Project Title: Communicating and Modeling Sustainability in Design
Research Thrust Area: New Design Paradigms and Processes, Optimization
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Need and Industrial Relevance:
- Engineers spend much effort on designing sustainable products, but this effort may be wasted if customers do not value this work
- Sustainable products need to communicate their sustainability to the customer through design
- Models of environmental impact need to include customer decisions in order to have predictive power—if people do not buy the product, then the predicted environmental savings is lost

Project Goals:
- Improve the manner in which sustainable design is addressed in engineering research by exploring seven cognitive concepts related to sustainable design and using optimization of interdisciplinary design models
- Motivate all customers to think about sustainability when they purchase and use products

Objectives:
- Forge a new line of customer-(and manufacturing) engineering design research: design for consideration
- Create design methods focused on sustainability using the “Seven Cognitive Concepts for Sustainable Design”
- Use mathematical models to represent customer decisions and the changes that can be made to those decisions through engineering design improvement

Approach and Methods:
There is a clear market demand for sustainable products and engineers are responding to this demand with rigorous sustainability analysis, such as Life Cycle Assessment and related the inclusion of materials and manufacturing methods that decrease environmental impact. Unfortunately, it is difficult to communicate these efforts to customers interested in buying sustainable products for a number of reasons: the associated product modifications are often “hidden” in a well-designed product; customers are unlikely to trust green marketing claims; and the customer decision process regarding the purchase of sustainable products is complex—even though customers may request sustainable products, sustainability may not be something they consider when they actually make their purchases. To this end, we are creating design methods based on seven cognitive concepts that
customers must grapple with when they purchase sustainable products. One aspect of research thus far proposed that the best way to communicate sustainability is in the design of the product itself. We created a method that “primed” the designer for a heightened focus on sustainability communication through the performance of sensory-focused pre-conceptualization exercises. The exercises serve to raise awareness of the communication of sustainability during the conceptual design process to a level on-par with life-cycle impact analysis. The research has demonstrated that this new method significantly increases the number and effectiveness of design attributes judged to communicate sustainability. The next phases of the research are to physically prototype the generated design concepts and test their effectiveness with potential consumers; and to test if these features designed to communicate sustainability are focal areas of interest in product images, using eye-tracking technology. Once effectiveness with consumers has been tested at a basic level, we will perform a deeper mathematical analysis into modeling change in purchases of sustainable products (and increased profitability) when sustainable features are better-communicated.

Another research program underway is the modeling of customer decisions regarding sustainable products – what changes in environmental impact when we do effectively communicate sustainability to the customer? This line of research substantiates the need for new design methods in this area. Optimization is used in this approach, and customer decisions are begin modeling in a new way for engineers, as a consider-then-choose two-stage decision-making process.

The figure below gives a general description of the interdisciplinary design projects that the IRIS (Interdisciplinary Research In Sustainable) Design Lab investigates. Other projects within these fields can be developed to address particular design issues.
Outcome/Deliverables:
New design methods and models that promote the purchase and use of sustainable products.

Impact:
- Increase the demand for sustainable products and the profitability of companies that offer such products
- Increase R&D resources devoted to the design of sustainable products
- Establish sustainable design as both a customer-and product-driven field
- Decrease our burden on the environment

Project Duration (plan and timeline):
Tasks and timeline would be determined in conjunction with the industry partner, a two-year project overall. Several different projects are underway and could be steered pending industry goals and interest.

Proposed Budget: $30,000 per year for two years