Prototyping

The use of simplified and incomplete models of a design to explore ideas, elaborate requirements, refine specifications, and test functionality.

Prototyping is the creation of simple, incomplete models or mockups of a design. It provides designers with key insights into real-world design requirements, and gives them a method to visualize, evaluate, learn, and improve design specifications prior to delivery. There are three basic kinds of prototyping: concept, throwaway, and evolutionary.[1]

Concept prototyping is useful for exploring preliminary design ideas quickly and inexpensively. For example, concept sketches and storyboards are used to develop the appearance and personality of characters in animated films well before the costly process of animation and rendering take place. This approach helps communicate the concepts to others, reveals design requirements and problems, and allows for evaluation by a target audience. A common problem with concept prototyping is the *artificial reality problem*, the plausible presentation of an implausible design. A good artist or modeler can make most any design look like it will work.

Throwaway prototyping is useful for collecting information about the functionality and performance of certain aspects of a system. For example, models of new automobile designs are used in wind tunnels to better understand and improve the aerodynamics of their form. The prototypes are discarded once the needed information is obtained. A common problem with throwaway prototyping is the assumption that the functionality will scale or integrate properly in the final design, which of course it often does not.

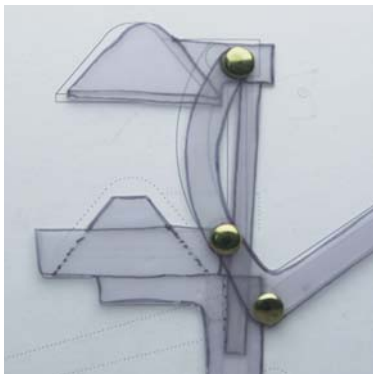
Evolutionary prototyping is useful when many design specifications are uncertain or changing. In evolutionary prototyping, the initial prototype is developed, evaluated, and refined continuously until it evolves into the final system. Design requirements and specifications never define a *final product*, but merely the next iteration of the design. For example, software developers invariably use evolutionary prototyping to manage the rapid and volatile changes in design requirements. A common problem with evolutionary prototyping is that designers tend to get tunnel vision, focusing on tuning existing specifications, rather than exploring design alternatives.[2]

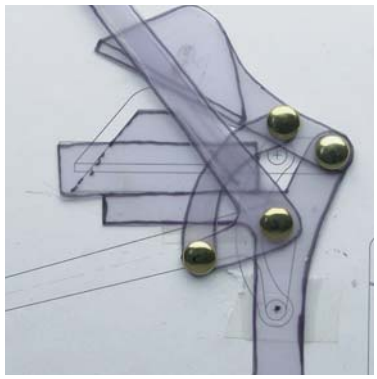
Incorporate prototyping into the design process. Use concept prototypes to develop and evaluate preliminary ideas, and throwaway prototypes to explore and test design functionalities and performance. Schedule time for prototype evaluation and iteration. When design requirements are unclear or volatile, consider evolutionary prototyping in lieu of traditional approaches. Consider the common problems of artificial realities, scaling and integration, and tunnel vision when evaluating prototypes and design alternatives.

See also Feedback Loop, Most Advanced Yet Acceptable, Satisficing, and Scaling Fallacy.

[1] See, for example, *Human-Computer Interaction* by Jenny Preece, et al., Addison-Wesley, 1994, p. 537–563; *The Art of Innovation* by Tom Kelley and Jonathan Littman, Doubleday, 2001; and *Serious Play: How the World's Best Companies Simulate to Innovate* by Michael Schrage, Harvard Business School Press, 1999.

[2] Evolutionary prototyping is often contrasted with incremental prototyping, which is the decomposition of a design into multiple stages that are then delivered one at a time. They are combined here because they are invariably combined in practice.





The function and elegance of the Ojex Juicer clearly demonstrate the benefits of prototyping in the design process. Simple two-dimensional prototypes were used to study mechanical motion, three-dimensional foam prototypes were used to study form and assembly, and functional breadboard models were used to study usability and working stresses.