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Lessons to Learn?
Past Design Experiences and Contemporary Design Practices

Proceedings of the ICDHS 12th International Conference
on Design History and Design Studies

Edited by: Fedja Vukić, Iva Kostešić
Zagreb 2020

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Herbert Simon in the Design Field

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Design methodology, design theory, design history, management and planning

The organisational theorist Herbert Simon is one of the most important authors in the design field today. His book The Sciences of the Artificial *(1969) is considered a milestone in the development of design theory and is extensively quoted by scholars. In it, Simon advocates for the existence of a science of design concerned with 'how things might be' in contrast to the natural sciences, which are concerned with 'how things are'. However useful this definition is to the design field, its theoretical background and aim differ considerably from the tenets of modern design upon which the field constituted itself historically. Thus, in order to comprehend Simon's influence, it is necessary to investigate his life and work as well as the process through which his theory was integrated into design research. In this article, we consider solely the first main literary landmarks of this process, and, in this way, try to contribute to the understanding of the ongoing shift towards a more managerial view of the design process. Simon's theory is seen then as part of a common effort to illuminate the design process as such in the post-war period.*

The Sciences of the Artificial

Not only theories, but also practices constitute the design field. And so it is convenient, from time to time, to look into the making and canonisation of theories in order to understand why certain works or figures have become relevant to the field.

The central position of the political scientist, cognitive psychologist, computer scientist and organisational theorist Herbert A. Simon in the field of design is one of those cases that calls for an investigation. This does not mean simply to question the intrinsic value of his body of work or to dispense altogether with his thinking. We mean to throw some light upon the historical process that culminated in the adoption of Simon's theory by most design theorists today.

Simon's 1969 book *The Sciences of the Artificial* is regarded as one of the main references in the specialised literature. As DJ Huppatz (2015) puts it, the book 'has long been considered a seminal text for design theorists and researchers anxious to establish both a scientific status for design and the most inclusive possible definition for a 'designer' (p. 29). Considering this, it actually contributes to the ongoing project of establishing a rigorous design discipline in higher-education systems. A single passage of it has been extensively quoted and has recently set the tone for many academic papers: 'Everyone designs who devises courses of action aimed at changing existing situations into preferred ones' (Simon, 1996b, p. 111).

This is understandable, considering Simon's proposal of a new general science that covers a wide range of practical activities, including engineering, medicine, business, architecture and painting, and attends by the name design (Simon, 1996b, p. xii). The core definition of this science is laid out in another famous quotation, stating that those activities 'are concerned not with the necessary but with the contingent — not with how things are but with how they might be — in short, with design' (Simon, 1996b, p. xii). This puts design at the centre of the sciences of the so-called artificial world, in contrast to the sciences concerning the natural world.

At first, it seems that this definition must have immediately drawn the attention of designers and theorists in the design field. But that was not the case. Literary evidence shows that the incorporation of Simon's vision of design only started after 1980, mainly through the effort of one author. Yet this is no surprise, considering Simon's background and aim.

The Origins of Simon's Concept of Design

Herbert Simon graduated in the 1930s from the University of Chicago, during a time when a small revolution in the social sciences was under way (Simon, 1996a, Chapter 4). This revolution amounted to the use of behavioural concepts and empirical quantitative data in the analysis and critique of politics, and gave rise to the Chicago School of Political Science. In short, the Chicago School (to which Simon adhered) proposed the scientific study of politics as the study of human behaviour. In the course of the next few years, still owing to behaviourism, Simon expanded his knowledge and experience in a number of correlated fields, especially in public administration and organisational development (Friedmann, 1996). His doctoral thesis — published in 1947 as *Administrative Behavior: A Study of Decision-Making Processes in Administrative Organizations* — was considered a milestone in the development of the behavioural sciences within the field of management. Its main concepts, considered relatively new, were that of decision-making processes and the 'bounded' nature of the rationality of decision-makers. Simon is considered a central figure in public administration, policy science and planning theory, having absorbed several intellectual traditions into his own thinking, such as the rationale of public administration and scientific management, and 'approached the bureaucratic process from a behavioural perspective' (Friedmann, 1996, p. 11).

In 1949, Simon received an invitation to establish a business school at the Carnegie Institute of Technology in Pittsburgh, together with its Provost Elliott Dunlap Smith and the chairman of the Economics Department, Lee Bach. It was called the Graduate School of Industrial Administration (GSIA). On this occasion, Simon worked to create a new type of professional school, trying to combine 'education in both artificial and natural science at a high intellectual level' (Simon, 1996b, p. 113). His effort addresses the 'deep gulf' between the scientific and the 'applied' disciplines (Simon, 1997, p. 352). Simon and his colleagues considered business education at that time as 'a wasteland of vocationalism that needed to be transformed into science-based professionalism' (Simnon, 1996a, Chapter 9). The same attitude was initially adopted later on, in the early 1960s, in the curriculum reform of the Engineering College at the same institution. But then, there was a twist:

'My initial views were that engineering education needed less vocationalism and more science.

