Abstract

Golden Tools in Green Design:
What drives sustainability, innovation, and value in green design methods?

by

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What do product design teams value in sustainable design methods? Specifically, what kinds of activities and mindsets comprise different design methods, and which ones do design teams believe drive sustainability, innovation, and other value? How could they be combined to improve sustainable design's value to companies? This study was the first to deconstruct green product design practices into their constituent activities and mindsets to characterize them and hypothesize their potential synergies. It was also the first to empirically test and compare what practitioners value within three of these sustainable design practices—The Natural Step, Whole System Mapping, and Biomimicry.

Others have identified mindsets in sustainable design practices, or have identified activities in general engineering design practices, but none have done both for sustainable design practices. Such analysis is important, because most designers do not follow design methods like tunnels of process to pass through completely, but like toolboxes to draw from opportunistically. Here, fourteen design methods, guides, and certifications were deconstructed to categorize their component activities and mindsets, and hypothesize what designers, engineers, and managers would consider useful tools to select for different purposes, or could combine to multiply their value. It also hypothesized some green design methods might be preferred by designers, while others might be preferred by engineers or managers.

Empirical testing of the activities and mindsets within The Natural Step, Whole System Mapping, and Biomimicry measured their value for general purposes, sustainability, and innovation. It did so by providing 29 workshops on these design methods to 520 participants, with 376 survey respondents: 172 professionals from over 30 different companies and 204 Berkeley students, totaling 836 pre- and post-workshop survey responses, due to many people participating in multiple workshops. This testing of multiple design methods was new because most literature on sustainable product design either treats all sustainable design the same, or proposes a specific new design method and studies it. Quantitative and qualitative analysis of survey results validated the earlier deconstruction and found "golden tools" in each design method: In The Natural Step, Backcasting was most valued, largely for its strategic benefit of focusing thought to accomplish goals, and providing a new lens. In Whole System Mapping,

Draw System Map was most valued, largely for broadening scope, visually showing the larger system, and aiding collaboration. In Biomimicry, Nature as Mentor was highly valued as a new lens to approach problems, and for being inspiring; AskNature.org was greatly valued for providing new ideas and for being interesting / engaging. Some of these and other components of the design methods were valued for sustainability, innovation, or both, and some for neither. Results were broken down by demographics (job role, company type, company size, industry sector, and gender) to see if different groups valued different things, as hypothesized above. However, differences were generally too small to be statistically significant at these sample sizes, which implies that sustainable design methods can be taught and used universally between all these groups, even though individuals vary in what they most value and why.

In addition to these theoretical analyses and empirical tests, 42 professional designers, engineers, and managers were interviewed at the beginning and end of the study to help establish background context for the research, recommend what green design methods to analyze, validate survey responses, and test for longer-term impact of workshops. They valued a wide range of design practices for several different reasons; some design practices were valued for both sustainability and innovation. Differences in responses from sustainable design experts versus traditional design practitioners showed how specialized skills help sustainable design; this implied design teams should not merely use standard design practices while thinking green thoughts. Multiple respondents mentioned the value of combining green design practices with both each other and traditional design practices. The interviews also investigated how design professionals measure innovation, though they were surprisingly resistant to the idea of quantifying it. Interviews also investigated who can best lead sustainability in design teams, why sustainability might provide business value, and how adoption of sustainability might best be driven in design teams.

This study's results should help designers, engineers, product managers, and others who create our material world to practice sustainable design more effectively. It can help practitioners mindfully choose and combine golden tools from various green design toolboxes to build a better world while building business value.