

MASS CUSTOMIZATION AND DESIGN DEMOCRATIZATION

International Symposium, Friday and Saturday, May 12-13, 2017

<http://sites.psu.edu/mcdd/>

Thanks to parametric design and digital fabrication it is now possible to mass-produce non-standard, highly differentiated products, from shoes and tableware to furniture and now even houses. Variety no longer compromises the efficiency and economy of production. Furthermore, parametric definitions of products' geometry are made accessible via interactive websites to anyone, who could then design their own, unique versions of the product. Such "democratization" of design – through mass-customization – raises many interesting questions such as the authorship of design and the functional and esthetic quality of products (shoes, tableware, furniture, houses...) designed by non-designers. This symposium explores social, cultural and design implications of this emerging "design democracy", including its technological origins.

Learning as it Grows: Designing the new 'STEM' objects collection

Assa Ashuach, London, UK

In 2004, I have presented the Osteon chair, an object with an 'intelligent' bone-like internal support structure. At that time, we used a 3D AI algorithm that was placing a structural unit within a 3D voxel grid skeleton. This was one of the only ways to achieve a bespoke optimized internal support structure. Today we all know something similar called 'Infill' that is widely available within any FDM slicing application, that is not taking in consideration any design variables.

In a new recent research, I have been looking into the internal 3D geometrical growth of bamboo. I have focused on a very fast growing breed called 'phyllostachys' that, depending on a variety of parameters, can grow extremely fast and senses its environment to correct and reinforce itself while growing.

In collaboration with macromolecular and bio material scientists at KIT- Kyoto institute of technology D-Lab in Japan, we have translated the microscopic bamboo's internal structure into producible 3D structures. Scaled-up by 3000% we can now study the natural geometrical growth patterns of the bamboo, both in terms of structural porosity and its geometrical growth intelligence.

In my talk I will show a variety of process images, renderings and animations from the microscopic bamboo landscapes. Taking the original geometry into our studio 3D design workflows, we can now modify the original data based upon user ergonomics and or special parameters. The bamboo is 'learning as it is growing'. This means that its structural internal 3D morphology is constantly changing and adapting to new environmental conditions, growing differently from section to section based upon a kind of inherited intelligence and sensory systems.

The new 'STEM' objects collection were designed using the actual bamboo 3D micro-structure geometry together with my personal aesthetics impressions and a line of 3D automated scripts that are laying the foundations for a new type of personalization, customization, and re-adaptation behaviors.

It is opening the discussion around future industrial design and architecture at both large and small scales, where automated processes will be fed by a combination of human and biological intelligence, designing a new type of tool-path for the robots to follow.

Riding the Silver Tsunami:

Mass Customized Housing for an Aging Population

John L. Brown, Calgary, Canada

This presentation proposes a new housing option for 21st century seniors. Future Adaptive Building (FAB) is an interior system of design, construction, and inhabitation that adapts to meet changes in lifestyle, physical health, and cognitive health. Future Adaptive Building comprises three tightly integrated systems that help older individuals live well, and independently, for an extended period of time.

FABmodular is a system of prefabricated, modular cabinetry components that replaces fixed interior site built walls typically used in residential construction. The adaptability of the FABmodular interior means that lifestyle changes, including, for example, the resizing or relocating of the primary bedroom, or adding quarters for a live-in caregiver, can be completed quickly and for very little cost.

FABstudio is a web-based information and communication platform that helps older individuals maintain a sense of agency and control over the design and operation of their homes. FABstudio enables residents to continuously adapt the design the layout of their home and fine tune the smart home control, monitoring and sensing systems to their exact needs.

FAB+ is a series of specialized medical modules and safety systems that can be unobtrusively integrated into the interior to provide physical and cognitive support as well as individually tailored levels of home care, including physical therapy, chronic disease management, and palliative care.

Change is the only constant in life, and, as we enter old age, the degree of this change becomes increasingly profound, the rate more rapid, and the direction less predictable. The mass customization of FAB allows each house to dynamically adjust to these unique and ever-evolving needs.

