge. Her current interests focus on UXR methods and education, and identifying user-centred use cases for emerging technologies.

1 Thinking Inside the Box

Alon Razgour

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The workshop will be based on teamwork. The aim of this workshop is to create productive thinking and a dynamic of innovation in the group. The workshop is aimed to create an experience of how "thinking in the box", within a groups dialogue can create unique and new ideas. In the workshop the participants will experience how thinking inside a box can develop creativity. We will take products, such as a toothbrush or a children's educational game, and learn how to develop and create innovation in those simple objects.

2 What I Watch, What I See

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“What I watch, what I see” workshop will focus on video analysis techniques through the exemplary videos of a particular experience. This workshop aims to enable design researchers to understand and interpret participants’ behaviours, needs and preferences on a specific practice, and gain insights into that user experience via video analysis. The workshop participants will reflect on what they see and observe through making interpretations to develop themes and potential design solution areas. Design researchers can make use of the techniques incorporated into the workshop for their further design research processes, especially for the video analysis phases.

3 “Encounters of a Narrative Kind”: Multi-Linear Storytelling in Design Scenarios

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Storytelling is a prominent topic in design, as design researchers and practitioners discover its effectiveness in not only communicating ideas but understanding human behaviour, motivation and interactions. An important challenge of developing an effective and valuable design scenario is to reflect the perspective of all the involved stakeholders, from the user, the producer to the bystander who may be somehow affected. With every character that is included in the narrative, the designer needs to consider their various goals which might be diverging or even conflicting with each other as their individual narratives converge. This workshop builds upon organizers' previous research on Story Intervention Method (SIM) by exploring this issue of multiple narratives, which is especially relevant to service design or any design problem where the encounter of multiple users is in question. The workshop will focus on an experience most people are familiar with, and look at the various narratives that enfold as different users and stakeholders cross paths. The participants will be asked to create narratives for different characters, envision their encounters and design interventions that lead to alternative narratives.

4 Color Research and Designing with Color

Ece Yalim

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The aim of this workshop is to shift the general tendency of designers' approach of color decision from subjective to objective. Unlike the general tendencies of seeing color application as the last touch up, designers should be encouraged to carry out color search and color application in different phases of their design process, particularly focusing on the early stages of design where the form and function of products are still in progress. This workshop is constructed in a way to make the participants experience color application in design, on a conscious level with a purpose to reach a meaningful use of color, after they are given task-related color theory information with a short lecture.

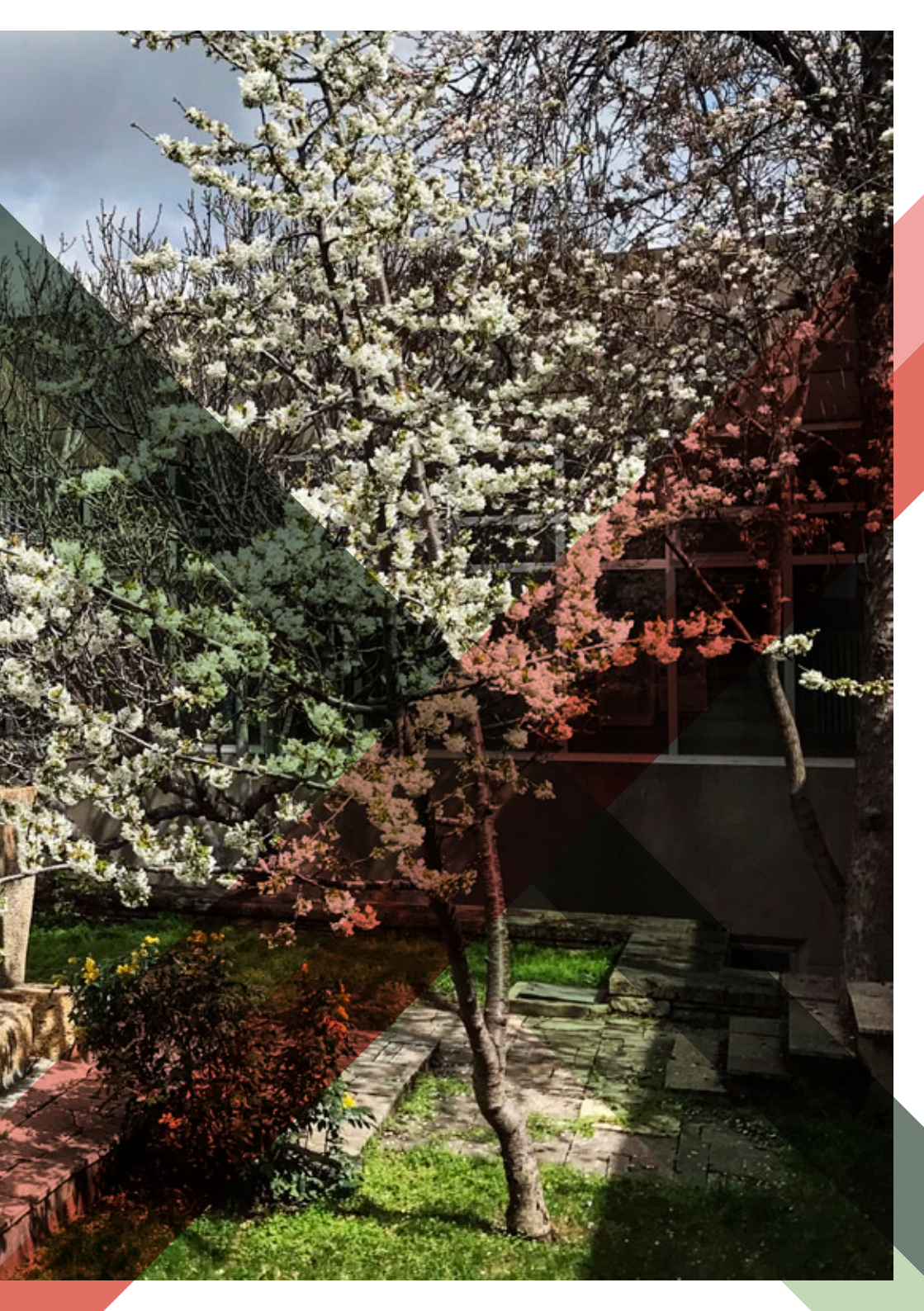
5 The Dynamic Syllabus: Participatory Practices in the Studio Classroom (Parts I & II)

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The syllabus is a primary instrument for projecting the path of a course. Traditionally, a syllabus is a multi-page, printed handout and its relative stability represents top-down pedagogy that delimits student contribution to content delivery, processes of discovery, and/or affective reflection. What if the syllabus is a means of allowing both faculty and student agency in shaping the course trajectory as it unfolds? What if the syllabus composition and application also (and intentionally) emphasizes and models open-ended design practices? What if the syllabus takes into account circumstantial and situated opportunities as a way to teach students responsiveness to ever-changing conditions? How might the form and delivery of the requisite syllabus facilitate such pedagogical values? This workshop introduces the “dynamic syllabus:” an inclusive, participatory, and situated means of building a course in real time (if not structuring curricula) using one simple tool: shared Google Sheets. The workshop demonstrates imaginative use of the workhorse spreadsheet for designing syllabi to instill in students the ability to tolerate, if not welcome, a natural but underplayed aspect of design practice: processes that are, by definition, in perpetual flux.





→ Alternative Studios

Derek Jones

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Contemporary higher design education is making increasing use of online, digital and distributed studios to augment, or even replace, physical (or proximate) studio space. In part this is due to increasing pressures on resources but it is also in response to increasing professional and practical uses of online and digital tools. Both have been enabled by developments in online technologies and their associated adoption as broader socio-technical tools. The body of scholarship and knowledge around such *alternative studios* has grown steadily but slowly over the past decades. Very often it is scholarship, small-scale projects, and case study-based work that contributes knowledge. Whilst this is valuable, especially to practitioners and teachers, it can often be at the expense of studying deeper ideas and themes. In particular, basic questions around how alternative studio pedagogy differs (if at all) from proximate studio pedagogy, are very often answered superficially or not addressed at

all. This track proposes to bring together researchers, practitioners and educators involved in alternative studios to share knowledge, cases and consider deeper themes of these as a pedagogical mode in art, design, architecture and engineering education. This will be one of the earliest gatherings of experts to focus only on alternative studios as a specific mode of design education and a further intention would be to initiate the emergence of an international community whose interests centred around this particular research area. This track would like to explore, but is not limited to, the following topics:

- Review of definitions (or frameworks) and meanings of alternative studio *spaces*, for example: proximate, physical, virtual, online, distance, social, dispersed, mobile, etc.
- Studies and work on the differences and similarities between proximate and virtual studios.

- Research into the affordances and affect in online and distance studios.
- Intersections between social media technologies and online studios.
- The boundaries of what an online studio is –technically, socially, professionally, and educationally.
- Theories of the pedagogy of alternative studios.
- Scholarship of alternative studios: case studies; learning and teaching design; practice-based theory(ies).
- Intersections between professional and educational online and distance studios – similarities, differences, modes and methods.
- Alternative studio modes and uses with a relevance to design pedagogy and practice or studio theory.

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→ Virtual Mobility and Democratization of Research and Teaching Practices

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Museums are primarily didactic institutions, and web-based education platforms bring innovative perspectives to object-oriented learning practices towards increasing the potentials of virtual mobility and democratization of research and teaching practices. New display environments also provide a medium to question the authority of museums as storages of knowledge and the authorship of producers (artists, designers, curators, etc.). This track invites designers, museum experts, historians and specialists in related fields, to seek and exchange alternative ways of sharing knowledge in e.g. museums, archives, and collections and initiate future research using the potentials of digital cultural heritage. It supports cross-disciplinary research initiatives that integrate science, design, engineering and aesthetics at the core and focuses on virtual mobility and democratization of knowledge and finds its space in museums. Professional engagement (curatorial, artistic, educational) as well as museum visits require mobil-

ity, which is highly restricted today due to various political, economic and social conditions. It is necessary to eliminate these boundaries with the establishment of shared platforms that can make the collections accessible and provide new ways of exploring and connecting knowledge and engaging with the objects. This track would like to explore, but is not limited to, the following topics:

- Web-based education platforms
- Object-oriented learning practices
- Digital cultural heritage
- Cultural techniques
- Scientific narrations
- Visualization of intellectual data
- Monopolisation of knowledge
- Exhibitions and aesthetic practices
- Digital displays
- Scenographies of knowledge
- Aesthetics of didactic objects
- Other modes of representation

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→ Rethinking Design Basics as Translation

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Starting from the historical tradition of Bauhaus, basic design can be considered as the core of design education. Basic design exercises have migrated through a variety of cultural traditions (German, Italian, Swiss, American, etc.). In these specific cultural contexts, historical models to teach design basics through a strong interaction between practical, theoretical and methodological issues in relationship with aesthetics, technology and society have been developed. We may ask if these models are still valid or whether they need to be revisited. What could be new in basic design? How can we describe new basics for the field of communication design? We suggest that communication design is facing today many levels of complexity and it demands new sensibilities and extended competencies that support *translation processes* among cultures, codes and patterns, senses, multiple languages and media. The translation paradigm, interpreted as a process of mediation, transfer and

re-transcription between different systems, can represent a new reference scheme for rethinking design basics. The same field of Translation Studies seems today to open up to possible interdisciplinary intersections that go beyond the simple textual translation and offer thematic connections of great interest. In parallel to the categories of linguistic translation we can describe the following aspects of a translation for basic design:

- Intralinguistic translation (the interpretation of signs by means of other signs of the same language);
- Intersemiotic translation (the process of transposition/transmutation between different semiotic systems, for example from verbal to visual, and from visual to sound);
- Cross-media/trans-media translation (the interactions between different media and their narrative potentialities);

- Interlinguistic translation (the mediation by design in the process of communication between different cultures, for instance through extra-textual translations).
- This grid of the design process seen as translation, can be an open matrix for a new experimental pedagogy with the goals to improve the comprehension and accessibility of the content, characterize the most appropriate form of expression for a new medium, facilitate the quality of communication in a multilingual, intercultural context, promote self-reflection, and reinforce cross-disciplinarity. This track would like to explore, but is not limited to, the following topics:
- The modernist tradition
 - The new basics
 - Structural approaches to design
 - Translation processes in design
 - Experimental pedagogy
 - Intersemiotic translation
 - Intermedial translation
 - Synaesthetic translation

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→ More-Than-Human Prototyping as Pedagogical Impugnation

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Although modernist principles (e.g. form, colour, composition, ergonomics, structural analysis, etc.) are still in widespread use in design pedagogy, they have not for some time now represented the only option. One alternative is the *anthropological turn*, often referred to as *human-centered design*, where the defining concept is that the designer is not an adequate surrogate for the user. This anthropocentric epistemology has arguably become the common, uncontested and politically correct place from which to teach and practice design. Nonetheless, as every frame of action that is taken for granted hides political and epistemological standpoints, the concept of human-centered design silently influences not just the process, but also the kinds of questions we tend to ask when practicing and teaching. This track aims to precipitate a space for critically reviewing and contesting naturalized epistemological and methodological frameworks (e.g. user-centered design, problem-

solving design). We want to dedicate special attention to the anthropocentric biases that encourage us to ignore the urgent ecological demands expressed by other-than-human beings in times of environmental crisis. Furthermore, we are also interested in the question of how critical action becomes an appropriate matter of design. Prototyping with other-than-human beings as a learning exercise, along with favouring a performative critique of anthropocentric politics, provide analytical keys to make the conceptualization of our modes of existence a matter of design, and in turn, to recognize design as a critical space to materialize unexpected and more-than-human ecologies. With this double challenge, we want to encourage participants to share experiences and reflections on design learning, where other-than-human actors significantly impact the affective and operative framework that a design classroom project produces. This track would like to explore, but is not limited to, the following topics:

- Prototyping
- Speculative research
- Cosmopolitical design
- Experimentation in design education
- Interspecies explorations
- More-than-human correspondence
- Design facing the Anthropocene
- Environmental enrichment
- Design anthropology
- Situated knowledge
- Performativity

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→ Computational Design Thinking

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The new computational design paradigm indicates a shift from representation to simulation with a special focus on creating integrated systems. Material properties, performative qualities, natural evolution and other important knowledge is being integrated into highly interdisciplinary design processes. Designer-authored generative systems enable us to conceive and manage the design process as a dynamic ecosystem rather than fragmented practices of form-finding, analysis and production. All of these developments entail transformations both in design education and practice. However, we can see an unequal pace of developments in both fields. A select group of pioneering schools and firms is pushing and developing the notion of computational design thinking, whereas a large section of both are struggling with the concept or altogether dismissing it. In schools, non-Euclidean geometries produced by the new media are embraced enthusiastically by the students, but mostly it needs to be incorporated in

an educational pedagogy. The question of how to prepare graduates as “computational designers” remains unanswered from both schools and practice. The distinction between computation and computerisation in design education is critical in this sense, since the real potential of computational design lies in its conceptualization as a way of thinking. Within this framework, this track calls for innovative and thought-provoking work around the following 5W1H questions:

1. What is computational design thinking?
2. Why is computational design thinking important in design education?
3. How is computational design thinking employed in practice and design education?
4. Where and when is computational design thinking best employed in practice and education? What does the transformed practice/curriculum look like?

