

Process Issues are Integral to the Science of Design

Leon J. Osterweil
Department of Computer Science
University of Massachusetts
Amherst, MA 01003

I find it significant that the word “design” is both a noun and a verb. Considering it as a noun, it denotes a conceptual structure that consists of a variety of elements, generally of a variety of types, interconnected and constrained by a variety of relations. If there is to be a science of design it seems that it would have to address the question of how to define a design as such a web of artifacts, focusing on the nature of the artifacts, and especially upon the nature of their relations to each other. As this web of artifacts is typically quite large and intricate, it seems reasonable that the designer could benefit from assistance in strategizing and executing its creation. The process of executing the creation of a design (the noun) is referred to as design (the verb). Just as it seems essential to be precise about defining the web of artifacts that is the design (noun), it seems to me to be equally essential to be precise about the process of creating this web of artifacts (design, the verb).

There are myriad reasons for being interested in design. These range from a desire to be sure that a specific design will facilitate the creation of end-products of known (presumably superior) quality, to a desire to understand the quintessential dual nature of this noun/verb. Again, in all of this, process issues seem central. At the utilitarian end of this spectrum there is an interest in using designs to develop better end-products more inexpensively and quickly. Studying the characteristics of a design should be helpful in doing this, and it seems that there are many sorts of characteristics that would need to be studied (eg. completeness, consistency, and breadth). The determination of these many characteristics is a process that is potentially substantial in size and scope. Performing it poorly or inefficiently could reduce the value of the design. Thus, the process of doing design evaluation and analysis seems important.

But it seems that design (the verb) is also an important product, important for a variety of reasons. Most straightforwardly, it seems reasonable to expect that superior end-products tend to result from superior designs (the noun) which, in turn, result from superior design (the verb) processes. This suggests that the ability to study and evaluate the process of design (the verb) should be integral to any science of design. While it is important to devise designs (the noun) and evaluate their quality, it seems equally important to be able to devise design processes and evaluate their quality as well. The latter entails process specification and analysis, while the former seems to require product specification and analysis, strongly informed and influenced, however, by process design and analysis as well.

My ongoing interest in process definition drives me to focus particular attention on design. While it has been speculated that process definitions might help in carrying out such software processes as testing and configuration management, it has been even more widely suggested that process could be of little help in design. It is far from clear to me that this is true. Attention has been focused on the fact that design revolves around a highly creative, quintessentially human, activity. Far less attention has been focused on the fact that this creative activity needs complementation by a welter of such more mundane activities as cross-checking and documentation. These activities, moreover, become of much greater importance during design evolution. Thus, the application of process technology to the support of the processes of developing, analyzing, and evolving design seems quite reasonable, indeed essential. The evaluation of the hypothesis that design is materially aided by process seems eminently worth evaluation.

In recent work with my Ph.D. student, Aaron Cass, we have demonstrated that our Little-JIL process formalism, augmented by the use of a constraint-checker, can be used to define processes that seem to materially aid novices in the creation of object-oriented designs of superior quality. The reactions of users to variations in these design processes seem to us to be potentially useful tools in determining what aids human designers want and need. In particular, we are noting resistance to certain forms of assistance, and more ready acceptance of others. That, in turn, seems to promise to provide insights into the nature of design, and the ways in which humans perform designing. Subsequent work aimed at supporting expert designers is planned. This work should provide further insights. All of this should contribute to the maturation of the science of design.

In summary, the careful study of design seems tightly intertwined with process issues. Processes are inherent in evaluating the characteristics of design, and in their use in the development of products. In addition, the activity of design is itself a process. Processes can facilitate its performance, and can also be useful in elucidating its nature.