Blu Homes: Interplay of Design, Technology, Manufacturing, and Business

Karl Daubmann, Detroit, USA

While the aesthetic of modern prefab housing is widely appreciated, it is the logistics that allow for broad distribution. Blu Homes developed a unique hybrid approach between modular and panelized construction to fold their houses for shipping across North America. The folding approach allowed for quick onsite erection and compact shipping dimensions. Bright spaces filled with light, connection to the outdoors, and sustainable building practices are central to the design direction and mirrored in the marketing materials. Transparent, fixed pricing and client customization pushed the internal development of automated design and layout systems along with databases to manage and order building supplies and components. This database was tied directly

to an online configurator for client choices with real-time pricing. Structural design and design technology both support the need to permit different projects at state and local jurisdictions depending upon local codes. The fragmentation of the construction industry will be discussed as a limiting factor in the rise of a national prefab model. The presentation will highlight the interconnected relationship between design technology innovations as informed by broad distribution, business ambitions, and the logistics of manufacturing approaches.

The Physical Implications of a Mass-Customization Economy

Thomas Fisher, Minneapolis, USA

The American economy has begun a transition from one based on mass-production in the 20th century to a 21st century one based on mass customization – a transition that promises to bring profound changes not only in how we produce and consume goods and services, but also in how we live, work, move, learn, and play. This will bring equally dramatic changes to the physical environment and to the design and construction fields that create it. The great challenge lies in overcoming the 20th century thinking embedded in existing policies, codes, regulations, and expectations that remain a barrier to a reality in the process of being born.

Massive Customization

Marc Fornes, New York, USA

Choosing a car today means choosing the color of your car seat, the color of that seat's stitches, the kinds of finishes and headrests. The number of components is exponential to the number of choices of components. For any car company, this means knowing in advance exactly how many combinations of product are possible.

Massive customization means customization to the extreme.

Marc Fornes will discuss THEVERYMANY proposal of mass customization, based on the *search model*. Such an operation means when one initiates the search protocol, one does not know the number of the total possible. All inputs and parameters are understood, and yet their effect is unknown. This 'black box' drives the direction of the studio's work.

The Question of Authorship

Fabio Gramazio, Zurich, Switzerland

While, as a technical and intellectual precondition to digital fabrication, parametric design manifests itself throughout Gramazio Kohler's work, one early project, called mTable, where the "m" stands for mobile phone, particularly stages the newly defined relationship between author and design in the era of parametric freedom and digital production. The lecture revisits this seminal experiment with 15 years distance and discusses the actuality of the themes and theses it picked up. mTable directly addressed mass customization and the end user as its object of investigation, but the

question of where authorship manifests itself in contemporary digital design practice and how this relates to the alleged openness and, in the terms of this symposium, democratization of design is key to many more recent architectural projects and academic research works by Gramazio Kohler.

Towards Entrepreneurial, High-performance Cities

Kent Larson, Boston, USA

Kent Larson will discuss the work of his research group to develop and model urban interventions that enable innovation, with a focus on three current projects: CityScope combines physical 3D models with real-time simulation to create an evidence-based process for urban design and system integration; The CityHome project makes use of architectural robotics to allow a more diverse population to live and work in the creative heart of cities, increasing vibrancy and exchange of ideas; The Persuasive Electric Vehicle (PEV) is an ultra-lightweight, shared-use, autonomous electric vehicle designed to move both people and goods in high-density cities, reducing the need for private automobiles. Larson will also discuss City Science projects in Hamburg, Andorra, Taipei, Shanghai, Helsinki, and Cambridge.

Digital Capabilities and My Twenty Five Year Quest for the Personalization Market

Greg Lynn, Los Angeles, USA

Architecture is one of the few industrial professions where tools are employed to make generic components but the actual construction of industrialized buildings is one off. So architects are the first to believe they can apply this knowledge of one-of-a-kind industrial processes to commercial products like fashion, jewelry, housewares, vehicles, furniture and athletic apparel. I vividly remember being invited by Volvo, along with Sanford Kwinter and Lindy Roy, to discuss how to place architects between car dealerships and factories to leverage exactly this model of mass produced diversity. I have been preaching this vision for more than 25 years.