5. Who is responsible for teaching and managing computational design?

This track would like to explore, but is not limited to, the following topics:

- Material-based design
- Digital fabrication
- Computational making
- Biologically inspired design through computational methods and tools
- Shape grammars
- Parametric design
- Performative design; performative architecture
- Responsive design; responsive architecture
- Coding education
- Computational thinking in the design studio

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→ Intercultural Collaboration in Design Education

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The ability to work effectively in a global environment has become essential for designers in the current workplace. Educational institutions need to nurture student skills not only from a design skills perspective that takes into consideration a broad worldview, but also from an intercultural perspective that incorporates the necessary communication skills, cultural sensitivities and flexibility. Design schools around the world have been collaborating through international events such as design workshops, summer schools, or design projects for the generation of solutions developed by intercultural student teams. Since 2014, we have been conducting the annual series of International Collaboration Workshops between Turkey and Japan. In addition to the aforementioned educational objectives, these workshops have proven to be beneficial for the instructors regarding the management of the differences in educational approaches and cultural traditions between the participating countries. It also provided the instructors with

the opportunity to conduct joint research. Furthermore, the design solutions developed by the intercultural student teams have attracted the attention of local industries. Based on these arguments and experiences, we suggest that in situ intercultural collaboration has significant benefits and implications for design education, research and practice. We expect to uncover further insights through your experiences concerning international or intercultural collaborations in design education. This track would like to explore, but is not limited to, the following topics:

- International collaboration in design education
- Intercultural design student teams
- International workshops, summer schools, projects, etc.
- Intercultural management

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→ Insider Out: Knowledge Transfer in Alternative Design Practices

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Design education mainly targets skill development and knowledge enhancement. Design information, which is used to establish design knowledge, comprises of data ranging from raw to structured. Consequently, educational practice in design aims to create and utilize these data. However, the design knowledge is usually implied, or tacit and design act is generally based on implicit utilization of this domain knowledge. The knowledge transfer is usually performed on an experience base. This experiential nature often pushes design act to a non-institutional ground. With the advancement of technology, new forms of design practice has emerged both in handicrafts and technology centred making. The emerging mind-sets and skills enabled new design practitioners and communities to appear in small-scale making, analogue and digital crafts. Therefore, new forms of experiential knowledge transfer

occur in the practice of *designers* who have not gone through a formal design education, such as craftsmen, or makers. The track aims to scrutinize this issue. Possible questions may be as follows:

- How is knowledge transfer made within these communities?
- How are the skills acquired?
- What are the alternative mediums of communication and transfer?
- What are the training programs offered?
- Can these new communities integrate with design education or practice?
- How can these emerging mind-sets and skills contribute to formal design education?
- What are the ways of transferring tacit knowledge generated and acquired by these communities to novice design students?

This track would like to explore, but is not limited to, the following topics:

- Craft communities
- Maker movement
- Knowledge transfer
- Mental models
- Training materials
- Knowledge structures
- Skill-based performance

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→ Learning for Autonomous Design

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This track is intended to address concepts, methods and practice in design education that coach students towards awareness, criticality and mindfulness of their future professional practice. In a world of rapid technological, economic and environmental change where it is possible to design and make so much, there is a need for a designer who is able to respond not just to the global market but to global circumstances. Design education is overwhelmingly defined by the instrumental role of design in the global economy, but must re-orientate towards practices of sustainability. Design communities and individuals are driving change from within and outside the traditional boundaries of design practice, but such critical approaches are marginal. This relation must be reversed. A designer is needed who can respond to global circumstances, named by Arturo Escobar as “the autonomous designer” (Escobar, 2018). Critical pedagogical methods are emerging that challenge traditional approaches embedded in design education.

Central to this is identification of new and re-configured essential knowledge for future designers. This equally involves critical engagement with implicit design values, norms and rules within design education that sustain the unsustainable. This track aims to engage dialogue across design disciplines and practices, and build on previous literature such as transition design (Gideon et al., 2015), social design (Armstrong et al., 2014), redirective practice (Fry, 2010) and design after design (Willis, 2006). Of relevance to this track are both successful and failed experiments, critical dialogue within education and industry, and the challenges inherent to capturing critical methods. While criticality may implicitly be part of some designers’ insider knowledge, it needs further elaboration and theorization to be disseminated within design education and beyond. This track would like to explore, but is not limited to, the following topics:

→ Mindfully experimental approaches to learning and designing, and how we express these.

- Methods to support learners in defining their relationship to the material world, and to build up a critical sensitivity to it.
- Supporting agency of the learner in defining their own projects.
- Developing self-awareness of the design educator.
- How to engender enthusiasm for redirecting design creativity towards the conditions of now.
- Intellectual resources: which non-design areas of knowledge are essential for future critical designers?
- Developing new skills, learning and dispositions needed to work meaningfully in the gig economy.
- How to elevate the importance of non-traditional design practices (co-design, social-change design, etc.) as desirable career paths.

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→ Designing for Social Inclusion and Public Engagement

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Public Engagement initiatives in UK higher education institutions offer one route to confronting elements of social exclusion in society. Diversity -ethnic, gender and socio-economic- in STEM and arts education and careers is low (The Warwick Commission, 2015; Archer et al., 2013), linking to low levels of social inclusion. Design-led approaches such as SMASHfestUK and the Heart and Lung Repair Shop have been recognised as successful mechanisms for engaging underserved and under-represented publics, and challenging institutional public engagement culture. The prevalence and effectiveness of design as the driver for public engagement and social inclusion development is, however, underexplored and uncertain. Design, often through the concept of design thinking (Brown & Wyatt, 2010) has been popularised as a universal approach to innovation across disciplines. Can the claimed benefits of a design approach enhance social inclusion, and develop the effectiveness of public engagement strategies and delivery?

Some initiatives are explicitly design-focused, whereas many others are carefully designed (but without acknowledgement of the discipline and approach), while others have evolved from the disciplinary heritage within which they sit. The aims of public engagement, as defined by the National Coordinating Centre for Public Engagement, are “the activity and benefits of higher education and research [that] can be shared with the public” and that can enhance inclusion in higher education (Ćulum, 2015). Across public engagement initiatives, human-centred, design-led innovations seem to be emergent. When Emi Kolawole (2016) asks that we “...consider what a human-centered approach to growing diversity and inclusion might look like”, this consideration has resonance with the emergence of design within this sector. This track aims to explore the state of the sector, and landscape in expert and diffuse design for public engagement and social inclusion (Manzini, 2015), interrogating a diverse range of perspectives about

philosophies, practices and impacts within the landscape. This track also aims to explore the understanding, prevalence and impact of design and human-centred approaches within this field. What do researchers and practitioners recognise as *design*? Whether there is recognition of design as explicit (expert) or implicit (diffuse) within these approaches? Whether diffuse or expert design lead approaches (Manzini, 2015) are considered the optimum approach within the community of practice? How are initiatives and individuals confronting embedded *feet-on-the-ground* recruitment metrics in higher education and cultural organisations? The track seeks contributions from researchers or practitioners engaged within design, design for social innovation, public engagement/public engagement with research, social policy, STEM or arts communication, and general or design education to enable a broad consideration of the state-of-the-landscape and to drive future conversation within the area and in society. This

track would like to explore, but is not limited to, the following topics:

- Design thinking
- Design for social inclusion
- Design for social justice
- Design for widening participation
- Embracing diversity
- Public engagement
- Public engagement with research (PER)
- Experience design for public engagement
- STEAM
- STEM communication
- Arts communication
- Socio-economic status
- Social policy

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→ Integrating Socially and Critically Oriented Approaches to Design Education

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Recent literature on design competences reports how design education has changed both its emphases and contexts over the last decades. As design educators, we all seem less concerned with the traditional, technical and designerly skills, than *soft skills*, which are expected to help design graduates at the job market navigate a wide range of job offerings as curators, coordinators, design thinkers, and strategists. In these roles designers collaborate with a wide range of stakeholders for a seemingly endless range of innovation problems. A common sight in design curricula are those projects that are shaped with social and political considerations: projects where design students work with communities, with schools, with local craftspersons; projects of criticality and fiction through which they inquire into todays and futures; projects where they learn to position themselves not only professionally but politically within real-world environments. Rather than considering merely to prime our students for

a more flexible job market, however, design educators are genuinely enthused by the learning opportunities that socially oriented projects offer: in teaching design students lessons in social responsibility, critical thinking, political awareness, and empathy. We are interested in papers that contribute to a discussion over possibilities of integrating socially and critically oriented pedagogies in design education. Possible topics are as follows:

- Strategies for integrating social responsibility, critical thinking, feminist epistemologies and intersectional positions, politics of dissent, etc., into design curricula.
- Use of ethnographic, generative and other design research methods in teaching for fostering awareness, reflexivity, criticality and empathy.
- Shortcomings of novel learning models or practices as currently applied in design education.

- Studies of power asymmetries within social, participatory and critical design practices in education, not least between design educators, design students and project stakeholders.

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→ Systemic Design Approach for Transdisciplinarity

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Design discipline is currently undergoing a phase of great and challenging debate, chiefly sprung by the expression and acquaintance of a reality that is intrinsically complex. This feature is still emerging and figures out the world as a sole living system. Design has to face unprecedented social, environmental, political and economical challenges with a new perspective, questioning the role it plays, its tools and methodologies. This track invites to explore how design, finding itself transdisciplinary and acting so, can face the complexity of issues, actualizing a one design act by the interplay among all disciplines. Moreover, it encourages critical reflections on how disciplinary contamination affects the design pedagogy of present and future generations of researchers and practitioners. Design studies acquire the awareness not to be a self-standing discipline anymore, taking the advance of a systemic thinking. This has been the first real contamination among knowledge and led inter

alia to the flourishing of a completely new approach to design, in meaning and doing. From this angle design moves from being solutions supplier to critical reader, with the capacity of grasping facts with an holistic point of view. The current purpose and requirement of design gets close to a social function, assuming a key responsibility in understanding how to manage complex challenges by setting networks of people and professionals to plan mesh of solutions. Systemic design embraces designers' expertise in an advanced position. Based on interconnected knowledge, spins over them to envision and draw strategies by founding relations and implementing a comprehensive cross culture. Contributions are welcomed from students, researchers and professionals from the fields of design, architecture, education, anthropology, sociology, economics, management, environmental sustainability, among others. This track would like to explore, but is not limited to, the following topics:

- Systemic design
- Holistic approach
- Founding relations
- Designer roles
- Fluid disciplinary boundaries
- Multi-Inter-Trans Disciplinarity
- Insider/Outsider knowledge
- Complex issues management
- Design to mediate
- Design to connect
- Mutual strengthening

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→ Learning from Prototypes

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Prototyping is central to design and teaching students to prototype well must be central to their education. The scope of prototyping has expanded to enabling each level of study, from undergraduate to PhD, to reify their ideas. We propose a set of topics outlined by Scaletsky et al. (2014), which include developmental, experimental and provocative prototypes. Currently, design education uses studio time for developmental prototyping; learning the process, skills and forms of production. These are useful skills, however it is only one area of prototyping currently covered in design education. There are new pressures on design educators to include topics such as new technologies, added theory, and methods that have changed studio curriculum. What have we learned from the *prototyping* class? How do we teach designers to learn from making? Can we offer the *werkbund* experience to all design students where they can produce full-scale prototypes? To paraphrase John C. Maxwell, *learn fast by failing early and often*

describes the strategy of experimental prototyping. The goals of experimental prototypes are not to create something for production, but rather to create something that embodies a theory to be explored. In the experimental type the notion of learning is more strongly bound to the observation of the user and objects in use. Theory is meant to benefit practice as generalizable knowledge that is applied to a variety of scenarios and contexts. Design students at the master's level should be well versed in the experimental form of prototyping. It is uncertain which form of prototyping comes first, experimental or provocative, but it is clear that we use the latter less often in the design process. Using prototypes as a form of brain-storming can help explore new behaviours, challenge presumptions, and offer new approaches to old ways of doing things. Provocative prototypes do not attempt to refine or address research questions but rather challenge people to think in novel or interesting ways. Prototypes are more important to the design

process in all forms of design and often underutilized as a way of thinking about design problems. The subject is broad enough for new designers to learn more about their function and to be expanded further by many design researchers. This track would like to explore, but is not limited to, the following topics:

- Developmental - Production prototyping.
- Experimental - Prototype as thought experiment.
- Provocative - Prototype as idea generator.
- Prototypes are central to design - Design education starting with prototyping.
- Boundary objects - Prototyping consensus, collaboration.
- Large format prototypes - Systems designing for scale and complexity.
- Evaluation and analysis of prototypes.
- The dark side of prototyping - Catastrophic failure, fixation, and other prototyping problems.
- New tech beyond the rapid - High and low fidelity, functionality, add-on features.
- Types of prototypes - Aesthetic, functional, structural, alpha-beta-gold standard.
- Observing users - Prototype testing.

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→ Bringing User Experience (UX) Agenda into Design Education

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The rapid technologisation of the work, leisure and educational aspects of everyday life imposes a change in the design practice from object-focused towards a more comprehensive, experiential approach to designed artefacts. The reflection of these transformations on both academia and industry has recently brought about an interest in integration of UX knowledge and skills into the educational programs. Although different fields of design and technology pose varying approaches, we find it vital to develop a multi-faceted yet common educational agenda in order to secure a meaningful position for design students in their upcoming professional lives. Current professional practice of UX shows a strong tendency towards methods and skills relevant to screen-based interaction; all the same, the academia sustains a theoretical interest in instrumental or non-instrumental aspects of the user experience. Focusing on the design of meaningful interactions for users as the major premise of the experiential approach well aligns

with the conventions of design education, especially the user-centred design perspective. Although having roots in ergonomics and human factors, user-centred approach in design education has been evolving into an awareness of user contexts, and designing for positive, holistic user experiences. The relevance of the UX process and methods for design education is also evident in recent publications reporting on local, institutional and independent efforts to equip the students with such emerging requirements of the professional life. From this point of view, we aim to create a space for dialogue between design educators and researchers who are interested in integrating UX awareness and skills into design education. We welcome contributions sharing teaching experiences as well as theoretical work aiming at bringing the UX agenda into design curriculum, hence preparing future designers and researchers for the emerging demand in design and technology industry. This track would like to

explore, but is not limited to, the following topics:

- Theoretical models for the integration of UX theory and methods into design education.
- Methods developed to familiarise students with UX awareness, tools and skills.
- Equipping design students with technical UX knowledge and skills.
- State-of-the-art examples of applied user research in design education.
- Hands-on experiences in integrating user experience factors into student design projects.
- Contextual design practices in design education.
- Practices of teaching design for special user groups and needs.
- Collaborations with UX industry in educational projects.
- Multidisciplinary collaborations in student UX projects.

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→ Design Education for Sustainability: New Directions and Dimensions through Innovative Methods and Research

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Design considerations focusing on the diverse aspects of sustainability have become a key source of drive for design education, which would include the development of design solutions in line with local needs and preferences, localization and personalization, open design and maker culture in relation to sustainability, enabling maintenance, repair and upgrade, design for behaviour change, and effective use of resources. To better address and reflect on these considerations, design educators and researchers could incorporate various tools and methods into the design process, aiming to equip design students with the knowledge and skills related to design for sustainability and help them better understand and internalize sustainability considerations at the early stages of idea generation. Through critical discussion and reflection, and the employment of the innovative and generative tools and methods, design education projects could be effectively tailored to the principles of sustainability. The following items

would be suitable to cover as topics under this track, and the list can serve as a guide to those interested in contributing to this track with a paper:

- Design education
- Sustainability considerations
- Generative design research
- Exploratory design for sustainability
- Design process
- Localization and personalization
- Post-use
- Maker culture
- Open design
- Effective use of resources
- Design for behaviour change
- Circular economy

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→ Design Materialization

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The transition from ideas and concepts held in the designer's mind or on paper into physically achievable artefacts describes a process of *materialization*. The prevailing approach to materialization has been a staged and rather engineering-dominated process, involving material elimination and selection using material database metrics allied to material family knowledge. Design educators have often complied with this approach for lack of resources or methods defining alternative ways of teaching and learning materials. The currently developing situation is rather different and more exciting. Materials of today are more dynamic, expressive and adaptable than ever. They make us think, feel, and act in complex ways. Research and case studies on *materials experience* have grown significantly in recent years. Broadly, this body of work is (a) defining how the practices of material *selection* are evolving into more complex and active events during material *creation* and *appropriation*, and (b) establishing the knowledge

and skills needed to use materials as an influencer of people's experiences of the designed world. Materialization crucially attends not only to performative but also experiential requirements of artefacts. Introducing design students to this duality and defining confident, creative, engaging and effective ways for its teaching and learning is a major responsibility and challenge for design educators. Traditional approaches no longer adequately deliver. This track invites contributions from educators using, adapting or creating contemporary methods to teach materials and design. Industrial, product and fashion design perspectives are obvious candidates, but submissions are also encouraged from interaction design perspectives, concerned with the physicality of user interfaces, as well as educational practices within interior design, architecture and the built environment. Of particular interest are submissions focused on teaching and learning of NEU (new, emerging, unusual) and ICS (interactive, connected, smart) materials,

especially when exemplified through student projects and coursework. The track would like to explore, but is not limited to, the following topics:

- Material driven design projects
 - The material studio versus the material lecture
 - Integrating fab-labs and 3D printing in design curricula
 - Relevance of *making* and *workshops* in contemporary design education
 - DIY materials, material tinkering and material design
 - Active learning for materials and design
- Educational exercises to learn materials and design
 - Tools and methods for acquiring materials experience
 - Material resources for design students
 - Materialization in the absence of materials

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→ Learning Spaces

This track is open to topics related to learning spaces such as learning in situ, learning through collections, etc.