With my experience in GSIA and a wider view of the world, I began to see things a little differently [...]

As I began to understand the trends in the stronger engineering schools, I saw that [...] science was replacing professional skills in the curriculum. [...] Professional skills were disappearing from the curricula, and professionals possessing those skills were disappearing from the faculties.' (Simon, 1996a, Chapter 16)

So Simon began 'to urge Carnegie Tech to restore design and designers (or theorists of design) to its Engineering College' (Simon, 1996a, Chapter 16). Basically, he advocated for the teaching of principles and methods not only of analysis, but also of synthesis, considering that, in engineering, people act on real situations and 'design structures and devices and processes' (Simon, 1996a, Chapter 16). In his view, design was to be taught as a science, but a science of the 'processes of synthesis'; and, for that, 'an explicit, abstract, intellectual *theory*' was needed (Simon, 1997, p. 354).

From the debate on the engineering curriculum came the subject matter of Simon's lectures at the Massachusetts Institute of Technology in 1968. They were entitled *The Sciences of the Artificial* and were the beginnings of the book Simon published in the following year (Simon, 1996a, Chapter 16). One of the lectures was dedicated to the science of design and gave a prescription for a curriculum in design (Simon, 1996a, Chapter 16).

In sum, Simon's interest in design and proposal of a science of design stem from his reflections of the role of scientific disciplines in professional education and from his experiences in establishing curricula

in an institute of technology and business. Thus it is only natural that Simon's theory overlooks the issues traditionally pertaining to the education of the arts, such as aesthetics and style. But ignoring this aspect may lead to a misinterpretation of his ideas. This is often the case when Simon's definition of design is merely inserted into an argument still bounded by the tradition of art and architecture.

As a result, Simon's science of design is in fact very much at odds with the principles of modern design. This discrepancy is revealed during the brief time Simon taught at the Illinois Institute of Technology, where the great architect Ludwig Mies van der Rohe also taught. Relating to the same students, Simon concluded that the 'functionalist' architecture advocated by Mies meant the designing of 'structurally honest' buildings, that is to say, buildings that worked 'visually'. The professional architect was viewed as an 'artist, whose task is to build beautiful buildings' or to 'produce a great work of art' (Simon, 1996a, Chapter 7). Simon's course was on urban land economics, but he found that, for the architecture students, economics was 'a dirty word' and that they 'desired above all to preserve their profession for the expression of noble artistic impulses and to protect it from the baneful influence of money-grubbing speculators' (Simon, 1996a, Chapter 7).

Parallel Initiatives in the Design Field

There is no strong evidence that Herbert Simon's proposal for a science of design was heard at the time by the architecture and design community. Simon himself wrote that '[t]here was no immediate seismic response' to his lectures on the sciences of the artificial, 'but, in their published form, they began to attract more and more notice' (Simon, 1996a, Chapter 16). This may be because other scientific accounts of the design process were starting to circulate around the end of the 1950s, but in different contexts.

Firstly, there was a major change in the course of education at the Hochschule für Gestaltung in Ulm, Germany, between 1956 and 1958. Its first rector since 1954, Max Bill, left and the new school board made a shift in design education from the arts and crafts tradition, bequeathed by the Bauhaus, towards more scientific methods of teaching and designing (Lindinger, 1991). In the words of Tomás Maldonado (1965), considering the new order of problems of the post-war world, a new 'methodological dimension' was needed in the development of future designers. It would conjugate theory and practice and consolidate a design methodology. In the same context, Horst Rittel tried to apply ideas from cybernetics and operational research to design (Huppatz, 2015, p. 36). But those ideas developed to the point of critique: as early as 1964, Maldonado and Gui Bonsiepe pointed out the

dangers of Ulm's 'methodolatry' (Maldonado & Bonsiepe, 1964). Besides, the artistic trends inside the school never completely ceased to exist. The school was closed in 1968, due to financial problems and political tensions between the students, the faculty and the local authorities.

Secondly, there was the so-called Design Methods movement, which was born by means of a conference in London in 1962. Similarly to the Ulm School, the movement proposed the general study of designing methods, apart from the specifics of each project. It revolved around the concepts of problem and process, and posed the possibility of combining intuitive and systematic methods of designing. Unlike the Ulm School, though, the Design Methods movement was multi-professional: it remained for a long time, through other initiatives, such as the Design Research Institute, a meeting point for engineers, architects and designers of different strains.

