Randomness and control in design processes: An empirical study with architecture students

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The aim of this study is to explore designers' preferences between randomness and control in the generation of architectural forms. To this end, a generative computer tool was implemented that allows both random and controlled generation of elements. An assignment was given to fourth-year Architecture students which involved the designing of several megastructures using the tool. Results show that both randomness and control can have their own space and play a complementary role in design. Most students were willing to explore randomness and were able to exploit it to generate good designs. However, some of them have certain degree of preference for more controlled solutions.
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The use of randomness in design has been considered and analyzed by many researchers, usually by means of case studies (Goldschmidt, 1994) or computer based simulations (Petre, Sharp, & Johnson, 2006). Randomness can help designers in the initial stages of the process or even can be present in the final result for the sake of visual pleasure (Verbeeck, 2006, p. 73).

This paper performs an empirical study of randomness in design processes. More concretely, our research goal is to determine the degree to which novice designers are willing to perform random explorations in a design space, that is, the degree to which they exploit randomness, prefer random to controlled results, and are able to obtain 'good' designs by means of partially random processes. To this end, an interactive computer tool has been designed and implemented by the authors and has been offered to a group of fourth-year Architecture students. The students were asked to perform a certain design task, and the resulting work was analyzed in terms of randomness and quality. Another research goal of this work is the evaluation of the computer tool in order to continue this research, and eventually modify it in such a way that it can be used in a more realistic design environment. Therefore, students also had to complete a survey giving their opinions on the task and the tool.

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1 Randomness in design

A certain amount of uncertainty and randomness has sometimes been advocated for the first steps of design processes. The intended benefits are twofold: allowing for computational design exploration, and introducing an unintentional influence that forces reinterpretation of the whole design (Verbeeck, 2006). Some well known cases are cited to support this approach. For example, it is said that Alvar Aalto (Quantrill, 1983, p. 5) commonly made random pencil marks and unconscious drawings, from which he developed relevant forms in his architectural design process. Aalto would use these random marks as stimuli in the development of ideas for building forms and designs.

Some experiments have also been carried out that support these ideas. In one of them (Goldschmidt, 1994), an architecture student had to design a kindergarten on a given urban lot. He decided to start his project using a random drawing which then shifted to a structured drawing. In Figure 1, we can see some steps of the design process, from a random start to an elaborated solution.

In other research (Petre et al., 2006) on the exploration of ideas in knitwear design, evidence was gathered on how designers perform their task and then a computational model was implemented that placed motifs and objects partially at random. The program was able to produce interesting designs similar to those generated by human designers.

So far we have taken the concept of *randomness* for granted. However, the concept of randomness is not clearly defined. From a mathematical point of view, Chaitin's randomness (Chaitin, 2001, chap. 8) relates the randomness of an object to the properties of its generating algorithms. Chaitin says that 'something is random if it is algorithmically incompressible or irreducible', i.e., if the simplest rules to generate the result are as complex as the result itself. But this is not always the concept of randomness that we use in everyday life. The popular meaning of the term is quite different, and usually it is associated with unpredictability and seen as opposite to 'order', and sometimes simple rules can generate what looks to be a totally disordered object. For example, Wolfram (Wolfram, 2002) has extensively studied randomness in nature by means of deterministic, simple cellular automata that compute seemingly random patterns. Hence it could be said that 'visual randomness' is not always the outcome of a real random process.

In architecture and visual arts the same reflections also apply. As Verbeeck remarks, 'even in its visual complexity, a Jackson Pollock painting can be considered the result of a limited set of rules' (Verbeeck, 2006, p. 57) and he even tries to express Pollock's 'action paintings' by means of a shape grammar.