LEARNING IN SITU. Factories, design offices, workshops, labs, nature. Benefits, challenges, and ways of integrating learning in situ into designers' education. Learning at the work space; summer practices in factories and design offices; impact on curriculum. Onsite observations, field trips, field study.

LEARNING THROUGH COLLECTIONS. Museums, design museums, archives, special collections, exhibitions. Are they still valuable? Connecting generations and inspiring minds through collections. Approaches, methods, tool kits, assignments that facilitate engagement, reflection and creativity with reference to collections in design education.

OTHER TOPICS you would like to suggest.

→ Learning Cultures

This track is open to topics related to learning cultures such as hidden curriculum in design, the "project", tutors and critiques, teamwork, etc.

HIDDEN CURRICULUM IN DESIGN EDUCATION. Values, norms, beliefs, implicit rules, customs and rituals. Geographical and institutional patterns. Changing écoles around the world, changes in écoles throughout history. Proficiency, skills, knowledge.

THE "PROJECT". The studio project as "the curriculum in a nutshell". Projects and design briefs, what do they tell us about the design education we offer/receive? What happens

while we are busy making projects? Problem-based learning.

TUTORS AND CRITIQUES. How do tutors facilitate, listen and intervene? Power relations, master-apprentice relationship, alternative models. Questions and challenges posed by mass education.

TEAMWORK. Dialogue, discussion, decision making, conflicts, crises, performance, evaluation. Consensus and dissensus. How can we get ready?

OTHER TOPICS you would like to suggest.

→ Evolving Skill Sets and Mind Sets

This track is open to topics related to evolving skill sets and mind sets such as design education and intellectual property, etc.

DESIGN EDUCATION AND INTELLECTUAL PROPERTY. Educational design projects as intellectual resource; students, tutors and educational institutions as right holders;

the use of IP resources in teaching design history and design management; alternative IP management approaches in design education; intellectual property and collaboration with external partners in design education.

OTHER TOPICS you would like to suggest.

→ 09.07.2019 Tue

08:30	Registration		
09:00	Welcome Speech Introduction to PhD Pit-Stop → Hall A		
09:20	Short Lecture Gülay Hasdoğan Formulating Research Goals and Questions → Hall A		
09:50	PhD Researcher Presentations → Hall A	Workshop 1 Thinking Inside the Box Alon Razgour → Hall H	Workshop 2 What I Watch, What I See Senem Turhan, Çağla Doğan → Hall E
10:50	Tea & Coffee		
11:05	PhD Researcher Presentations → Hall A		
12:00	Short Lecture Owain Pedgley Conducting Research Through Design → Hall A		
12:30	Lunch		
13:30	Short Lecture Peter Lloyd Quality in Design Research: Tales from a Journal Editor → Hall A	Workshop 1 cont'd Thinking Inside the Box Alon Razgour → Hall H	Workshop 3 Encounters of a Narrative Kind Dalsu Özgen Koçyıldırım, Yekta Bakırlioğlu, Aykut Coşkun → Hall E
14:00	PhD Pit-Stop Workshop → Hall C		
15:00	Tea & Coffee		
15:15	PhD Pit-Stop Workshop → Hall C		
16:15	Short Lecture Gülşen Töre Yargın Communicating Design Research: Evolution of a Research Framework from a Phd to Postdoctoral Research → Hall A		
18:30	Welcome Reception		
21:00	PhD Pit-Stop Party		

→ 10.07.2019 Wed

08:30 Registrations

09:00 **Welcome and Opening Speeches**

→ Kemal Kurdaş Hall

09:20 Paper Session 1
Insider Out: Knowledge Transfer in Alternative Design Practices
069, 122, 124
→ Hall A

Paper Session 2
Evolving Skill Sets and Mind Sets
021, 102, 123
→ Hall B

Workshop 4
Designing with Color
Ece Yalim
→ Faculty of Architecture Studio 27

10:35 Tea & Coffee

10:50 Paper Session 3
Insider Out: Knowledge Transfer in Alternative Design Practices
006, 016, 113, 127
→ Hall A

Paper Session 4
Design Education for Sustainability
027, 091, 117, 107
→ Hall B

12:30 Lunch

13:30 **Keynote 1 Gabriela Goldschmidt**
Disciplinary Knowledge and the Design Space
→ Kemal Kurdaş Hall

14:30 Tea & Coffee

14:45 Paper Session 5
Learning Cultures
130, 005
→ Hall A

Paper Session 6
Design Education for Sustainability
003, 017
→ Hall B

Paper Session 7
Systemic Design Approach for Transdisciplinarity
039, 064
→ Hall D

Workshop 5 - Part 1
The Dynamic Syllabus
Denise Gonzales Crisp,
Nida Abdullah
→ Hall C

15:35 Tea & Coffee

15:50 Paper Session 8
Learning Cultures
011, 095
→ Hall A

Paper Session 9
More-than-Human Prototyping as Pedagogical Impugnation
024, 114
→ Hall B

Paper Session 10
Systemic Design Approach for Transdisciplinarity
077, 100
→ Hall D

17:00 Social Event at City Centre

→ 11.07.2019 Thu

09:00

Paper Session 11
Alternative Studios
028, 079, 082, 083, 089
→ Hall A

Paper Session 12
Rethinking Design Basics as Translation
075, 081, 084, 109, 019
→ Hall B

Paper Session 13
Learning From Prototypes
026, 034, 038, 060, 119
→ Hall D

11:05

Tea & Coffee

11:20

Paper Session 14
Learning Cultures
022, 025, 106, 118
→ Hall A

Paper Session 15
Integrating Socially and Critically Oriented Approaches to Design Education
007, 029, 040, 098
→ Hall B

Paper Session 16
Design Materialization
032, 033, 037, 094
→ Hall D

13:00

Lunch

13:30

Keynote 2 Zeynep Çelik Alexander
Drawing Circles
→ Kemal Kurdaş Hall

14:30

Tea & Coffee

14:45

Paper Session 17
Alternative Studios
062, 063
→ Hall A

Paper Session 18
Integrating Socially and Critically Oriented Approaches to Design Education
043, 046
→ Hall B

Paper Session 19
Design Materialization
087, 078
→ Hall D

Workshop 5 - Part 2
The Dynamic Syllabus
Denise Gonzales Crisp,
Nida Abdullah
→ Hall C

15:35

Tea & Coffee

15:50

Paper Session 20
Alternative Studios
071, 104
→ Hall A

Workshop Presentations 01
WS1, WS2
→ Hall B

19:00

Conference Dinner

→ 12.07.2019 Fri

09:00	Paper Session 21 Designing for Social Inclusion and Public Engagement 058, 090, 110, 121 → Hall A	Paper Session 22 Learning From Prototypes 020, 066, 076, 088, 115 → Hall B	Paper Session 23 Bringing User Experience (UX) Agenda into Design Education 010, 013, 015, 059, 129 → Hall D
11:05	Tea & Coffee		
11:20	Paper Session 24 Learning for Autonomous Design 004, 072, 086, 126 → Hall A	Paper Session 25 Learning Cultures 045, 061, 125, 128 → Hall B	Workshop Presentations 02 WS3, WS4, WS5 → Hall D
13:00	Lunch		
13:30	Keynote 3 Halime Demirkan Learning and Knowledge Building Skills in Design Education → Kemal Kurdaş Hall		
14:30	Tea & Coffee		
14:45	Paper Session 26 Intercultural Collaboration in Design Education 018, 031 → Hall A	Paper Session 27 Computational Design Thinking 012, 048 → Hall B	
15:35	Panel Design Pedagogy for Future Generations İpek Akpınar, Aykut Coşkun, Emre Çağlar, Derek Jones (Moderator), Stanley Ruecker, Yasuko Takayama → Kemal Kurdaş Hall		
16:50	Closing Speech → Kemal Kurdaş Hall		
17:30	Farewell Drinks		





069 Learning Fashion Outside Academia: From Sewing Circles to Maker Spaces

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In the current state of fashion, industry and educational institutions are challenged by digital technologies and the ways that they disrupt traditional practical and designerly skills. New design tools including 3D modelling, coding and electronics are not currently covered in the context of a formalized fashion design education. However, maker communities and maker spaces that are dedicated to fashion and textile production and innovation, provide alternative learning environments for self-made designers with skills beyond traditional clothing development. The aim of this research is to explore current maker spaces and maker communities related to fashion and textiles outside the formal education institutions including the skills acquired, methods and tools used, the training programs offered and the dynamics of knowledge transfer within these communities by a critical analysis of the literature. The study reflects on the processes of learning in maker communities and maker spaces in comparison to formal fashion design education offered in higher educational institutions, exploring the potential implications for future of fashion design education.

Keywords: fashion; maker movement; learning; digital fabrication; maker spaces

122 A Design Course for Craftspeople in Istanbul

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This paper aims to present a design course conducted for craftspeople at İSMEK, an adult education organisation in Istanbul, Turkey. The aim of the twelve week long program was to introduce novel perspectives in design by instructing fundamental issues about design methods, providing critical inputs and mentorships through the design processes. The participants did not have a background in design education, had a mastery in a particular area in crafts, and were already tutors in their own field. Thus, the aim of the design course was to enhance a broader look at the existing processes in craft making by supporting the participants to experiment and create novel interpretations of traditional crafts. As a unique example of designer-craftsmen collaboration, this design course is introduced in this paper with its background, context, structure and outputs in order to discuss its possible contributions to prospective studies.

Keywords: design course; design and craft relation; innovative craft products; lifelong learning; craftspeople

124 Education, Motivation, Maker Practice: The Case of Woodworking

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Maker movements arose with a democratisation of technology and outspreading of a culture of sharing knowledge. Makers are involved in every step of creation and distribution of the items they make: ideation, production and selling. For production, both traditional and digital techniques are used by makers. Woodworking, which appears as one of the most common practices performed by makers, has a material-oriented skill knowledge which is mostly based on personal experience. Makers from different educational and professional backgrounds are able to acquire the tacit knowledge for woodworking via easily accessible printed and online resources. Besides, their relationship with craftsmen and customers act as other means of knowledge transfer. The aim of this study is to examine the tacit knowledge acquired and used by makers, the effects of makers' educational backgrounds and motivations on knowledge transfer and product ranges produced. In order to do so, 24 makers dealing with woodworking were interviewed.

Keywords: maker movement; woodworking; tacit knowledge; knowledge transfer

021 Exploring the Ongoing Diversity Issues Embedded in Product Design

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The Fourth Industrial Revolution offers great opportunities and challenges to the UK design economy. The emphasis on communication and connectivity, together with new disciplines and new markets derived from technological, political and social change, makes it all the more crucial that the future design industry is infused with a wide range of skills, experience and perspectives. Lack of diversity is hindering that process, and this is especially true in product and industrial design – an industry which is 95% male with no measurable black contingent, according to current figures. Focusing on gender imbalance and opportunities for black, Asian and minority ethnic (BAME) designers, this paper explores some of the issues surrounding diversity and inclusion in product design. Using data drawn from a survey of BA/BSc students from Bournemouth University's Product Design programme, together with academic records from the past five years, the authors investigate some worrying and enlightening trends amongst young designers in higher education. Drawing on the views of previous research and current professional practitioners, the potential causes behind the diversity deficit are explored, along with the methods that some companies are using to try to help build a more inclusive cohort of UK product designers for the future design economy.

Keywords: diversity; gender; ethnicity; product design; higher education

102 Reimagining the Future of Design Education: Nurturing Mindsets and Skillsets in Students

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This paper reveals the outcomes of an investigation to develop a radical manifesto for the future of creative design and media higher education. The result was the development of a manifesto (Mindsets and Skillsets) that sought to profoundly redefine how creative design and media education could be delivered. At its heart, the manifesto attempts to create the optimum environment for students to thrive in education, careers and through life. Ravensbourne University began a review of its portfolio of courses and academic delivery in May 2016. This provided a unique opportunity to evaluate the existing programme delivery philosophy along with the practices and models of a range of international creative educational contexts, and to review relevant literature and practice. Using a combination of the *Double Diamond* design-thinking approach and a *grounded theory-light* research methodology this study gathered data from international college visits, pedagogic conferences, literature reviews around student learning, delivery modes and learning spaces, and a hosted symposium anchored by an international educational panel and a creative industries professional panel. The five resulting principles emerged from the analysis of the data and materials were identified as: Cultivate / where the whole person thrives; Collaborate / where disciplines evolve; Integrate / where education engages industry; Advocate / where purpose informs practice; and Originate / where creativity harnesses technology. This paper attempts to position the Mindsets and Skillsets Manifesto as a visionary, pragmatic and deliverable new model of creative higher education.

Keywords: interdisciplinarity; transdisciplinarity; pedagogy; thriving; creative higher education

123 Repurposing Online Videos for Exploratory Design Research

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This paper presents the development of a generative toolkit which utilizes user-generated online videos (UGVs) as found data and repurposes them for exploratory design research and idea generation. The toolkit aims at supporting design students to browse, select and analyse UGVs for generating design insights and ideas for unfamiliar problem domains and hard-to-access user groups. The toolkit development process started with a retrospective analysis of a selection of industrial design studio projects followed by interviews with the students and the tutors involved. An initial model was developed and used in a 5-week design studio project taken by 75 senior year industrial design students. Based upon the findings of these studies, the revised toolkit was implemented in a half-day crash workshop involving a small number of participants. During the workshop, the participants were provided with a concise literature review regarding a specific design project topic, a YouTube playlist of related videos, the video analysis board samples from previous studies, and the video analysis board templates for different analysis modes. Since the toolkit puts a special emphasis on unfamiliar domains and challenging user groups, the workshop also involved the assistance of an external expert during the video reviewing process. Through the UGVs the participants were able to immerse themselves into the subject and get familiar with the problem domain rapidly. The components of the toolkit such as video analysis samples and templates were also used as guidelines to interpret UGVs. The expert was directly involved in the video reviewing process, and made clarifications and remarks concerning the participants' questions and comments for gaining insights. The paper reports the outcome and findings of this half-day workshop and discusses the key insights for further developing the toolkit.

Keywords: exploratory design research; idea generation; user-generated videos; unfamiliar problem domains; design education

006 Teaching (with) Empathy and Creativity in Design

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Empathy and creativity are desirable core design competencies. The relationship between these concepts, however, has remained largely unexplored – including how this relationship shapes, and is shaped by, design education. This work unfolds the creases between empathy and creativity, identifies their synergies and contradictions in design education, and defines a research programme to improve the teaching of and with creative and empathic dispositions. A comprehensive research programme for the advancement of empathy and creativity in design requires diverse and highly inventive approaches to design knowledge. Design researchers are encouraged to draw from their professional and personal areas of expertise to formulate new research questions that connect empathy and creativity, and to adopt and adapt methods of inquiry to study these connections.

Keywords: design education; ethics; collaborative design

016 Upside Down: A Flipped Design Thinking Course

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In constructivist learning, learners are responsible for their own learning process in order to acquire specific professional and personal skills. Constructivist learning methods based on prior knowledge of the learner and learning objects (LOs) of the constructivist approach are the conductors and activators of learners' insider knowledge. In such a learning approach, the planning of effective learning needs to be questioned and restructured. The use of LOs in learning planning is of great importance in encouraging learners to be self-learners. This paper presents a case study conducted in an interdisciplinary Design Thinking course conducted with 16 students, one instructor, and one researcher in a Department of Industrial Design. The case study aims to explore the efficiency of flipped classroom in course planning, information transfer, process management, and student motivation and participation. This explorative case study included three projects during the semester, focusing on the use of LOs in alternative ways depending on the learning process. Three different models were experimented with for the delivery and usage of LOs. These models were compared and evaluated by facilitators' observation and reflection, as well as students' reflection and feedback.