But by the early 1970s, this common effort lost a lot of its steam. Some of the exponents of the movement, such as John Christopher Jones and Christopher Alexander, rejected its tenets, recanting previous positions. They reclaimed the importance of intuition and personal judgment in the design process, looking suspiciously to its possible full mathematisation. Roughly at the same time, some side figures, such as Bruce Archer at the Royal College of Art in London, introduced a different line of investigation, giving rise to a design research centred on the concept of material culture and on special ways of dealing with design problems (Archer, 1979a, 1979b).

The legacy of the Ulm School and of the Design Methods movement can be found concentrated in one idea: the idea of 'problem' and of the design process as a problem-solving process. It is fair to say that this idea paved the way for the integration of Simon's work into the field of design. In the proceedings book of the second Design Methods conference, organised by Sydney Gregory, first references are made to Herbert Simon and Allen Newell, regarding a number of texts on artificial intelligence and problem-solving techniques (Gregory, 1966). Before that, Simon is mentioned only in passing in the Ulm School magazine (Maldonado, 1965, p. 11). It's worth noting that these references precede the lectures on the sciences of the artificial and are quite independent of them. They signal a growing interest of design theorists in the conceptual language of general problem-solving systems and also in the rigorous mathematical framework for posing problems.

Despite the initial claims of the Design Methods movement to integrate intuition and method, in the examples seen in the 1966

publication, there are no accounts of the behaviourism underpinning the theories of Simon and Newell. Their mathematical and logical devices are taken at face value and applied to design problems in a trusting way. Nevertheless, at that point, their application and the consequences to design theory are only marginal. Still, they are evidence of an early alignment of a certain strand of design research with engineering and management.

Design Methodology and Wicked Problems

An overview of the design literature indicates that the first major author to assess and encompass Herbert Simon's ideas in his own thinking is Nigel Cross. Cross was trained as an engineer and became a key figure in the Design Research Society. In the beginning of the 1980s, accompanied by John Naughton and David Walker, Cross quotes Simon's 1969 book. But his line of argument goes initially in a different direction:

'The basic text on which is founded the faith of the would-be 'design scientists' appears to be H. A. Simon's The Sciences of the Artificial. *In this slim volume the paradoxical 'design science' attitude is again strikingly evident. [...]*

Despite the openly acknowledged fundamental distinction between science and design, Simon went on to outline a series of elements that would embody 'the science of design' [...] The examples of the elements of this emerging doctrine [...] included several that are now regarded as of dubious value in a design context; for example, methods of optimization borrowed from management science (sic), and methods of problem structuring based on the hierarchical decomposition techniques developed by [Marvin] Manheim and [Christopher] Alexander.'
(Cross & Naughton & Walker, 1981, p. 195)

For Cross (1981), the focal point of the design field is not science, but design proper methods. In this regard, design is more closely identified with technology (Cross et al., 1981, p. 198). Nevertheless, Cross follows the main thread of problem-solving theory in his proposal for a design methodology. In his famous next article, 'Designerly Ways of Knowing', he regards Simon's concept of satisficing as a 'central feature of design activity' (Cross, 1982, p. 224). And on this occasion, he accepts Simon's discerning between the sciences 'concerned with how things are' and the sciences 'concerned with how things ought to be'. But his view of what constitutes the nature of design problems is crucially different.

Cross refers to 'ill-defined, ill-structured, or 'wicked' problems, that is, problems 'for which all the necessary information' cannot be available (Cross, 1982, p. 224). They are 'not susceptible to exhaustive analysis' and in relation to them 'there can never be a guarantee that 'correct' solution-focused strategy is clearly preferable to go on analysing 'the problem' (Ibid.). Yet, a solution to these problems must be and often is found. The question is then *how* designers are able to do it.

The succinct answer is that there are 'designerly ways' to do it. Cross takes up the expression first used by Bruce Archer in 1979 to refer to a way of coping with problems that is different from the procedures of science and academia.

The idea that there is a special nature to the design problems is found in its most complete form in Horst Rittel's description of wicked problems. In an article in 1972, Rittel defines a class of problems that are intrinsically unsolvable by the methods of the natural or logical sciences (Rittel, 2010). They are 'wicked' in opposition to the 'tamed' or well-definable problems of those sciences, whose parameters of solution can be properly set. Wicked problems, on the contrary, depend on foreseeing solutions to even be defined, and so they don't have a closed set of solutions. In other words, if design problems are wicked problems, then the designer oscillates back and forth between possible solutions and possible determinations of the problem. Cross concludes that

'In order to cope with ill-defined problems, the designer has to learn to have the self-confidence to define, redefine and change the problem-as-given in the light of the solution that emerges from his mind and hand.' (Cross, 1982, p. 224)

In view of this process, Cross evokes Simon's 'satisficing' process: a process of 'producing any one of what might well be a large range of satisfactory solutions rather than attempting to generate the one hypothetically-optimum solution' (Cross, 1982, p. 224). According to him, a process of satisficing applies to the practice of a myriad of professionals including architects, urban designers and engineers.