Since the early 1990s, when architecture adopted both procedural modelling design tools and the ability to speak to manufacturing machines from 3D printers to CNC controlled lathes and mills, there has been an attack on the modular and a desire for the digital bespoke. In architecture, the field has moved more towards mass production of editions and signatures with these new approaches. At the ANY Conference at the NY Guggenheim when I first showed the Embryological House the first question was by Peter Eisenman: "Greg, please tell me which one is the best and what is your criteria for discrimination?" These questions and responses have moved the architectural debate over the last three decades perhaps more than anything else.

There remains one important unanswered question regarding these now familiar developments. The question is not if it technically, financially or logistically feasible. The question is also not how to develop a signature or aesthetic for this new regime of design and production. These questions have all been worked on by the most intelligent and talented people in our field. The question that has not been worked on

outside of gallery and haute couture is: are mass produced bespoke consumer products culturally desirable? If yes, then how can architects position themselves in the ecology of commercial products. If no, then we have reinvented our field which is not so bad.

Twoness

Elena Manferdini, Los Angeles, USA

In a society of duplicated and copies, originality is merely a romantic deception.

Nowadays, contemporary architectural practices have embraced a way of working that utilizes scripting chronicles, robotic fabrication, and digitized replicas even in the most personal part of the project: the sketch. Doubling is the new-normal that subverts the one-off and glorifies multiples. Mass production –either visual or material– is our way of living. Mass customization, as it turns out, is an anachronistic concept that refers to a way of working that belongs to the past.

The lecture argues that it is time to theorize similarities rather than originality and will explore the relationship of replicas in our contemporary design practices. This lecture will argue that copy and original can coexist in what we will define a state of twoness. The term twoness refers to a status of double consciousness and describes the feeling that you have more than one social identity, which makes it difficult to develop a sense of self.

In particular the lecture will try to define the role of procedural scripting when used in the early stages of architectural design at Atelier Manferdini as a way to produce multiple sketches rather than multiple mass customizable products. The premise is that parametric tools produce a variety of options that are not necessarily used to produce a variety of customized projects for the market, but simply a multitude of initial sketches that architects can use and adapt in their final designs. Multiplicity is not a way of mass-customize a product, but a tool to calibrate an idea.

Customization 4.0: How Industrie 4.0 and Smart Products Enable a New Generation of Mass Customization

Frank T. Piller, Aachen, Germany

The growing individualization of demand and the advent of long-tail markets are forcing companies to re-invent themselves and reach new levels of flexibility. Mass customization is a key strategy to meet this challenge. Over the past decade, we have studied mass customization in more than 200 different organizations. Our Customization500 study provided the first international benchmarking of more 500 companies in BtoC mass customization.

In our research, we found that mass customization is a strategic mechanism that is applicable to most businesses, provided that it is appropriately understood and deployed. Successful mass customization builds on developing a set of strategic capabilities that will, over time, supplement and enrich an existing business.

The talk will introduce these capabilities and then reach out to discuss new opportunities for mass customization provided by smart, connected products and

flexible manufacturing technology provided by digitalization and connectivity (“Industrie 4.0”). Its objective is to provide an overall strategic framework how to profit from mass customization and set up a corresponding business model.

Customering: The Next Stage in the Shift to Mass Customization

B. Joseph Pine II, Cleveland, USA

There are no markets, only customers. The term “market” is a convenient fiction masking the fact that enterprises do not treat customers as the unique individuals they are. Instead, we must restore the original conception of a market as a place where a buyer and a seller freely come together to exchange money for value. In an era where Mass Production no longer works the way it used to, businesses must ascend to the proposition – and irrefutable fact – that all customers are unique and deserve to get exactly what they want at a price they are willing to pay. That is the promise of Mass Customization. But to reach its full potential, businesses must further recognize the term “individual customer” as the redundancy it is, reorienting themselves around each one to become truly customer-centric, placing the one who pays us money at the center of everything we do. For it is each and every customer that is the lifeblood of any business.

Crafting the Future

Virginia San Fratello, San Jose, USA

This presentation will focus on the future of crafting 3D printed architecture and the built environment through the use of innovative, accessible and recycled materials. The term craft traditionally refers to a specialized skill in making but more recently the term crafting has emerged as a form of DIY and self-expression.

Through the exploration of future manufacturing technologies such as 3D printing, local, inexpensive and readily available materials including clay and salt, Emerging Objects is exploring how technology and material promote the crafting of novel, customized architectural products that will serve as the building blocks of the future.

