Design for Manufacturing Decision Tool for Additive Manufacturing

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Background
The possibilities of 3D printing and Additive Manufacturing are rapidly expanding. In order for product designers to capitalize on this, they must:

• Know when it is best to use Additive Manufacturing
• Design the physical part for 3D printing
• Make this decision as early as possible

Approach and Method
Quickly and effectively decide the best design alternative by:

• Incorporating and expanding Analytic Hierarchy Process (AHP) and Quality Function Deployment (QFD) to better facilitate a decision
• Analyzing and prioritizing multiple Design Criteria
• Comparing their relationship to the needs of the customer
• Considering and evaluating different product designs and manufacturing processes
• Combining performance evaluation and cost analysis to investigate how the best direction changes with product

Objective
Develop an Early-Stage Design Decision Tool to allow designers to know whether or not to use additive manufacturing, considering other factors and alternatives.

Creating an Application
Using MATLAB, Rachel Unger and I have developed a standalone application that:

• Allows user to fully execute the decision making process.
• Provides structured framework to manage information and data.
• Incorporates and considers additional metrics, such as Boothroyd-Dewhurst’s Ease of Manual Assembly.

• Quickly collects and visualizes data
• Fully customizable parameters and easily editable user interface.

Potential Application Areas
• Extends across multiple manufacturing and design domains.
• This holistic method has the potential to apply to all projects.
• Application compares additive manufacturing, injection molding, CNC and is able to analyze a customized manufacturing process.

Benefits
Industry partners, such as Raytheon, are interested in this application because it can:

• Help make informed decisions, earlier.
• Dramatically improves time to market
• Reduce risk associated with early stage design decisions
• Reduce cost associated with delayed/incorrect decisions.

Case Studies
Haptic Mouse
A mouse that is able to measure and supply force feedback to aid in stroke rehabilitation.

Figure (1): Showcases the difference between a part designed for a standard manufacturing process and a part designed for Additive Manufacturing.

Figure (2): Simplified Design Decision Flowchart.

Figure (3): Main GUI for the application.

Figure (4): Haptic Mouse, designed for AM

Figure (5): Interactive graphical interface.