In this way, Cross (1982) manages to articulate Simon's fundamental insight about the design process with its own main critique, that of the ill-structuredness of design problems. Rittel's (2010) account of wicked problems is explicitly made against the first-generation approach to systems theory. Although Simon is not named, it is easy to see the major obstacle the concept of wicked problems represents to any theory of problem solving. The conceptual outlet for this quandary is, as much for Rittel as for Cross, the study of the ways designers actually think and work. That in turn opens a psychological strand of design theory and epistemology.

The Crossing of Theories

The defining moment of Herbert Simon's entrance into the design field as a major theorist is Nigel Cross's (1984) edition of *Developments in Design Methodology*.

The volume consists of texts that range from 1962 to 1982. Most importantly, it puts authors belonging to different schools of thought side by side, such as John Christopher Jones, Herbert Simon and Horst Rittel. Cross (1984) writes an introduction to each grouping of texts in which he tries to reconcile different theoretical positions. The publication was quite successful. Nevertheless, Archer's text 'Systematic Method for Designers', for example, is placed among those presented in the Design Method Conferences, when it's known that, despite its specific subject, Archer has a distinct line of thought. And serious omissions should also be considered, such as of the writings of Tomás Maldonado.

More surprising, though, is the appearance of Simon's 'The Structure of Ill-Structured Problems'. The text was originally published in 1973 in a periodical about artificial intelligence. In it, Simon presents the case of designing a house and tries to give an account of the design process as if the designer (in this case, the architect) was an information-processing system. In accordance with his previous inquiries, Simon describes the way an intelligent being (artificial or not) may take on a problem considered ill-definable. But, unlike other authors in the same publication, such as Rittel, Simon does not account for the intuitive dimension of the design process. One then wonders what role Simon plays among authors who had already questioned the fundamentals of design problem-solving theory and the impersonal character of linear decision-making processes. As can now be deduced, the trouble with Simon's account of the design process was not exactly the lack of empirical evidence for his claims, but the theoretical framework implied in his discourse. As Archer puts it in a text reproduced at the end of the same publication:

'One of the features of the early theories of design methods [...] was their directionality and causality and separation of analysis from synthesis, all of which was perceived by the designers as being unnatural.

Another problem was that design theories were so often communicated in language that was alien, too. I do not mean that the wrong kinds of words were used. I mean that words or mathematics or scientific notation alone were themselves inappropriate.'
(Archer as cited in Cross, 1984, pp. 348 – 349)

Final Remarks

After Nigel Cross, many design authors include Herbert Simon among their references. For them, Simon's theory of design represents a turning point in the ongoing interweaving of design and management disciplines. Above all of them stands Richard Buchanan who studied in the same institution where Simon taught and knew the man himself (Buchanan, 2004). Combining the works of Simon and those developed inside the Ulm School, the Design Methods movement and the Royal College of Art, Buchanan integrated the artistic, scientific and managerial dimensions of design into his own thinking and teaching. And following the trail left by him, much additional research on the close relations between management, the service economy, design and information systems has recently come into being.[1]

1 *Cf. Richard Boland Jr. & Fred Collopy (org.), Managing as Designing (2004); Sabine Junginger & Jürgen Faust (org.), Designing Business and Management (2016).*

Nevertheless, if one does not remain attentive to the subtleties of theory, there is a great chance of hitting an impasse, where one has to choose between two conceptions of design: either a modern art approach or an abstract process. As seen in Simon's critique of Mies's doctrine, this conflict is not easily shaken off. It all depends on what one considers to be a proper design problem and how to appropriately deal with it.

On one hand, modern design considers world problems in terms of their bare materiality and aims therefore to produce change through the reshaping of environments. According to this conception, the designer stands above other professionals and should assume the role of coordinator of production. On the other hand, design methodologists address complex problems that concern no one in particular. They are simultaneously social, political, technological and environmental, and can only be tackled through the coordination of different types of knowledge and skills. Yet, they are also problems of form, and thus also need the cooperation of form-giving experts.

In this regard, the concept of wicked problems became very useful. It is responsible for the expansion of the scope of design activities and for the integration of art, science and business into a potentially new model of education. But, historically, the concept owes much to the first generation of systems theorists. Among those who helped make the transition from modern design to design methodology is Herbert Simon. In the end, Simon's organisational theory considers above anything else the importance of coordinating actions and communicating plans. And those factors may be vital in tackling the complex problems that concern us all today.

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