Keywords: design thinking; learning objects; flipped classroom

113 Participatory Design Methodology in Design Competition Practice

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More and more companies are trying various external design resources to meet their innovation needs. For example, design competitions can bring many innovative design ideas to enterprises, but leading, managing, and assessing innovation from a design competition is difficult for an enterprise and there are limited reference materials and research available on the topic to help enterprises take full advantage of this resource. By studying the Thermaltake Creative Design Competition for six years and combining a literature review, empirical research, and interviews, the authors of this paper explore how to use design competitions as an effective resource for commercial design research and innovative concept exploration. The findings indicate that: 1) The company, using participatory design methodology to manage design competitions, needs to have sufficient R&D ability to assist the organiser and contestants to execute their objectives; 2) the subject of the competition and the consumer needs should be defined and transferred clearly to the contestants by the instruction or presentation at beginning; 3) a design seminar is a helpful co-design process, which allows the organiser and participants to work on design together; 4) mutual benefit is important in participatory design competitions, for example, while the company explores innovative design concepts through the competition, the entrants earn design practice and design cooperation. This study puts forward some practical and theoretical findings in the field of innovation management, which can be a reference for enterprises to use design competitions as an effective innovation design method.

Keywords: design competition; design methods; participatory design; design management

127 Representation and Context Based Studio Design Process: Articulating a City (Istanbul)

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In architectural education, imparting of stationary knowledge, which establishes space only as physically, is insufficient to achieve the skill that will enable the architect to find solutions to problems encountered in the future. In this case, to perceive space both tangibly and intangibly, a trans-disciplinary milieu is required to acquire derivable knowledge and create a setting of debate and criticism over that acquired knowledge. What might be methods and approaches that can stimulate and re-shape thought, encourage curiosity to acquire creative and critical knowledge in the architectural design studio? How can new experiences and perceptions of the city be reflected in architectural milieu? How are the experiences and outputs produced by different types of representations in the studio? To what extent can a contextual reading trigger the architectural scenario and program? In the light of the above-mentioned questions, this study focuses on the relations of the design studio with the city, the people, the place and everyday life, and, it unveils everyday life by the setting up of contextual readings and representations. It discusses the role of the design studio in understanding the place, the people as a social phenomenon and the reciprocal relationship of space with everyday life through the milieu of the Architectural Design Studios 3-4-5-6 at Istanbul Technical University, Department of Architecture. It is expected that the student's own journey and experience, rather than the de facto assumptions, are highlighted by grasping the information of place/city at different scales and disassembling (de-composition and re-composition) of existing knowledge. In this respect, different scales and approaches set the design strategy of the studio and direct the design. The study gives a brief theoretical background focusing on the relations of architecture with the city. Secondly, it discusses architectural studio as a platform of representations and narratives for the city and the people. Thirdly, and finally, it gives concluding remarks. Although the results are provisional, this study may give a broader understanding of the relations of the city, the people and the design studio.

Keywords: architectural design studio; context; experience; everyday life; architectural education

027 Behavioural Change for Efficient Usage of Electricity at Homes

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Electricity is not visible or tangible yet always available in our houses. The only way users can keep track of electricity consumption is to look at meters or monthly bills. Energy-monitoring systems promise to help users to understand their consumption by visualizing and displaying the consumption data in a meaningful way. However, they are not successful in changing users' behaviours and sustaining their intentions. The current paper presents a suggestion to promote behavioural change by adopting Diffusion of Innovation (DOI) Theory to stratify the target user groups and apply user-centred design approach when developing a prototype of conceptual electricity monitoring system. Initially, users' awareness and knowledge levels were measured by a questionnaire identifying and stratifying the target groups who were interested in saving energy in their homes. For one of these groups who are ready to act on an opinion, users' electricity usage behaviour and their intentions were captured and detailed through interviews. The resulting information was used to develop a series of criteria to design a conceptual electricity monitoring system. The study proposes a case in which DOI stratification of target users may have a potential for behavioural change.

Keywords: behavioural change; product design; diffusion of innovation; design process; electricity monitoring

091 Self-Organization for Design Education: a Sustainable Flocking System

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Scientists have discovered the efficiency and elegance of systems found in the behaviour of natural groups, one of which is self-organization and flocking. Many researchers have studied and applied self-organization in business management but it is yet to be addressed in the design education field in Egypt. Design students are reliant on the teacher's input, which limits their independent decision-making and development. This study aims at introducing self-organization to groups of students in Egypt to enhance learning outcomes. A system was developed based on flocking to enable better team work experiences between design students. The system is based on using two positive and one negative feedback loops. An experimental method tested the proposed system on two groups of design students, backed up by semi-structured interviews and a survey to compare previous experiences with the new model. It was found that self-organization enabled students to interact with each other to create innovative designs with an improved general experience, group dynamic, and project structure. A method of rotatory leadership was also identified. By implementing self-organization and the system of flocking, teams can become more agile and therefore, succeed and sustain.

Keywords: self-organization; design education; flocking; systems thinking

117 Integrating Repair into Product Design Education: Insights on Repair, Design and Sustainability

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With the pressure of growing environmental problems, the world is changing and so is the paradigm of design. Accordingly, the calls for change in design education have been increasing throughout the literature day by day. As the designers of the future, students must be prepared for alternative scenarios. This article describes an assignment which is a part of the master's degree design course at Linköping University. In this project, repair is integrated into product design education aiming to explore insights about repair and sustainability. The requirement of the assignment for each student was to visibly repair one or more products in an aesthetically pleasing way by using different design perspectives such as artistic, industrial and critical perspectives. In the end, the students have repaired fifteen different types of products including a bicycle, leggings and a motorcycle part. Aiming to find out the insights of this process and articulate each students' views, a focus group session was conducted. As a result of this focus group session, fifteen insights were developed such as the concepts of brokenness, designed repair and the collaboration/social aspect. All these insights emphasize the richness of the repair as a subject area and how it can be used in product design education to teach sustainability principles. Repair is an inevitable part of a product's life and it should be understood and applied to its maximum extent if we are to transition to a circular economy. The value of this research for academics and researchers is in providing a case of incorporating repair into product design education. For design practice, its value lies in showing concrete examples as well as insights from diverse repair processes.

Keywords: repair; product design; circular economy; design education

107 How Industrial Design Students Approach Service Design Projects

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This paper aims to investigate the ways industrial design students approach service design projects. Taking the unique aspects of services compared to products into account, first, the notion of the studio project was discussed from a service design perspective. The elements of service design projects were articulated as the offering; the modules and interfaces; and the suppliers, customers, and resources. Then, using an undergraduate service design elective course as a case, a thematic account of nine student projects was developed. Four design strategies utilized by industrial design students in their service design project development efforts were inductively identified: replacing a product with a service idea; reconceptualising an existing service in a local context; expanding the scope of a professional service through digital channels; and changing the target user group of an existing service and redesigning the customer journey. These strategies were distinguished by the locus element of the projects and the amount of iteration that took place between the three project elements. The results show that the design strategy followed, impacts the degree of novelty of the proposed service. Consequently, for successful service design projects, students and design teams need to combine different methods to visually manifest the parameters and limits of the service, decide on the locus project element that will guide the design process, and continuously explore and seize new ideas that emerge from the interactions between the different project elements.

Keywords: design strategy; industrial design; service design; studio projects; teaching and learning

130 Application of QFD and AHP in Curriculum Planning of Industrial Design Education

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Industrial design is to formulate innovation, promote business success, and hence to offer a better life. It is a design activity that applies strategic process of problem solving in the design of products, systems, services and experiences. It is interdisciplinary, and should be coordinated with the needs of the enterprise due to the development of times. However, it lacks a scientific method in the process of curriculum planning, causing professional competencies of graduates failing to meet with company expectations. From industrial and academic perspectives, the requirements for industrial designing talents are listed. By Analytic Hierarchy Process (AHP), we can acquire the ratings of professional competencies, and analyse them into the professional capabilities that should be mostly addressed in curriculum planning. The use of the AHP method establishes decision-making patterns in a reasonable manner, making complex problems systematic, by decomposing into levels. Also, by means of quantification, the weight of importance degree concerning expertise of industrial design is obtained and sequenced, facilitating the process of curriculum planning in terms of identification of expertise favourable to students. Lastly, QFD is applied to the planning of industrial design curriculums that comply with the requirements of enterprise and society development, bringing forward the courses and disciplines which should be strengthened and attached with great importance among students in current industrial design curriculums. Such research is favourable to the promotion of conformance in curriculum planning with actual needs, enabling actual utilization of school lectures, meanwhile offering a scientific technique for education curriculum reforms.

Keywords: industrial design; curriculum planning; quality function deployment (QFD); analytic hierarchy process (AHP); scientificity

005 Qualities of Design Briefs for Studio Learning

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The design brief is considered a pivotal component in studio-based learning, yet there is a paucity of studies on the student brief genre in design education research. This work seeks to contribute by examining brief qualities from a variety of relevant sources that can help tertiary educators name, define, frame, evaluate, and present student briefs. The paper draws from the scant but growing academic literature on this topic, as well as from textbooks and publications on professional practice and design competitions. A dozen qualities are articulated from the literature that shape the purpose, content and context of briefs. Of special interest are the affective qualities of briefs, the interplay between project outcomes, learning objectives and assessment criteria, and the degree to which student briefs are execution dependent. A research agenda concludes the paper to comprehensively study the effects of design briefs in studio-based learning.

Keywords: problem space; design projects; design tasks; reflective practice

003 Using Problem-Based Learning in Sustainable Design Education

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This study investigates whether problem-based learning (PBL) can further enhance interior design students' sustainability learning. It compares the learning environment of a conventional lecture-based approach and PBL in sustainable design education. This study differs from the existing design literature on sustainable design education in that; (i) it implements PBL into interior design education to overcome the limitations of sustainability teaching in a conventional lecture-based instruction, and (ii) it proposes a new way of organising classes based on learner-centric features of PBL to increase student awareness toward sustainability. To achieve these two aspects, the two instructional modes of learning were applied during the two years of a sustainability module. In the first year, sustainability has been taught in a conventional lecture-based environment, and in the second year, in a PBL environment. It is possible to conclude that different than the other design topics, sustainability teaching and problem solving require a more learner-centric approach rather than an instructor-centric instruction to further enhance critical solving abilities of design students. Moreover, sustainability learning in the PBL setting is more effective when compared with the learning outcomes in the conventional lecture-based setting.

Keywords: problem-based learning (PBL); sustainability; learner-centric; interior design

017 Asking the Industry Partners: Reflecting on the Value of Internships for Circular Design

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As part of Circular Design: Learning for Innovative Design for Sustainability (L4IDS) Erasmus+ Knowledge Alliance project, a series of internships were conducted in collaboration with local industry partners and interns from four different European countries. The aim of these internships is to develop an adaptable training programme focusing on design for sustainability and circular economy with standardised educational tools and techniques, which can be replicated by other European HEIs. The internship projects were focused on local industry partners' real-life challenges at the time, and industry partners, interns and researcher/educators facilitating the collaboration throughout the programme. While the immediate feedback upon the completion of the internships was generally positive, as authors we were interested in long-term effects of this experience on industry partners' professional practices. This paper introduces the internship programme and industry partners' involvement throughout it and presents the results of interviews with key contacts from each industry partner conducted a year after the internship ended to uncover what/if any changes occurred in practice. The paper presents some considerations on developing the structure of an internship programme on sustainability, ways of collaboration among industry partners, novice designers and universities, observed and potential effects on business practices, and limitations in implementation.

Keywords: design education; industry collaboration; knowledge exchange; design for sustainability; capacity building

039 Visualisation Method Toolkit: A Shared Vocabulary to Face Complexity

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With companies, universities, individuals or entire departments, promoting open dialogue, constant interdisciplinary collaboration is a challenge that still meets some resistance. Learning to deal with complexity, with the coexistence of different points of view, learning to work in more heterogeneous teams, in relation to know-how combined in new, sometimes original and challenging formulations, brings particular needs. From the importance of language and a shared vocabulary to the ever-increasing need to work on tools and not just applications, from the constant promotion of collaboration and contamination between different backgrounds and disciplines to the guarantee of a continuous training process through laboratory activities and workshop, this contribution - through the Visualisation Method Toolkit project and its experimentation - investigates the potential of data visualization as a medium to bring design closer to a company's core business as well as support students, institutions and other organizations in communication, both in the analysis and/or scenario phase and in support of dissemination actions towards a more informed quantitative/qualitative collective decision making with the aim of enabling new innovative and sustainable good practices.

Keywords: data visualisation; workshop; toolkit, communication; sustainability

064 Transdisciplinary Knowledge: A Systemic Approach to Design Education

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Historically, the design discipline has been strictly connected to the productive sector. For this reason, design education was mainly related to the world of arts and crafts and technology. With such a vertical specialization, designers could not deeply grasp the potential repercussions of their design choices. Their commitment was largely tied in with mass-production and unconstrained technological innovation. Increased awareness of the complexity of the world has risen in recent decades. Designers nowadays are requested to achieve new transversal skills and competencies, to cope with the incumbent metamorphoses of cultures, societies, economies, and natural environments. Thus, a linear mono-disciplinary outlook is no longer adequate in design pedagogy. Educators need to embrace a holistic approach and to activate new collaborations, to train experts capable of configuring and managing complex design activities. This paper analyses the rise of systemic thinking and its influences on design studies, with an overview of geographical and temporal contributions. It invites reflection on the role of present-day designers and on the importance of embedding humanistic and economic values in design knowledge. Furthermore, it illustrates the directions for a systemic transdisciplinary education in Master's degree programs and Ph.D. courses in Design, aimed at providing the necessary tools to a new and responsible generation of professionals. The awareness of their important and influential roles in society should be inspiring and lead to the creation of innovative entrepreneurial activities.

Keywords: systemic design; transdisciplinary education; awareness;
societal influence; relational mediation

011 Taking the Culture out of the Lab and Into the Office: A “Non-Lab” Approach to Public Service Transformation

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Over the years, “innovation labs” have come and gone in public sector organizations. At Immigration, Refugees and Citizenship Canada, one low-key, co-design project over-delivered on client insights, service experience improvements and operational efficiencies. This case study shares one department’s success in embedding human-centred design into organizational culture by: competing against graduate design students, co-designing across the organization (from call agents to policy, immigration officers, and communications), creating a design project alumni community, and adhering to rigorous measurement and experimentation. The case study will share opportunities and challenges that emerged from the process of embedding human-centred design (via a “non-innovation lab”) into the department.

Keywords: innovation; service design; culture; organizations

095 Exploring the Motives Behind the Formations of Recently Established Industrial Design Programs in Turkey

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Studies on the history of industrial design education in Turkey suggest that the emergence of industrial design education was mainly a result of government policies and academy, rather than a demand by industries in Turkey. Along with foreign scholars, Turkish academics who were educated abroad played essential roles in department foundations. Until the late 1990s, the number of industrial design bachelor programs in Turkey was not more than five. However, as of 2018, there are almost 30 bachelor programs in Turkey. This study aims to explore the motives behind the rapid increase in the number of industrial design departments in Turkey. The paper explores the initial grounds for the emergence of industrial design departments through the literature review. In order to explore the motivations behind the recently established industrial design departments, interviews were conducted with five heads of departments. Four of them are the founders of their departments. The main motivations, missions, and strategies of these departments were questioned, along with the logic behind the curricula of the departments. The results indicate that regional environment, and the actions taken within available facilities and sources mainly define the missions of recently established industrial design departments.

