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General Information

BARC0044: History and Theory of Digital Design

last updated 16 Dec 2021. Course description, general bibliography, weekly syllabus and list of guest speakers appended. Itemized content and readings for classes in Jan, Feb, March 2022 will be added each week (scroll down)



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rev DP 15 SEPT 2021 OPTION MODULE: HISTORY AND THEORY OF DIGITAL DESIGN BARC0044(30 Credits)

Module Coordinator: PROFESSOR MARIO CARPO email: m.carpo@ucl.ac.uk

Module Description:

This seminar will assess the present state of computer-based design and fabrication by situating today's digital turn within the long duration of the history of cultural technologies. It will first describe the technical logics of hand-making, mechanical reproductions, and digital making, and highlight the differences between digital variability, manual and artisanal variations, and

the mechanical mass-production of identical copies.

It will focus on some instances of identical reproduction that were crucial in architectural history, and particularly on the early modern invention of architectural notations and of architectural authorship (the rise of the 'Albertian paradigm' in the Renaissance), and on the modernist principle of mass-production and Taylorist standardization in the 20th century. It will then outline a brief history of the digital turn and of its theoretical and technological premises: starting with a brief survey of the "prehistory of the digital" in the 1950s, 1960s, and 1970s, highlighting the roles of Wiener's cybernetics and the first steps of Artificial Intelligence up to and including works of Cedric Price, Gordon Pask, and Nicholas Negroponte; then focusing on the turning point of the early 1990s: the legacies of Post-Modernism, Deconstructivism and the invention of the Deleuzian Fold; works of Bernard Cache and Greg Lynn; the rise of the spline-dominated environment in the late 1990s; the transition from free-form, topology and digital formalism to mass-customization, non-standard seriality and more recent developments in digital interactivity, participatory making and building information modelling (BIM).

Lastly, the seminar will discuss the present state of digital design theory and computation, and particularly the cultural and epistemological implication of Big Data, recent developments in artificial intelligence and machine learning, and their consequences for the making of form (legacy of post-modern complexity sciences, theories of emergence and self-organizing systems, cellular automata, simulation, optimization, material computation, bio-computing, and discretization). Particular attention will be devoted to research on "computational discretism" and robotic automation currently pursued at the Bartlett School of Architecture. Additionally, given the circumstances, this year we shall devote some time to a discussion on the environmental sustainability and the social implications of robotic automation, and to the role of digital technologies and computational tools during the pandemic. Alongside the instructor's presentations, a few guest speakers will present topics derived from their own research or practice. Recent guest speakers included Gilles Retsin, Roberto Bottazzi, Helen Castle, Emmanuel Petit, Marjan Colletti, Nathalie Bredella, Philippe Morel, Daniel Koehler, Claudia Pasquero, Mark Garcia, Jasia Reichardt, and Philip Steadman.

STUDENTS' WORKS:

Students will test these interpretive patterns by developing a case study of their choice (of a media object, object, building, software, or technology).

Basic Bibliography

1 - Textbooks for the course:

Mario Carpo, *The Second Digital Turn. Design beyond intelligence* (Cambridge : MIT Press, 2017)

---, *The Alphabet and the Algorithm* (Cambridge : MIT Press, 2011)

---, *The Digital Turn in Architecture, 1992-2012. An AD Reader* (Chicester : Wiley, 2012)

2 - Additional readings:

---, "Rise of the Machines. Mario Carpo on Robotic Construction." *Art Forum* 58, 7 (2020): 172-79, 235

---, "Digitally Intelligent Architecture Has Little to Do with Computers (and Even Less with Their Intelligence)" *GTA Papers* (Zurich, ETH), 3 (2019) : 112-120. On line publication forthcoming.

---, "Republics of Makers," in *Imminent Commons: Urban Questions for the Near Future*, Seoul Biennale of Architecture and Urbanism 2017, edited by Alejandro Zaera-Polo and Hyungmin Pai, 302-09 (Barcelona : Actar, 2017). Also on line at <http://www.e-flux.com/architecture/positions/175265/republics-of-makers/>

---, "The Alternative Science of Computation," *E-Flux*, New York (electronic publication, June 2017: <http://www.e-flux.com/architecture/artificial-labor/142274/the-alternative-science-of-computation/>)

---, "Breaking the Curve. Big Data and Digital Design." *Artforum* 52,6 (2014): 168-173.

3 - Additional sources to be found in:

Gilles Retsin (ed.), *AD 258* (2019), *Discrete: Reappraising the Digital in Architecture*

Molly Wright Steenson, *Architectural Intelligence: How Designers and Architects Created the Digital Landscape* (Cambridge, MA : MIT Press, 2017)

Daniel Cardoso Lach, *Builders of the Vision. Software and the Imagination of Design* (New York : Routledge, 2015)

Pablo-Lorenzo Eiroa and Aaron Sprecher, eds., *Architecture In Formation* (New York and Abingdon, UK : Routledge, 2013)

Rivka and Robert Oxman, eds., *Theories of the Digital in Architecture* (New York and Abingdon, UK : Routledge, 2013)

Marie-Ange Brayer and Frédéric Migayrou, eds., *Naturalizing Architecture* (Orléans : Frac Center and éditions HXX, 2103)

weekly syllabus : see below

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SYLLABUS JAN-MARCH 2022

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Term 2, Wednesdays 10-1 Room 5.04

(if on line, details of the electronic venue, either prerecorded on UCL lecturecast, live on zoom, or both, will be confirmed each week for each session)

Week 1, Wednesday 12 January

Part 1 - Lecture (MC): Ways of Making. Hand-making, machine-making, digital making (general introduction).