Democratizing Creativity

Chris Sharples, New York, USA

Whether at the object or the urban scale, the suite of tools that make possible current systems of mass-customization have opened up an enormous range of possibilities for consumers of design. On the production side of the equation, however, the implications have largely been limited to two areas: the added value of offering greater choice to clients (or customers), and the increased freedom afforded to designers within traditional process hierarchies. Both understandings may be unnecessarily constrained; the possibility also exists, just over the horizon, for a revolution in exactly where the creative act is situated. Leveraging his experience in the field (with projects such as the modular tower known as B2 and the development of predictive zoning

softwares), as well as research in pre-modern modes of architectural production, Chris Sharples explores the possibilities that may exist for activating current and impending technologies to redistribute design decision-making. Rather than focusing solely on an end-user or purchaser's choice, or the further empowerment of individual designers, for instance, is it possible to steer our new communications-intensive means of production to create a more equitable system in which, like a return to the ethos of the medieval guilds, craft workers themselves can reclaim creative agency in the process of architectural design and construction? If the technique of mass-customization is to expand to the scale of city-building as a salutary force, the holistic consideration of its effects on labor and society only become more pressing.

Architecting for Mass Customization: Reducing the Costs of Complexity

Timothy W. Simpson, State College, USA

Customer demand for individually configured and customized products is on the rise across all industries. Companies are faced with the challenge of maintaining cost and quality while producing customized products with heightened response to individual customer needs. Given recent advances in design and manufacturing technology, how do companies architect their products and their platforms to achieve effective mass customization? How does a company develop a robust, yet flexible, architecture that accommodates an evolving product line? What are the best practices and constraints/inhibitors for using modularity to reduce complexity and balance individual customer needs? In this talk, I will provide an update on an ongoing industry study led by the Industrial Research Institute (IRI) that is focused on the product design and architecture implications of mass customization on manufacturers/producers. The project is using a breadth of approaches and maturity of IRI members (and beyond) to determine best practices to achieve design for mass customization while identifying common pitfalls. A common theme that is emerging in the study is the use of advanced design and manufacturing technologies to reduce the costs of complexity to enable mass customization. Opportunities to engage in the study will also be discussed.

Resolution: 4 Architecture / The Modern Modular

Joseph Tanney, New York, USA

For almost 100 years architects have pursued the Holy Grail of Modernism, which is to design a relatively affordable modern domestic space that could be mass-produced, though with varying degrees of success.

Although the single-family home has historically been a focal point in the exploration of architectural ideas, most people do not live in a custom space designed by an architect. In fact, most domestic structures are conceived by developers as products, produced for profit. The efficiency of mass production, both conceptually and physically, has in many ways contributed to the self-same tombstones representing graveyards of complacency otherwise known as the American suburb.

As an alternative to designing a product to be produced, RESOLUTION: 4 ARCHITECTURE has been exploring a process, a method of design that attempts to

leverage existing methods of residential prefabrication in order to create custom modern homes specific to each client, site, and budget.

Joseph Tanney will present his firm's ongoing prefab experiment, THE MODERN MODULAR, including several recently completed projects, the process of implementation, and the ideas behind the work.

A Call for the Specificity of Cities

Tom Verebes, Hong Kong, China

The legacy of cities in the last century begs new paradigms with which to guide the current era of the greatest project of urbanization ever to occur. Given the vast speed and extent of urbanization, and the risk of building cities devoid of specificities, new technologies are enabling an important transition away from an industrial paradigm of mass production to increasingly bespoke and mass-customized systems, spaces and experiences. The context of today's emerging methods of non-standard production will be explored in this conference paper presentation, with an emphasis on elucidating the design repercussions of this new paradigm at the urban scale. Given the diverse cultures surrounding, within, and against technology, this paper will confront the difficult issues of the expression of identity in late capitalism, through a discourse which negotiates oppositions such as globalization and locality; positivism and nostalgia; and, heterogeneity and homogeneity. The notion of an interactive urban model, is proposed as the basis of embedding intelligence into city design, through the capacity to produce deeply structured variants of highly specific design outcomes. A series of projects by OCEAN CN, within the disciplinary categories of Master planning, Urban Design and Landscape Urbanism, will serve to explicate some of the urban repercussions of computational design and production technologies.