Keywords: industrial design education; newly-industrializing countries; industrial design departments

024 Design for the Nonhuman

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Students, even from non-design disciplines, are sometimes familiar with the use of prototypes to develop a commodity. Rarer, even among students from design disciplines, is the awareness that prototypes can be used to address research questions. In this paper, we discuss a case study for the idea of using prototypes to better understand a situation that includes nonhuman actors. In particular, we used the famous squirrels on the University of Illinois campus as the subject of our design efforts. A group of undergraduates from mainly non-design disciplines was led through a half-day workshop on prototyping. Instead of focusing on prototyping towards a commodity -an object or experience that the squirrels could use- our workshop encouraged students to think of investigation as their primary goal. Thinking through making, participants produced artefacts with features that could help us better understand squirrels. Some prototypes, for example, embodied strategies for observing behaviour in more detail, while others were designed so that their very conceptualization led immediately to additional questions. We recommend workshops of this kind as a tool for encouraging two things: a broader appreciation for the different purposes of prototyping, and an awareness of the limitation of human-centeredness in design.

Keywords: human-centred design; prototypes; workshop; squirrels; design research

114 Using Cat-Centred Research to Learn the Design Thinking Process

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A new design centre at an American university was given the mission to incorporate design thinking and human-centred design across the university through multi-disciplinary collaborations. An opportunity arose with the university's College of Veterinary Medicine to conduct research around cat house-soiling in preparation for a Hackathon to create new products and services to combat this type of behaviour. The design centre worked in collaboration with veterinarians to adapt the design thinking process to incorporate both cat owners and their cats while allowing students the chance to practice their design thinking skills in combination with an exploration of interspecies relationships. Through in-context field research conducted in cat owners' homes, students used both human-centred and cat-centred design techniques to understand the cat-cat owner dynamic. By observing cats' environments, behaviours, and human relationships, students were able to uncover three key opportunity areas for design around house-soiling for the Hackathon participants: leveraging data to modify cat behaviours, owner acceptance of existing undesirable behaviours, and a lack of understanding amongst owners for their cat's motivations and intentions.

Keywords: other-than-human centred design; experimentation in design education

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077 Competency Domains for Systemic Design Education

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Systemic design is an emergent field demanded by the complexity and the scale of 21st-century problems. Its objective is to provide a holistic vision over fragmented entities to design responsibly for incremental change. For addressing the complexity of societal and environmental problems, it is important to equip future designers with a broad systemic design skill set. Industrial design education needs to be restructured and regularly updated to transfer required competencies compatible with the nature of contemporary issues. The Competency Domain Model (CDM) proposed in this paper, lists and categorises the essential designer competencies in four different domains. This classification could serve as a framework for educational reforms in the near future, and facilitate meaningful communication between different design programs. The model is applied to 15 industrial design departments in Turkey in order to understand the current status of design education in the national context and to present its potentials for others. Research results are shared within the context of insider knowledge.

Keywords: systemic design; design education; competency model; orders of design

100 Facing a Phytosanitary Emergency Through Transdisciplinary Approach of Systemic Design

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Nowadays the designer is called to face increasingly complex problems and multi-faceted challenges of great importance. This factor leads designers to redefine the boundaries of their profession through interaction with other scientific and humanistic disciplines, in order to integrate a holistic view of reality and achieve higher degree of results completeness. A transdisciplinary approach and the dissemination of research outside academia become important aspects of this new professional perspective, which encourages the designer to investigate new areas of research and collaborate on several levels with specialised stakeholders in different branches of knowledge. The purpose of this paper is to describe a concrete case of interaction between different disciplines -in the frame of Systemic Design- to eradicate the complex problem of the Olive Quick Decline Syndrome in Salento (Apulia, South of Italy). This phenomenon caused by the progressive proliferation of the pathogenic agent *Xylella Fastidiosa*, has compromised the environmental, economic and socio-cultural sphere of the territory and has solicited the attention of international authorities and institutions, such as the European Food Safety Authority (EFSA). The paper explains the methodology and the results of a concrete Systemic Design project applied to infected territory.

Keywords: systemic design; phytosanitary emergency; holistic approach; transdisciplinary approach; prevention strategies

028 Tacit Learning in an Extended Interior Design Studio

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Tacit knowledge, an important component of design is widely researched. However, its acquisition in design education still remains unclear. Its difficulty in transference and articulation suggests that it is constructed and thereafter internalized by the student. The social environment of the design studio scaffolds and further shapes the acquisition of tacit knowledge. But as the boundaries of the physical studio are extending to the virtual, how this extension facilitates the acquisition of tacit knowledge is the aim of this study. Constructivist theories are applied to study the above in the Environment and Interior Design programme at the School of Design, The Hong Kong Polytechnic University. Methods of data collection were focus group interviews and studio observations. Participants in the study include students and tutors in various years of the programme.

Keywords: tacit learning; constructivism; blended studio environments; extended interior design studio

079 Educating Designers in Virtual Space: A Description of Hybrid Studios

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Little is known about how design learners experience competence development in alternative, hybrid design studios. The research reported here explored the development of learners' competences in distance design education in a longitudinal qualitative study. Learner biographies were recorded through repeated interviews and analysed using a narrative, grounded theory approach. The paper discusses emergent themes such as phases in development, roles of learner autonomy and learning groups, crisis situations, and expert dialogue. It presents the hybrid studio as an intersection of internal and external factors in distance design learning. The paper goes on to suggest a taxonomy of virtual design learning, teaching, and educational theory that may aid educators in the design of hybrid design learning spaces. It suggests a design didactic concept that combines the theories of creative processes with the media didactic contexts of a development-centred design pedagogy. The work concludes with the proposition that study programmes should be developed based on competence and personality. This experience-centred didactic is a prerequisite for the success of digitised educational systems.

Keywords: virtualisation; design didactics; hybrid studios

082 Virtual Learning Spaces: Designing Learning and Learning to Design

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This paper argues the pedagogical positioning of video gaming spaces in art and design education as alternative studios. It serves as an analytical formulation for understanding gaming spaces as studio spaces. During the introduction, the paper argues the qualities of studio learning goals and related assessment approaches. After that, it explores studio spaces and their position in learning through a constructivist approach. It uses the theory of four pillars of education during this exploration. It continues with a structural analysis of video games. It approaches this structure and its elements as enablers of a unique spatial experience. Later, it discusses how studio and gaming spaces are in tune with one another, by arguing the resemblances between studio education and game structure. Lastly, it suggests using studio evaluation methods due to this similarity and concludes with further research suggestions.

Keywords: video games; virtual art and design studios; art and design education; alternative studios; transfer in informal education

083 OpenDesignStudio: Virtual Studio Development over a Decade

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This paper presents a case study on OpenDesignStudio (ODS), an online, virtual design studio used to support the Design and Innovation qualification at The Open University (UK). The case outlines the main design and development iterations to ODS over a period of nearly 15 years and presents recent usage data of large-scale student populations (3000+ students). As such it is one of the largest and longest-running online, distance design studios, representing a unique longitudinal study of virtual design studio use. The case highlights the importance of learning design, social learning mechanisms, and induction into studio culture.

Keywords: virtual design studio; online design studio; studio pedagogy; alternative design studio

089 The Evolution of the Design Studio: Hybrid Learning Spaces

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This paper discusses an innovative pedagogical initiative that is currently the subject of ongoing development at Coventry University in the School of Art & Design - the Hybrid Learning Space (HLS) project. The HLS delivery paradigm originated in response to recent shifts in the tertiary education landscape: The need to meet the challenges of growth in student numbers; and the growing emphasis on international recruitment and the development of internationalised curricula. Fundamental questions need to be asked that challenge entrenched notions of what constitutes a learning space, and, the future role for the traditional design studio in internationalised design course frameworks. The imperative is to design integrated mechanisms of design course delivery that can meet these challenges without compromising the academic integrity and quality of the student learning experience. Methodologically, the paper draws upon thematic analyses of student survey and interview responses to uncover common pedagogically-relevant themes in the context of student participation and attainment. These analyses are correlated with direct observations of student behaviour within conventional and disrupted learning spaces. A case study review illustrates the HLS model in action. It draws upon active research initiatives, interventions and delivery practices from several institutions in the UK and in China. The objective is to explore the effects of learning space topologies on design student participation and to propose a conceptually alternative notion of the design studio as praxis-based learning environment. The paper concludes by summarising the potential benefits of the case study while pointing the way forward to the ongoing evolutionary development of the HLS experiment.

Keywords: hybrid learning space; design pedagogy; internationalised learning; alternative studio; student participation

075 Mediating Cultural Values in a Multimedia Installation

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This paper sets out approaches and trends in interactive and smart solutions designed to use a multimedia educational approach to foster and promote cultural heritage. The research presented aims at envisioning novel strategies to facilitate learning by encouraging visitors to interact directly and physically with the heritage on display, and to communicate cultural messages. Analysing the interactions between the user and different media and their narrative potentialities, we describe an installation which allows visitors to meet a life-sized simulated hologram and interact with it. The project is set in the field of Human Computing Interaction (HCI), looking at the world of digital encounters and interactive systems based on embodied interaction, investigating if and how the designers, as a mediator between different media and tools, succeeded in achieving their aims and proving the envisioned user experience. Relying on user tests and direct observation, we discuss how the interactive exhibit and the digital character affected visitors' behaviour, effectively capturing their attention and fostering interaction. Furthermore, we examine how visitors perceived the digital character and the gestures they asked them to perform, directly or indirectly, to trigger actions. In conclusion we generalize the results in terms of possible translations for teaching design basics in higher education.

Keywords: digital encounter; design; embodied interactions; cultural heritage

081 Translational Aspects of Basic Design Exercises

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Among other things, translation is defined as “carrying something across”. With this interpretation, derived from the etymological root of the term, translation is not exclusively bound to a linguistic context. Therefore, a comparison between aspects of translation theory and the transfer of meaning in basic design exercises can be justified. Understanding linguistic translation as an act of cultural negotiation, raises the question to what extent basic design exercises reach across cultural constraints in transferring experience between design teachers and students. In other words: are basic design exercises transferring universal design principles or are they culturally determined the way language is? With the close reading of three basic design exercises, we present their diverse goals and intended transfer from teacher to student. (1) Drawing a cube is declared as a schooling of observation and an exercise in representing three-dimensional space in a two-dimensional drawing. (2) The technical aspect of constructing abstract geometric compositions had the declared goal of teaching perfection and craftsmanship. (3) And the graphical exercises followed the declared goal to generate a field of visual variations inferred from a strict set of rules and to learn to navigate within the design process. Based on this archaeology of intended goals described in the course of the three exercises, the paper discusses the implicit cultural constraints of the three exercises.

Keywords: basic design exercises; translation studies; cultural studies; technical drawing; design process

084 Inter-Semiotic Translation in Intercultural Communication Design

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In the late nineteenth century, as new technologies, social needs and commercial opportunities emerged in industrialised societies, communication design evolved in line with them. The massive development of mass media and mass communication brought on by cultural globalisation created various levels of complexity for communication design. Understanding the different kinds of translation that take place between cultures, languages and systems will improve the comprehensiveness, quality and inclusivity of communication in multicultural contexts. This in turn demands new knowledge, competencies and skills that will allow designers to create inclusive intercultural communications to serve the current societal and cultural needs of audiences. This paper reports on a traffic awareness project initiated by the UAE Traffic Department to raise public awareness of road safety. The project was intended to explore the role of designers as cultural mediators through an iterative, research-based design process. Students were invited to create culturally relevant posters to communicate intended meanings in a multicultural community. Here, the resulting process of transmuting the visual into verbal and the verbal into visual within the communication design process is examined as inter-semiotic translation (Jakobson 1959), an interactive process that creates connections between different cultures and media in visual communication. This paper highlights the role of such translation in mediating communication among individuals and communities of different cultures.

Keywords: communication design; intercultural communication; inter-semiotic translation; multiculturalism; traffic awareness

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09:50 → 10:15

Paper Session 12 Rethinking Design Basics as Translation

109 Transition from Basic Design to Product Design: A New Practical Basis

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The discipline of industrial design is in continuous change due to the developments in information and production technologies. As a result of this change, designers are expected to be equipped with diverse skills and sets of knowledge. Hence the scope of formal design education needs to be enlarged and the theoretical and methodological basis of it needs to be reconstructed according to this new scope. This enlarged scope is embedded in the curriculum on theoretical and practical aspects. On the account of basic design, which is regarded to be the foundation course of industrial design education, these newly emerging aspects are generally introduced by relating practical bases of the course with new sets of design knowledge. This study proposes a three-step framework for a basic design course for industrial design, which intends to construct the practical bases in accordance with the current needs, skills and mindsets for design practice.

Keywords: basic design; practical basis; transition of design practice; design knowledge

019 When Rabbits Lead to Ideas: Inspiring Design by Retelling Stories through Metaphors

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This paper proposes a method that utilizes expressive narratives to inspire design, especially in the conceptualization process leading to design ideas. In this method, expressive narratives need to be deconstructed by designers through the identification of metaphors. These metaphors are then examined to discover the concepts they embody. While interpreting the metaphors the designers try to find alternative representations referring to the same concepts by creating generative metaphors, which open up new ways of looking at the situation by defining new connections. Eventually, the proposed method assists designers particularly in the development of coherent scenarios, abstraction and re-contextualization of objects, and generation of new meanings in their conceptualization process.

Keywords: design methods; metaphors; idea generation; narrative; retelling

Hall B

11.07.2019 Thu
10:40 → 11:05

Paper Session 12 Rethinking Design Basics as Translation

026 Impossible Design: Fostering Creativity by Quick and Dirty Prototyping

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In this paper, we will present the results of challenging students into designing impossible artifacts using quick and dirty prototyping. We have worked during 2017 and 2018 school years with three different groups of undergraduate industrial design students. The challenge was to imagine how living would be in a house in the year 2050. The results show that imagining living in a near future triggers generation of impossible scenarios. Also, working with a limited time to complete the challenge using quick and dirty prototyping allows the students to think less and skip the early phases of the design process, eagerly engaging with the ideation phase while they are also discussing different possibilities with their teammates. Thus, quick and dirty prototyping is seen in this paper as a thinking tool, fostering creativity and promoting dialogue among students. The more uncertain the challenge becomes, as the year 2050 could be, the more dialogue the teammates will need to complete it. Therefore, impossible design activities should aim to bring uncertainty in challenges that could be addressed using quick and dirty prototyping to foster hands-on thinking and creativity in students, while learning about the design process.

Keywords: quick and dirty prototyping; impossible design; border thinking; creativity

034 Bundles of Spatial Ingredients: Designing through the Prototype

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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; tinkering

038 Why Design Students Need Application Programming Interfaces (APIs)

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One of the perennial questions faced by designers, researchers, and students of design is to what extent they should develop a prototype in order to learn the most from it. In some cases, a simple paper sketch is sufficient. In others, a fully functional version is necessary in order to adequately convey the core concept. In this paper, we focus on the latter end of the spectrum, and propose that one way to quickly and efficiently create these kinds of prototypes is to identify and use one of the publicly-available application programming interfaces (APIs) that can be quickly found in API databases. In short, we seek to simplify prototyping in the field of Interaction Design that appears complex and multidisciplinary with a lot of moving pieces and formulate a way to streamline rapid prototyping. We argue that proper choice and use of an API allows designers with minimal knowledge in information technology to skip the complexities associated with multidisciplinary ideas and enables them instead to traverse different regions of the design space. This helps prototyping, even in this fully-functional space, to take on additional roles such as a generator of design ideas, stimulus for reflection, and influence on behaviors in order to discover and refine design ideas. We ground our discussion in a case study focusing on design process of a language learning prototype that accesses half a dozen APIs to analyze uttered speech and visualize lexical stress in real-time.

Keywords: application programming interface; API; prototype; interaction design; design space

060 Game-Design-Driven Knowledge: When Prototypes Unpack and Reframe Conventions

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This paper explores the implications of conceiving, designing and prototyping location-based mobile games (LBMGs) that bridge the real and the digital into fascinating and unexpected hybrid worlds. The distinguishing traits of these games make them pop up as a compelling contemporary field for design research and practices, where design knowledge is informed in multiple ways: from posing the questions of relating to/embedding technology, to addressing design issues, from ruminating and dealing with UX and UI, to assessing communicative aspects. Moreover, being situated in a specific context and addressing unpleasant topics in the meanwhile, these games prove to be further challenging. The result from our study is that especially when the design activity pushes the line beyond playing within a formal structure, becoming a way to play with structures and a way to celebrate experimentation, prototyping has a crucial role in nurturing awareness and knowledge. In the light of this reasoning, designing, prototyping and testing of LBMGs are framed from a design perspective, exploring their potential in terms of design education.