Part 2 - Guest speaker : Philip Steadman (Bartlett): The true story of the Cambridge Centre for Land Use and Built Form Studies, 1967

Week 2, Wednesday 19 January

Part 1 - Lecture (MC): Craft, mechanical mass-production, and digital making in architecture. The technical logics of CNC milling, 3D printing, automation and robotic assembly.

Part 2 - Guest speaker : Roberto Bottazzi (UCL): Machine Learning and Speculative Architecture.

Week 3, Wednesday 26 January

Part 1 - Lecture (MC): Artisan variability and mechanical identity: theories and principles of mass-production and standardization. The technical logic of digital variability and of digital mass-customization. From a mechanical to a digital paradigm: from economies of scale to a new economy without scale.

Part 2 - Guest speaker : Daniel Cardoso Llach (Carnegie Mellon University, Pittsburgh, PA) : Materials, Graphics, and Interactions: A CAD Origin Story in Three Movements

Week 4, Wednesday 2 February

Part 1 - Lecture (MC) : Examples of digital mass-customization from consumer goods, daily life, and apparel. Digital tailoring, 20 years of (mostly failed) experiments.

Part 2 - Guest speakers : Helen Castle (RIBA) and Neil Spiller (Editor, *AD*, Wiley): The Digital Turn in Architectural Design (*AD*): intelligent ideas propagated by a small magazine

Week 5, Wednesday 9 February

Part 1 - Lecture (MC): The rise of digital mass-customization. Precedent: the industrial standardization of branded drinks and food. Coca Cola, Seagram. The standardization of the hospitality industry: the Hilton hotel chain in the 1960s. From modernist standards to the post-modern quest for differentiation, variation, and choice. Digital mass-customization and the implementation of the post-modern quest for consumer's choice. Societal and political implications: the digital mass-customization of daily life.

Part 2 - Students presentations and/or discussion.

Week 6, reading week

Week 7, Wed 23 February

Part 1 - Lecture (MC): Technical history of electronic computing. From the Turing Machine to the ENIAC (1946). Norbert Wiener's theories of analog feedback and the invention of Artificial Intelligence in the late 1950s. Marvin Minsky, the connectionist and the symbolic approach to AI.

Part 2 - Guest speaker: Gilles Retsin (Bartlett): Discretism, a new theory and practice for computational design

Week 8, Wednesday 2 March

Part 1 - Lecture (MC): Cedric Price, Archigram, "Cybernetic Serendipity" and electronic art, circa 1968. Nicholas Negroponte and the Architecture Machine. The fall of cybernetics and the "winter of Artificial Intelligence" after 1975. Post-modernist reactions against cybernetic High-Tech: the 1980s and the rise of personal computing. Technical timelines of early CAD. The turning point of 1993.

Part 2 - Guest speaker: Bernard Cache (EPFL- Lausanne): Objectiles.

Week 9, Wednesday 9 March

Part 1 - Lecture (MC): Bernard Tschumi and Columbia's paperless studio; *Folding in Architecture*; the rise of spline-modeling. The end of the notational bottleneck. Free form, folds, blobs, topological geometries and digital form-making in the 1990s. Peter Eisenman, Greg Lynn, formalism, and the Deconstructivist legacy. A short history of splines, from craft to digital streamlining. The rise of the "first digital style" at the end of the 20th century. Frank Gehry and Zaha Hadid.

Part 2 - Guest speaker: Mark Garcia (Bartlett): Post-humanisms, and Object Oriented Ontology

Week 10, Wednesday 16 March

Part 1 - Lecture (MC): Theories of despatialization and virtual reality in the 1990s. Bill Mitchell's *City of Bits*. "Architects in Cyberspace." The participatory turn that never was: agency and participatory authorship in a new age of variable media. Invention of the Web 2.0 in the early 2000s; issues of non authorial form-making. Francis Galton and the "wisdom of crowds": the Open-Source movement, Wiki-Building, BIM.

Part 2 - Guest speaker: Matias del Campo (Taubman College of Architecture, University of Michigan): GAN and Style Transfer

Week 11, Wednesday 23 March

part 1- lecture (MC): Theories of indeterminacy, complexity and non-linearity: "emergence," self-organizing systems, form-finding, material computation. Problems and perspectives of the present: Big Data and "a new kind of science." Simulation, optimization, generative and evolutionary algorithms, cellular automata,. The "Second Digital Turn": brute-force computing, the revival of Artificial Intelligence and the post-scientific methods of machine learning. Problems and perspectives of the present: toward a post-digital computation.

part 2 - students presentations.