Keywords: location-based mobile games; prototyping; learning; meaning-making; hands-on experimentation

119 Prototyping a New Economy

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It is conceivable that capitalism and the new market economy as it currently operates is unsustainable despite the bullish opinions of businessmen and entrepreneurs. There are many obvious concerns surrounding an economy without money the most basic of which is the accounting of productivity. However, if we are seriously engaged in this thought experiment, we must also consider two operations of the current system that seem to be most detrimental to societal and more recently, political constructs which are the accumulation, and transfer of money. Moderate restrictions have been placed on both operations but considering the involvement of business in government countless examples evidence the lack of enthusiasm to restrict them further. If we consider life without money, we need to substitute some values that would take the place of cash in order to reshape societal values by placing an importance on things that have greater return than the construct of money can provide. In this study we developed a series of prototypes to learn how a game might be designed in order to emulate a new economic system using time and choice as important values. This study extends students' understanding of the prototyping process through participation in both development and usability. The students who have a basic understanding of economics provide the feedback loop in order to establish rules, playability, and begin to understand how the game can be rigged in their favour.

Keywords: prototyping; game design; capitalism; human behaviour

022 Dichotomous Tension: A Route for Self-discovery in Architectural Pedagogy

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This paper presents the initial findings of an ethnographic study that explores the different facets influencing the socio-cultural context and their impact on the flow of design knowledge between students and the instructor within a specific pedagogical architectural design studio in Cairo, Egypt. The study uses ethnography, where the first author of the paper joins the studio of the second author as a participant observer to be able to understand how the socio-cultural system within the studio influences the students' experience. In this investigation, students and recent graduates of this design studio were interviewed regarding their perception of the studio, the instructor, and the process. The analysis, which used Grounded Theory as its basis, started to reveal a series of themes that appeared to be working in tandems. In this paper we discuss the first two emerging themes that created The Push and The Pull dialectic. Their interdependent duality gave shape to a specific socio-cultural context for the studio, and appears to have played a role in shaping the students' perception of the course while affecting the flow of design knowledge in it. The resulting state of dichotomous tension influenced students' behaviour by pushing and pulling them towards a state of self-discovery that led most of the interviewed students to consider the studio under study as one of the most influential in their learning experience within their school of architecture.

Keywords: architectural education in Egypt; ethnography; architectural pedagogy; design process; design education

025 The Outcomes of Collaborative Learning in Design Studio Courses

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The most effective learning in industrial design education takes place in the studio courses, in which the students can explore, analyse, practice and observe the outcomes of the design project. In studio courses, occasionally, students are encouraged to take part in collaborative learning by working together in a group and submitting a joint project that results from the group work. The collaborative learning projects commonly end up with discussions, confusions and conflicts between the group members and the instructors. The basic problems are especially declared by group members as not choosing their partners by themselves, and working on a design project that does not interest them. In accordance with this information, a study was conducted by integrating the collaborative learning system to the industrial design studio course. In this paper, the outcomes of collaborative learning will be evaluated in light of the project conducted in a design studio course with undergraduate students. The study will be interpreted by the context of the dynamics of collaborative learning, the common problems observed during collaborative learning, and novice designer properties featured by the students.

Keywords: collaborative learning; studio course; design project; board game design; design education

106 An Ethnography of the Design Studio: Exploring Social Interactions and Performances in Studio Environment through Goffman's Dramaturgical Approach

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This paper aims to disclose undercurrents of in-class interactions and provide a deeper understanding of the social interactions and performances in the design studio. By adopting an ethnographic approach, this study attempts to explore the participants' activities and dynamics behind them. The chosen subject environment for this study is a first year basic design studio at a selected School of Architecture and Design. The setting is taken as a social environment and observed using ethnographic methods; then the observations are interpreted through Erving Goffman's metaphor of drama (1959). This study is not primarily interested in the materials used in the class; similarly, maintaining a certain standpoint for the methodology of the education is out of concern. Rather, it uses such subjects as mediums to understand participants' behaviours in the design studio. Being an on-going descriptive work, focusing on social interactions, this study delivers insights from the design studio and provides social explanations which can form a basis for developments in design education in the future.

Keywords: design education; design studio; ethnography of design; drama metaphor

11.07.2019 Thu
12:10 → 12:35

Hall A

Paper Session 14 Learning Cultures

118 A Pedagogical Framework for Managing Miscellany

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This paper proposes a pedagogical perspective and practices that privilege inclusive methods with the aim of preparing students to respond to and manage dynamic conditions, circumstances, and social complexities -what the authors call "miscellany"- and fostering a collaborative environment that models "communities of practice." Rather than frame classroom design activities around design problems and resolutions (solutions) as is typical, the authors privilege designing. The process of discovering possibilities and reaching conclusions (in the form of artifacts and/or designed systems), is grounded in performative and reflective practices that are inherently social, constant and consistent. The paper describes some of the authors' experiences writing educational studio courses that engage in the development of a community of practice through experimental course structures, critique methods and project framing.

Keywords: design; design pedagogy; community of practice; situated learning; theoretical statement

007 Towards a Critical Paradigm

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This paper suggests that including theory and practice of critical design in the traditional industrial design curricula can benefit the future designers. Four specific aspects of critical design are proposed as valuable for their potential in constructing a critical paradigm and subsequently lead to more conscious designs. All these characteristics emphasize the enlightening capacity of critical design, which allows to critically revise one's assumptions. The author argues that studying and analysing existing critical design projects, as well as trying this approach out in practical tasks can have emancipating effect on the designers' future professional activities in various fields of design. It can foster the awareness of ideological constructs and the capability to critically analyse them in order to avoid biased designs; understanding of the advancement of futures and the design's potential of steering it; productive adoption of design fiction; and a deliberate use of design product as a means of communication.

Keywords: critical design; ideology; futures; design fiction; aesthetics; design education

029 Motivational Factors for Participation in Industrial Design Competition

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Design competitions play an important role in education. The purpose of this paper is to explore the motivational factors of the participants in industrial design competitions and what attributes of the competitions affect these factors. In this study, a two-stage method combining qualitative and quantitative methods was used, including evaluation grid method (EGM) and quantitative theory type 1 method. These methods are based on Miyoku engineering theory. The results of the study reflect the motivational factors of students to participate in design competitions and establish the weighted relationship between these motivations and the competition attributes. The study indicates that the participants want to compete in design competitions with a sense of authority, a sense of fairness, a sense of self-realization and a sense of honor. These abstract reasons contain the corresponding rationale and specific reasons. The results of the study can provide a theoretical reference for participating students, educational institutions and competition organizers.

Keywords: industrial design competitions; motivational factors; EGM; quantification theory type I

040 Cast Away: A New Way to Read Value of Objects in the Context of a Movie

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This paper is the exploration of an assignment given in an industrial design undergraduate course called "Culture and Communication in Design". The course aims to give an insight about how objects are analyzed and evaluated by tools provided by semiotics, products semantics and critiques of commodity culture. In this assignment, the movie "Cast Away" was used in order to make an analysis about the meanings and meaning shifts of artefacts that are placed in different contexts. The assumption is that "reading" movies with a concentration on the artefacts placed in the scenes gives students a different perspective to see, understand and discuss some terms about the changing cultural significance and value systems of design. Cast Away, as an original interpretation of the story of Robinson Crusoe, enriched by the objects carried together with the main actor to an unknown island, provides a very rich ground to see and interpret the cultural changes and dynamics between objects, individuals and society. The significance of the exercise, or such exercises in design education, lies in the motivation of training students not only as mere practitioners and creators of commodities, but also as intellectuals who can reflect on their own profession through a critical lens.

Keywords: movie analysis; design education; use value; exchange value; sign value; symbolic exchange value

098 Contemporary Art for Product Design Studio: Informed Conceptualism

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The aim of this article is to discuss the potential of studying contemporary art to foster critical skills in designing. This aim is part of a larger argument of the requirement of equipping design students with arts and humanities as well as design skills for a more meaningful and ethical future professional practice. It is hypothesized that contemporary art content guides students towards this meta aim. Here, contemporary art comes into play as a resource of not only liberal art theory but also its manifestation in art form. This method of art practice founded intensely on criticality is proposed as a tool for critical industrial design studio practice. Prior research by the author has indicated that students exposed to contemporary art content in elective courses acquire consciousness on the meaning of their future profession, but ways of integrating this content to compulsory industrial design studio courses remains unknown. Based on the findings of prior research, this study presents as initial argument of developing ways of such integration. To explain the role of contemporary art as a resource of criticality, first the criticality implicit in the nature of contemporary art is explained with art historical theory. After that, the change in art after the end of modernism is explained with the ready-made with reference to Fountain (1917) by Marcel Duchamp. Following this, the presented features of contemporary art are matched with the parts of the design process it can enrich with particular reference to "utility", "viability" and "agency". This is discussed in more detail with the reported experiences of students who have studied contemporary art content during their schooling. Experience from the elective course "Contemporary Issues in Design and Interaction Between 20th Century Art and Design" is presented in relation to related theory. The reports collected from students indicate the ways in which the content is reflected to product design practice in the studio.

Keywords: design education; industrial design; contemporary art; liberal arts; criticality

032 Multi-Attribute Material Information Platform

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Materials selection phase plays a pivotal role in product development, which is driven by consumers' needs and manufacturers' requirements. Hence, material research is decisive in achieving competitiveness and success in the products market. Moreover, advances in contemporary technologies have a paramount influence on how new materials are invented and developed. New trends, lifestyles, living expectations, amended with legal requirements imposed by the government -in particular, environmental concerns of products usage and their disposal- additionally complement this process. Therefore, environmentally friendly materials are getting more attention in substituting common materials in markets that are a threat to humanity and the environment. The aim of this paper is to develop an assistive classification method that comprehends product requirements and accordingly, offers the designers substantial suggestions regarding environmentally friendly materials. The complexity of the stated problem, deriving from the conflicting requirements of the designer, consumer and manufacturer, is addressed by utilizing multi-attribute analysis. The herein proposed solution is tailored more towards industrial designers, who in principle are less familiar with material attributes, which in turn complicates the material selection process when designing for the environment.

Keywords: industrial design; product attributes; material attributes; design for environment; material information platform

033 Educational Tools to Teach Design Students the Dynamic Behaviours of Smart Materials

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Materials teaching is currently part of a paradigm shift in the design education. It becomes crucial to provide design students with an up-to-date knowledge about the latest advance in materials and manufacturing technologies with the aim to prepare them to more effectively cope with the next industry challenges. The introduction of smart materials started to revolutionize the way we design and interact with products. Their dynamic properties are changing our perception and understanding about what a material is in itself (a system), and especially what it is able to do (its performance). This paper presents a multidisciplinary framework for teaching functional materials based on a 5-layers structure: from the material science basics (1), materials engineering (2), stimuli-responsive phenomena (3), material experience (4) and product experience (5). Among the research outputs, four design-oriented tools are described. A part from an introductory lecture, descriptive cards provide information on the most common phenomena that describe commercial smart materials application (level 1-3). The Smart Materials for Sensory Experiences Map (SM4SE) classifies such materials based on their input/output stimuli and puts them into relation with the explorative sensory modalities (level 3-4). By selecting an application of smart materials, the Dynamic Product Experience tool encourages students to explore, describe and qualitatively rank the dimensions of product experience (usefulness, desirability, credibility, understandability, usability) (level 5). The tools have been tested in a one-week learning experience focused on smart materials teaching within the Material Selection Criteria course in Design & Engineering of Politecnico di Milano. As an output of the full immersion, 28 case studies on dynamic products were collected by students.

Keywords: material systems; smart materials; material experience; transdisciplinarity; design engineering

037 Nurturing Competence on Innovative Materials through New Media: The Case Study of Public Engagement of MATto, The Material Library of Politecnico di Torino

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The third mission of academia, i.e. public engagement, has become more and more explicit. Nowadays universities have to engage with societal needs and market demands by linking the university's activity with its own socio-economic and cultural context. In this perspective, this paper will deal with the educational activities of academia through the activities of a material library: the spread of recent and continuous innovations of materials for design. In the landscape of academic material libraries, the case study of MATto appears as of particular interest, especially concerning the topic of the continuous updating proposed to its contacts, therefore it will be investigated and explored. A new strategy, whose main objectives are generating widespread learning based on a continuous dialogue, nurturing a polytechnic knowledge on materials through on-going updating and involving the wide public into informative processes by generating curiosity and interest on the research on materials for production, was designed ad hoc. The most interesting and effective tools in relation to the attended results were selected and the working methods are based on a series of informal live-meetings and a new media presence growth action plan. After one year, the results of this new approach to public engagement are still embryonic but yet promising. This work can be an example for other institutions facing issues such as contemporary methods to teach or, at least, to spread materials and design culture.

Keywords: innovative materials and design; design education; consultancy services; materials library; public engagement.

094 The NautICS Materials Workshop: Teaching and Learning Interactive, Connected and Smart Materials for Yacht Design

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Knowledge about materials is a key element in design education, considering not only their technical properties but also experiential and expressive-sensorial qualities of materials. To comply with this transition and with the emergence of novel materials, educators need to adapt or develop new formats, tools and methods for teaching and learning materials in design curricula. This paper presents a tentative design methodology experimented and validated in an educational workshop named NautICS Materials, with the aims of (i) teaching ICS Materials in the absence of material samples, (ii) exploiting the potential of ICS Materials in driving yacht design concepts; (iii) designing for ICS Materials; and (iv) introducing and applying the notion of materials experience. ICS Materials is an acronym that stands for Interactive, Connected, and Smart. Indeed, the domain of materials for design is changing under the influence of an increasingly technological advancement, which brings miniaturization of technology and material augmentation with the use of sensors, actuators, and microprocessors. Examples of new hybrid material systems with dynamic and computational qualities are increasingly emerging and is rising the need to forecast their potentials in the design space and to reflect on their future application critically, both in design and in teaching. The workshop NautICS Materials -ICS Materials for the Nautical sector- is described by its objectives, structure, methodology, tools and results, in order to present a model to transfer to other sectors or to scale up in larger experimental and applied actions.

Keywords: ICS Materials; materials experience; yacht design; design tools; design education

062 Crossing the Finish Line Together: Collaborative Team Learning in Design Studios

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Shaped by technological advancements and external forces, the narratives of contemporary architecture practices shift from the celebration of the master architect to the collaborative team player in explorative enterprises. Curiously, our studio culture remains lukewarm to such disruptions. The studio pedagogical framework embedded in our design studios of how design tutors teach plays a quintessential role in shaping future architecture educational discourses. It is argued that the traditional one-on-one desk crits have limited potential for breeding new modes of cross-industry design practices. To date, the relevancies of such ubiquitous hierarchical master and apprentice teaching pedagogical structure remains unchallenged. This paper argues for a collaborative design studio characterised by collective actions and mutual support as an alternative. This research examines the repercussions of an experimental model of facilitating architecture design studios with a reinforced focus on collaboration (Collaborative Team Learning - CTL) comparing against the traditional one-on-one (OOO) studio pedagogy. CTL's pedagogical strategy situates the design tutor as an enabler, engaging students in a cross-pollinative and collaborative approach. At the end of the academic year, students were invited to complete a paper-based questionnaire to gauge their learning experience. Preliminary analysis revealed that CTL students accomplished improved academic performance, instillment of self-directed peer-to-peer learning and lower attrition compare with OOO students. This research advocates that these CTL experiences play a pivotal role in inculcating collaborative mindsets for emerging modes of architectural practices that centre on effective communications, emotional intelligence and negotiations.

Keywords: design studio pedagogy; learning experience; collaboration; heterarchy; cross-pollination

063 Using a Self-Reporting Tool to Capture Design Student's Experience

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Considering the continuous design activities that are performed throughout design projects, design students go through several stages of decision making. Sometimes they experience problematic situations in between consecutive supervisory meetings. In order to provide better guidance, it is important for supervisors to understand students' process in between these meetings. There are available tools used in fields like education and healthcare in order to monitor an individual's daily life in relation to the context (e.g. time, place, activity) and personal circumstances (e.g. emotions, feelings, ideas). These tools are developed based on experience sampling method (ESM), a research method focused on collecting self-reported data from participants in order to measure their daily life experiences, especially during a long period of time. Aiming at assisting design students to do regular self-reporting on their experiences, this study presents background research for designing experience sampling tools that would be used by students and supervisors to keep track of students' experiences throughout design projects. In this sense, this study intends to assist students with self-reporting activities, translate the main design requirements of experience sampling tools into the context of design projects, as well as revealing guidelines for the future implications of ESM tools in design education.

Keywords: student experience; experience sampling; design education

043 Studio-Sustain Urla-Barbaros: A Design Studio Course on Sustainability

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A series of design studio projects on sustainability and design was initiated in 2017 at İstanbul Bilgi University, Department of Industrial Design. The series aims to lead the students to think, discuss, and get aware of their responsibilities on their decisions, about the environment, living things and resources in design projects. For this purpose, a design studio course encompassing the processes and methods of sustainable design was structured. The topic was the context of a locality in Turkey, outside the campus and within daily life, so the students would directly relate with these responsibilities. Similarly, the structure and project briefs of the studio were determined through a direct interaction with the locals and the local knowledge of the region. Aiming that, and in line with certain methodologies of sustainable design, three visits were made to the site during the semester; the first by the coordinators before the semester started, the second and the third with the students and coordinators, for research and project development phases. The research phase was based on the core topics related to sustainability and the region: built environment, culture, food, energy, waste, and water. During the project development the students focused on one of these topics and built vision scenarios for future on the grounds of the past and present of the village, and proposed system and product designs to facilitate reaching their vision. They shaped their design ideas on the grounds of the local context and shared their projects with stakeholders and the inhabitants.

Keywords: sustainability; industrial design education; systems thinking; design camp; local and rural

046 Teaching the Critical Role of Designers in the Data Society: The DensityDesign Approach

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In the modern *data society*, designers play a key role in the creation of artefacts that mediate our access to data and information. These artefacts include data visualisations and interfaces. Within this context, there is a growing risk of design educators training professionals who are indifferent to, or unaware of, the political power of the devices they contribute to creating. In this paper, we draw on our experiences in the DensityDesign course to identify and formalise a didactical approach providing students with opportunities to critically reflect on their work while gaining the technical skills they need as information designers. The paper describes the course's historical evolution, its didactical goals and its current structure. It then provides an overview of the didactical approach identifying practices that other design instructors can reproduce, entirely or partially, at three different levels: through the methodological framework, the situational tactics, and the research artefacts students produce throughout the course. Finally, a critical discussion evaluating the limits and risks of the proposed approach is provided based on our didactical experiences.

Keywords: information visualisation; information design; issue mapping; data publics; teaching tactics

087 Rapid Development of Materials Experience through Active Learning

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In recent years, initiatives have been made to transition materials and design teaching from a predominantly lecture-based and engineering-dominated subject to one that is more practical and nurturing of experiential knowledge. These initiatives have been sparked by the ever-growing body of research into materials experience and the characterization of materials as an influencer of user experiences. This paper contributes to the dissemination of tools and techniques that can bring teaching and learning of materials experience alive within a design curriculum. It presents the rationale and description of a structured activity entitled Material Love-Hate, specifically developed as a means for students to rapidly develop their materials experience in a classroom or design studio environment. The activity requires students to probe classmates' appraisals of two owned products: one with product materials that they love and one with product materials that they hate. Quantitative and qualitative data are generated and analysed through the activity. On completion of Material Love-Hate, students demonstrate the expansion of their materials experience by preparing a coursework assignment that relates the appraisal of their two products to sensorial-affective and interpretative categories of materials experience. The paper focuses on activity development and reflection of instructor and student didactic experiences, not on the material appraisal datasets that were generated.

Keywords: materials; user experience; product design; interaction; active learning

078 Material Education in Design: From Literature Review to Rethinking

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The world of materials for design is continually changing and evolving, not only thanks to technological advancements, but also thanks to the continuous original applications by designers, as well as the reinterpretation and understanding by design researchers that reveal new ideas, suggestions and unconventional paths. It is essential and fundamental for design educators to understand how to educate students and let them be autonomous and prepared for the choice or creation of materials and processes to complete their projects nowadays. The material is not only the object but also the tool or media around which most of the design education shapes: transferring the knowledge of materials' technical properties or experiential qualities to design students is essential, and in the process on materialising the design projects, students also being educated by their hands-on experiences. This paper provides a literature review to interpret the nature of material education in design and lists significant aspects. It is structured into four parts: the role of material in design education; learning through practice with materials; considerations on material in design; and the highlighted aspects in material teaching and learning processes. This paper lays the foundation for future material education research.

Keywords: material education; material experience; design education; material literacy

071 Forget to Clean-Up When You're Done

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In most university settings the rooms are scheduled centrally in such a way that even moving tables and chair configurations can prove problematic. Because different faculty use the space for different purposes, common courtesy and institutional exigency both dictate that classrooms should be reset to neutral at the end of each session. However, from the perspective of design pedagogy this otherwise beneficial practice becomes problematic. For design students there is a strong benefit in the material culture of the design space being intrinsically modelled in the classroom. We therefore offer an alternative argument to the conventional deployment of classroom space, based on three case studies from institutions in the USA and Canada where the opportunity has existed for various forms of material permanence in the classroom setting. The benefits to the students of leveraging materiality and material persistence in the classroom include: pedagogical benefits; efficiency; opportunities for mental reset; and more accurate discipline representation. Finally, and perhaps most importantly, embodied classroom environments support students more holistically by remembering that makers have both brains and bodies that need physical, psychological and emotional nourishment.

Keywords: design education; material design; material culture; embodiment

104 University Classroom Prototypes for Innovative Learning

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The relationship between the university and the society is a continuous exchange that never stops to influence itself, bringing benefits to both realities. Nevertheless, it is necessary to focus on the changes that can be applied in the learning field and not only on the evolution of the university system itself. The desire to refine the educational approach is an extremely current topic in the field of education. This is why, to face a series of social changes, it is fundamental to reconsider the method used to disseminate knowledge and to understand its real needs. Moreover, another element that has to be recalibrated is the lack of effective tools that are provided to students to deal with sudden changes in the business world. As a result of these transformations, the Politecnico di Milano has decided to undertake a deep revision of its didactic spaces in order to better understand the needs of all the university users and to foreshadow new scenarios that can support the evolving teaching and pedagogic methods in all the disciplines involved. The paper presents the results of a research that aims to dissert on spatial needs, potentialities, new habits and uses, and to organise all the requirements in guidelines for new learning spaces that will be firstly applied to four classrooms prototypes, and then finalised and revised for a large-scale dissemination.

Keywords: new learning models; innovative spaces and services; interdisciplinary; flexibility; customization

058 Design Education for Rural Revitalization

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Many countries in the world have experienced the process of rural decline and revival, and China is no exception. School of Design of Hunan University began to pay attention to the rural issues, especially in the remote and impoverished rural areas as early as 2009, and started the New Channel design and social innovation project that aims to find a suitable design education method to participate in the rural revitalization and promote the sustainable development of the rural areas. After ten years of practice and research on design education for rural revitalization, we have accumulated a large number of cases and experiences. We have gradually formed a practical process of design education for rural revitalization, innovated the participatory teaching mode of design education, and constructed the teaching activity framework of design education for rural revitalization that is centred on practice. In addition, we have not only trained a large number of students with social responsibility and passion for the countryside, but also helped the villagers to increase cultural self-confidence and improve living standards in the process of promoting rural revitalization. However, the relevant theoretical research is in its infancy at present, and many problems are still left to be solved. We will continue to explore and research through the practice of design education for rural revitalization.

Keywords: rural revitalization; design education; participatory teaching mode; rural culture

090 Towards Community Centric Design in Cairo Informal Areas

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Informal areas take up 65% of Cairo. Mansheyet Nasser -one of the biggest informal areas in Cairo- alone hosts more than 2,000,000 inhabitants. Several NGO founders feel responsible to create a model that fixes informal areas' problems (such as education, employment and health). Especially since the 25th of January revolution, they have been doing their role in sustainable development. Currently these NGOs are responsible for providing opportunities that generate income for informal area female inhabitants. This study focuses on sustaining this income through community centric design. Moreover, the designer's role was more of moderating between the informal area, the inhabitants and the NGO rather than designing only. Aiming the women could have sustainable income, the participants' needs and communities were investigated using Kimbell and Julier's (2012) Storyworld method. This resulted in three women sewing clothes that are sold using a well branded online store. A sample from the store's target group were invited to participate in several participatory design workshops to create the chosen products. This action research draws attention to the impact of community centric design on socio-economic status in informal areas.

Keywords: community centric design; participatory design; Cairo; informal areas; NGOs

110 Familiar Strangers: Enhancing Underground Travel Experience through Digital Screens

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Facial expression is the most effective way in which humans display their emotions. Such expressions play a significant role in social communication in humans because they transmit social signals about the mental and internal emotional state. This paper addresses an important issue of the underground travel in İstanbul, the lack of social interaction which is also a reflection of negative psychological impact of metropolitan life on individuals. Underground travel is a daily routine of a remarkable number of people in İstanbul and it is an isolating experience for most. Moreover, people living in big cities are exposed to risk factors originating from the physical environment contributing to increased stress. The core aim is to enhance the user experience of commuters for a more enjoyable journey by using the contagious effect of smiling, which is the simplest gesture, and face detection technology as game strategy for passengers to enjoy. A combination of qualitative and quantitative research methods was used to gather information about the underground travel experience of the passengers and determine what interventions might encourage social interaction during their commute.

Keywords: social interaction; facial expression; face recognition; underground travel; mood enhancement

121 Learning through Industry-University Collaboration: Observation of Product Innovation Cases Targeting Low-Income Communities

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Poverty is one of the most significant problems faced by humanity. Today, a significant number of the world's population, known as the bottom or base of the (economic) pyramid (BoP), lives on less than \$1.90 daily income. Various stakeholders take part in a range of efforts aiming to solve this multi-faceted and complex problem. Among these efforts, innovative product development has gained acceleration in the last two decades with the contribution of private sector actors. Yet, the challenges in practice force these actors to embrace the problem area creatively. At this point, university collaborations offer creative and inspiring ways of approaching the world's complex problems, including BoP initiatives. Nevertheless, despite the rising expectations from collaborative practices, only a minority of ideas are achievable. This study examines four collaboration cases targeting BoP communities, which took place between a global household appliances company and two academic institutions in Turkey. The examination is grounded in participant observation of the collaborations and the researcher's field notes in four diaries. The study sheds light onto the industrial partner's objectives and expectations from the collaboration. It presents barriers in the realization of student ideas and proposes enablers to overcome these barriers.

Keywords: design for the bottom/base of the pyramid (BoP); innovation; new product development; participant-observation; industry-university collaboration.

020 Teaching Wearables

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Wearables is a novel area in education, products and production. This cross-domain field is interesting from a teaching point of view. Students must learn and succeed in different areas such as jewellery design, programming and prototyping. In this paper we present our planning and teaching of Wearables classes since 2014. The paper reveals some failures which we have learned from. However, the focus of the paper is on the success of wearables teaching. We reveal our recipe to teach this very versatile, novel and challenging subject. The spark we get from teaching wearables derives from its multidisciplinary qualities. Wearables does not necessarily fit any established domain, yet it has touchpoints in many. We have a mix of students from Jewellery Design and Computer Science in our classes. However, in this intersection lie many vital domains as jewellery, fashion, crafts, design, programming and electronics. Students with knowledge from these different domains worked in teams in our Wearables classes. In addition to having learned about their own domains, the students learned about user involvement in the design process, prototyping and pitching the concept.

Keywords: wearables; jewellery design; multidisciplinary teaching; intrinsic and extrinsic motivation; prototyping

066 A Gestalt Approach to Teaching and Learning by Prototyping

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This paper describes a teaching approach used at both Politecnico di Milano, Department of Design and the University of Cincinnati, College of Design, Architecture, Art, and Planning. In this teaching approach, students learn about furniture and product design by prototyping a full-size working prototype, in tandem and with the integration of other design methods, in order to better see and learn - underscoring the Gestalt idea: The whole is greater than the sum of its parts. Different kinds of prototypes are used throughout the design process to verify, as touchstones, every step of the product's development, providing feedback and suggestions according to shape, function and usability. The paper intends to underline the importance of the prototype in the process of creating artifacts as a practical feasibility of the concept, along with a palette of designers' tools including sketching, drawing, 3D modelling and 3D printing.

Keywords: learning by prototyping; furniture design; product design; design method; making

076 From Observing Beans to Serving the Elderly: Prototyping Medication Administration for the Elderly in Hong Kong

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Ageing has become an important social issue and the concept of age-friendly city is increasingly advocated around the world, as we attempt to design information and social services that are accessible and comprehensible for the elderly. On the contrary to this trend, there is a design-related problem in Hong Kong's medicine services that have long led to poor performance in medication administration for the elderly. In response to this issue, our design students were required to develop a series of prototypes from the users' perspectives that centred around redesigning medicine labels and enhancing positive experience in medication administration for the elderly. However, it becomes challenging for design students who have a developed designer-centric mind-set but little experience in designing for older people. In this project, students need to be taught to reach beyond an emphasis on beautifying design and to bring end-users to the centre of the design development process. With no prior experience in user-centred design or training in observation skills, students were first motivated to raise their level of curiosity and sensitivity towards objects and people around, through the simple, easy and intriguing observational exercise of documenting the lifespan of beans. Throughout the 13-week course period, they conducted user tests with the elderly users and have learned how to pay close attention to their subtle gestures and expressions. Students finally verified the optimal medicine label designs and developed final prototypes with compelling solutions towards medication administration for senior citizens.

Keywords: ageing; observation; prototyping; medication administration; user-centred design

088 Progressive Prototyping for the Design of Spatial-Number Sense Tools

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While many design studies have used prototypes as test-instruments to validate the success or failure of design outcomes, only a few have touched upon the role of prototypes as learning agents for a designer during the design process. Prototypes, according to these latter studies, are considered more than mere evaluation tools; they are the means by which designers organically and evolutionarily learn, discover, generate, refine and communicate their design ideas. This study attempts to enumerate such roles of the prototypes during an iterative prototyping process followed for the design of spatial-based Number Sense tools for children. The designer has employed the process of prototyping itself as a vehicle for inquiry during the design of these tools. The study revealed that the features of a prototype that a designer decides to retain or filter during each iteration cycle, enable him/her to traverse the design space and act as a deciding factor for the success of the prototype. The study also illustrated the pivotal role of both the users and the prototypes in shaping the designer's thinking process. Based on this, some of the known models of prototypes are also revisited to be made user inclusive.

Keywords: prototypes; prototyping; filtering dimensions; number sense; spatial sense

115 An Exploratory Study for Provocative Prototypes: Creating Personas

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In a typical design process, the user group is one of the most important pillars for design decisions. The characteristics of the intended user group is usually identified with the help of personas. Personas help designers to create empathy with their user group and understand their needs and preferences better. In other words, designers use personas as a prototype to provide constructive design critiques to their designs. However, persona creation for the design of products with novel technologies is challenging as there is no real user of these technologies to base the persona on. This problem leads us to a workshop in which we question a provocative design solution where personas from fictional users are created and tested by the designers. Two groups, each having three participants, prototyped personas by real world scenario mapping and tested them by provoking conceptually with binary questions.

Keywords: provocative prototypes; persona; design fiction

010 *An In-between Ludic Approach for UX Research: A Case Study*

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UX research is a still under-defined topic, in which a definite sense for both researchers and practitioners is to be found. In this context, we propose a UX approach to be introduced as an integrative educational method, useful to translate user studies results into indications for the future experience that users will have in relation to the designed product, service or installation. Our approach is based on an early and direct involvement of the user, the scope of which is about letting the designer get inspiration throughout the ideation process. It is imagined to stand in-between the explorational and generative phases of the design process, putting itself in an interstitial space between quantitative or qualitative research, ethnography and co-design, detached analysis and proactive cooperation. In this way, we are trying to go beyond the concepts of human-centred design, towards a design-driven research that makes UX methods and tools meaningful for the designer. The approach is described through a hands-on experience of a student's thesis work and is purposed to set the beginning of a conversation for future developments.

Keywords: UX research; design-driven research; beyond HCD approach; user involvement; UX in education

013 A UX Pedagogy on Multimodal Aspects of Emotions

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Everyday products are becoming increasingly complex, at a time when the population is progressively ageing. These trends highlight the importance of teaching future designers to create inclusive and meaningful experiences for ageing users interacting with digital technologies and smart products. This paper presents a pedagogical approach to evaluate and analyse the affective interaction with smart products. Through the development of active problem-solving scenarios, students learn to understand the multidimensional aspects of emotions and cultivate the skills and dispositions needed to empathise with users. The training requires students to capture users' emotions through mixed methods and visually analyse the data in ways that are adapted from the initial stages of a PhD research project and grounded in the literature. Visualisations seek to enhance students' knowledge of how these methods can provide complementary information and how to analyse and interpret the collected data. The proposed model seeks to inform design education on effective ways to design with new technologies for more meaningful and positive emotional experiences.

Keywords: users experience; smart products; digital technologies; interaction design

015 Quantifying Design for User Experience Assignments: Using Rubrics as Assessment Tools

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There is an increasing interest in teaching user experience design in many of the industrial design bachelor's programs. The subjectivity of the topic requires new approaches as well as reliable and valid assessment tools. It has always been a challenge for the teachers to assess creative work in higher education. In relation, the assessment of how products create user experience in student works requires extra attention. In this paper, we discuss the difficulty of properly assessing design and explain the development and application of rubrics that we aimed to facilitate the assessment of design for user experience assignments of a 3rd year bachelors' course of the University of Twente. We present evidence of the reliability and validity of the assessment through the rubrics. Usability of the rubrics for assessment purposes has also been addressed.

Keywords: assessment; evaluation; grading; design assignments; user experience assignment

059 Accelerating Students' Capability in Design for Interaction

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User interaction and experiential aspects of electrical and electronic product design are complex areas for design students to grasp, requiring integration of industrial design (ID) and interaction design (IxD) knowledge and skills. This paper reports on a specific educational challenge that arose during the planning of a new Master of Science programme: how should a highly-compact (14-week, 8 ECTS) introductory graduate course in 'design for interaction' (D4I) be effectively framed and delivered? The paper reviews the boundaries of ID and IxD for clues about the implications of each profession on D4I education, revealing the centrality of user experience (UX) for envisaging successful interactive products and systems. The reported new D4I course is conceived with a structure divided equally between part 1 (theory/foundations) and part 2 (practice/design projects). A novel orientation framework comprising five interconnected elements is introduced to assist delivery of part 1, comprising: (i) user experiences, (ii) domains of interaction, (iii) usage cues, (iv) technologies, and (v) contexts of use. The content of each element is articulated and its contribution to D4I education explained. Student learning culminates in the carrying out of an interaction-focused conceptual design project. The paper is argued as a valuable source for instructors who are considering establishing an introductory D4I course or revising an existing course.

Keywords: product design; design for interaction; user experience; course development; framework

129 UX Modelling in Design Education: Methods, Processes and Examples

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This paper presents user experience (UX) modelling as an educational goal, outlining and grounding on the growing need for trained UX professionals and opportunities for expanding design expertise in this direction; and emphasises the importance of developing a sustained teaching agenda to address the requirements of the contemporary professional practice. After an overview of use and types of models in UX, we offer UX modelling as a teaching tool to equip design students with the theoretical and applied knowledge and skills relevant in user experience research (UXR) and design process. From this point of view, we demonstrate how we utilised UX modelling in graduate level industrial design education and illustrate examples from student works. We discuss applications of this approach by offering the use of modelling as a tool for analysing and communicating user experiences, as well as an apparatus to shape the process of transferring user insights into design implications.

Keywords: user experience; design education; industrial design; user research; UX modelling

004 Nature as a Framework for Teaching Design

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Design is integrated into every discipline practiced today and is employed in a plethora of interdisciplinary techniques which connect design to every aspect of modern life. This paper provides case studies where nature is used as a framework to teach design at the time when the complexity of the world challenges the ways design was traditionally taught. Looking at the university as a system, the author identifies the opportunities where design education could interact with a larger community and provide tools to meet some challenges of the complex world. This includes: teaching design in the classroom, teaching design outside the classroom by integrating it with other disciplines, and teaching design across the curriculum. Using nature as a model for learning, integrated design can be used as a method of investigation or an inquiry that seeks to create new ideas in any field. After testing different scenarios, the author examines what design educators can learn by looking at the ways students first understand theories, practice design skills and later reflect on their experiences. Outlined below are several experimental courses and projects attempting to use nature as a framework to teach and integrate design at every level of undergraduate coursework.

Keywords: biomimicry; interdisciplinary collaboration; sustainable design; human-centred design; innovation

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072 A Study on the Visual Thinking in the Sketching of Product Design

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Design thinking is the process by which a designer clarifies a design problem, proposes a solution or observation, and makes a design decision. The process of design thinking can also be considered as the process of sketching. The sketch helps the designer to reflect on the design to get the optimal solution to the design problem. The process of sketching requires visual involvement. Visual thinking is a way of thinking through visual perception that helps designers filter what they see. Nowadays, product design students present their design results and sketch quality at the time of independent creation far below their level at facsimile. Therefore, this study explores the visual thinking strategies used in the creative processes of experts and students by the audio-visual retrospective protocol analysis method, trying to clarify the differences in visual thinking processes between product design students and experts during sketch creation. Design educators improve their design courses and improve the quality of sketches for product design students. The research results show that the expert's visual thinking strategy is trend to visual imagery, while the novice visual thinking strategy is intuitive perception of visual. The research results clarify the shortcomings of visual thinking in the sketching process of students, which provides a scientific reference for the design thinking education that can be used for teachers to improve the teaching structure of the curriculum.

Keywords: visual thinking; protocol analysis; product design

086 A New Approach in Design Learning: Childhood Pretense

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In this paper a creative problem-solving approach to design learning is proposed, based on the integration of childhood pretense and creative problem-solving processes both from design creativity research and cognitive psychology. Evaluation of human creativity has strongly associated with children's pretense as flexible and divergent thinking abilities. Childhood pretense in the form of pretend play is used for enhancing creative abilities in children. Likewise, enhancing creative problem-solving process in design is associated with improving flexible and divergent thinking skills. Thus, a broad review has been done to identify the features and similarities of childhood pretense in the framework of affordance and adult designing activity that led us to a new approach in design learning to develop designers' creative thinking capacity.

Keywords: pretense; creative problem solving; design learning; affordance

126 Making the Students of Interior Architecture Design Seating Furniture

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This study suggests that students of interior architecture can be led to design furniture through two different techniques. The first technique is applied by guiding them on the basis of a direct analogy and the second one, by making the students produce fairly original designs through motivating them to move their ideas beyond their familiar thinking. The study reveals that it is rather hard to break the conditioned thoughts of 34 students divided in two groups. First, the students were provided with the information on definition, history and types of furniture classified according to the periods. Next, in the first stage, students were led to design contemporary seating objects by a method of direct inspiration from an existing piece of furniture constructed in the prehistoric period. In the second stage, synectics method was applied. Derived from the Greek word synecticos, synectics means the bringing together of diverse elements. It is a creative problem-solving technique. Upon a quick decision, the lecturer leading the session added a new stage to the methodology and told the students to draw the pictures of their souls as they cannot reach a satisfying result with the previous form of the methodology applied. The authentic result of this study was obtained by the designs developed from the pictures of souls added to the synectics method. The students' interests are triggered by a sudden decision of the lecturer so that they can reflect their souls, which constitutes the essence of their entity and their ideas, on the designs they produce.

Keywords: furniture design; synectics method; pictures of souls

045 Motivation Intended to Inform Design Teaching Practice

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Academic success is a difficult task that often involves struggles and mistakes, requiring effort and engagement on the part of students. As the literature is vast and complex, this work focuses on motivation with the intention of informing teaching practice. Design pedagogy is also affected by these aspects, which can influence student success, mastery and autonomy. Although the theme deserves attention, there are not many research reports on the impact of these factors in design teaching and learning. This work is a qualitative study based on subjective evaluation of specific aspects of motivation science regarding learning. The research design was developed with the intention of understanding the impact of non-cognitive factors in design education, by compared perspectives. Twenty-one professors of diverse design (studio) courses and 49 design students, also of different institutions, answered a survey containing twelve questions under three themes: the development of self-determination basic characteristics; the utilization of grades, rewards and praise; and seven statements regarding rewards and praise to ensure motivation, presented to collect subjective perceptions. The results show that students have a much more positive perception of self-developed skills regarding self-determination elements compared to their colleagues. A finding is related to the different perception of the subjects about the utilization of praise. The discrepancy can be a symptom of instructional problems, lack of information by educational professionals or even indicates a poor communication channel in the classroom. Another finding refers to the two groups' opposite views regarding three statements on the usage of rewards and praise for motivation. Apparently, professors utilize grades vastly, which is a clear opposition to the best practices signalized by scientists in the field. Students, also, do not seem to understand that the praise used is sincere and deserved, which could be an indication of lack of trust. Finally, although professors seem to agree that the emphasis of praise and rewards are associated to process and effort, students tend to feel that skill is the key point.

Keywords: motivation; design education; perception; self-determination; praise

061 Interactive Imagery and Shared Mental Models in Design Learning

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This study explores the relationship between interactive imagery and shared mental models in a design learning environment. The study focuses on design, design learning, and the cognitive components of design. In this research, conceptual project development processes of third year architecture students, in a design studio where four instructors gave desk critiques on a rotational basis, are examined. Within the scope of the study, interviews were conducted with four students and four studio instructors. The process was analysed and interpreted based on the collected data and interviews. It is argued that interactive imagery and shared mental models, which are shaped in the studio's desk critiques, juries and panel reviews, affect students' conceptual project development. It is possible to conclude that if there is more than one studio instructor giving desk critiques on a rotational basis, students may have both advantages and disadvantages.

Keywords: design learning; design cognition; reasoning; representation; imagery

125 Project Process Cards: A Self-Evaluation Tool for Design Studio

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Industrial design education is about process rather than product. Design education requires students to follow particular paths to learn design practice during their journey to proposing design solutions. A design studio course is characterized by hands on learning, learning by doing, collaboration, trial and error, peer learning and constructive criticism. Generally, evaluation of student performance is associated with the evaluation of the final design solution. However, the process that generated the final design solution is as important and useful as the final design solution. With project process cards (PPC) we aimed to collect students' self-reflection during the design process. The gap between students' self-evaluation of their performance and instructors' expectations from the students creates confusion in both parties. Project process cards are weekly self-reports that are borrowed from user experience research studies. A digital report template with two main sections, activities and reflection, is provided by the teaching staff. During the study we utilized PPC in 3rd and 4th year industrial design studio courses with a total of 101 students and the students prepared 563 cards. We received positive feedback and acceptance on students' side, as they used the tool for self-reflection. On the instructors' side, PPC served as a documentation and communication medium to increase the quality of communication between the students and the instructors.

Keywords: self-report; self-assessment; industrial design education; design evaluation

128 Metacognition in the Wild: Metacognitive Studies in Design Education

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This paper presents a literature review conducted to establish the current state of the discussion on the topic of metacognition in design education based on a review of empirical studies that present the results of educational interventions that introduced aspects of metacognition to design students. Inspired by Edwin Hutchins' seminal book "Cognition in the Wild," this paper intends to start a discovery trip to study metacognitive processes in real-world educational settings as part of a long-term research plan to investigate the intersection of metacognition and design. The paper presents the theoretical framework that contextualizes this review in which the concept of metacognition is discussed and is contextualized in design education. Likewise, the paper presents the methodology that was followed to complete this review, which consisted of four phases: search of relevant literature; sampling and selection of relevant articles; analysis and summary of each source; and synthesis of the body of research. Based on the reviewed articles, it was found that in design education metacognition is addressed as an instructional outcome, as a mechanism to promote other learning outcomes, and as a result of educational interventions. Likewise, it was found that the reviewed studies report, in general, positive results in terms of learning outcomes after conducting metacognitive interventions in design educational settings. Finally, this review identifies the field of metacognition in design education as a research opportunity for further research given the positive results that were found, and the limited body of research that has explored this topic.

Keywords: metacognition; self-regulation; design education; design learning; educational research.

018 Industrial Design Students' Reflections on Cross-Institutional and Distance Collaboration

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As an inevitable outcome of the increasing globalization of design and manufacturing of new products, distributed design teams bring new opportunities and challenges for creative engagements. In recent studies, there is a growing interest in the ways design teams collaborate and communicate. This paper builds on this strand of work by exploring a virtual design studio course conducted across three higher education institutions, Middle East Technical University (METU) from Turkey, Loughborough University from the UK, and University of Applied Arts Vienna from Austria, in 2017-18 fall semester. In this course, students work in teams in their home university, paired with another team from one of the other institutions. Each team writes a design brief and commissions it to the coupled team, who is then expected to deliver the design solutions. In the process, each team simultaneously works as clients and designers, interacting through online conference tools and e-mails, gives and receives feedback, and documents all the process on an online design process diary. Drawing on three sets of data derived from (1) systematic participant observation in every session, (2) reflective essays students submit at the end of the course, and (3) interviews conducted with students once the course has finished, this paper investigates how and in what ways pursuing a process-focused design studio provides industrial students with a different learning experience compared to their previous experiences in traditionally end-product-focused design studio courses.

Keywords: distributed design teams; design education; digital skills; collaboration

031 How Inquiries into Craft Generate New Avenues for Multicultural Collaborations in Design

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This paper reflects on the STICH research project, an international research cooperation between Switzerland and India that investigated the topic of requirements of future design education by jointly exploring issues in the area of craft, design and social innovation. The cultural differences between these two countries allowed for an inquiry into the transformation of craft, design in new contexts of social innovation – and to discover similarities in the re-interpretation and significance of craft and design in the context of entirely different social challenges. The paper builds on existing theories of design education, crafts and design to propose future approaches to design education that involve multi-cultural research collaborations. The findings suggest how design education can reach new *target groups* by way of exploring new educational formats and contents that focus on the reinterpretation of traditional design skill in globalised contexts. This research fills a significant gap in the literature both in design and in crafts and provides opportunities to conduct further comparative studies.

Keywords: design education; multicultural collaboration; research; social innovation; crafts

012 Rehashing Design through Evolutionary Computation

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Evolutionary computation has made its way in to design curricula in the last two decades. However, questions remain on how evolutionary computation can be made more accessible to design students and its potential to transform design thinking and learning beyond optimisation. This paper examines how the formulation and implementation of evolutionary systems can contribute to students' learning of historical and theoretical aspects of design. The paper reviews evolutionary computation in design and presents genetic algorithms (GAs) as a design tool. Opportunities are identified on how to teach design students to create and implement basic GAs. Strategies that can help design educators to identify and build on these opportunities are discussed. Design activities aimed at applying GAs to rehash the learning of historical and theoretical aspects of design are described.

Keywords: evolutionary computation; genetic algorithms; design learning; design thinking

048 Computational Design Tools and Education: The Smartgeometry Case

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Computational design has brought in novel concepts to architecture and design disciplines. Computational design thinking has evolved due to the potentials of contemporary tools and methods. Experiential learning environments such as computational design workshops offer strategies for a better understanding of the contemporary needs of the computational design education. Smartgeometry (SG) is a computational design organization that operates through workshops of interdisciplinary teams. SG uses and teaches the state-of-the-art computational design tools and methods. Instead of teaching the novel computational design tools in an instructive manner, SG workshops focus on using the potentials of these tools through personal discovery and experimentation. Besides enabling responsive design outputs, tools for sensing, computing and materializing lead to various learning strategies such as learning-by-doing, interdisciplinary collaboration and community building by democratization. This study aims to unravel the impacts of the novel computational design tools and strategies on computational design education through an in-depth qualitative analysis of the SG workshops.

Keywords: computational design education; tools; interdisciplinarity; smartgeometry

