4. Rapid Prototyping

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Definition and Background

An integral step in ***user-centered design*** and design thinking is prototyping, the process of building a model for a project so that it can be user tested and revised based on feedback. While prototypes are complete, they are not final or perfect; they are meant to test ideas, questions, or assumptions that designers have encountered through ideation or iteration. Often considered a slow exercise, prototyping takes time to complete because designers need to consider the tangible facets of their design, which may require attention to multiple options to build something and comparisons of costs vs. benefits.

Rapid prototyping is a version of prototyping where designers build a specific part of a project to be tested. Rather than taking time and resources to produce a full prototype that will have to be revised, rapid prototypes make the ideas of a project tangible enough to receive feedback in the short-term (IDEO, n.d.). The designer then returns to the process of ***iterating***—revising the component based on feedback—and then ***testing*** another component or an added revision.

Rapid prototyping is used in developing and refining 3D models, websites, processes, user interactions, physical computing projects, and more. It can be accomplished through computer-assisted design (CAD) software, paper prototypes, play-acting scenarios, storyboards, mock-ups, etc. (IDEO, n.d.). Rather than operating as a complete, yet unrefined, product, it is a stepping stone between the ideation or brainstorming phase and the fully realized prototype (Perkins, 2015).

In technical and professional communication practices, rapid prototyping takes on these same principles of manufacturing through the process of focused and repeated drafts. Whether in content creation, user interface design, social media, or simple long-form drafts, writers and communicators can present incremental changes to stakeholders and audiences, test their efficacy, and make changes on a repeated cycle so that no single draft must be overhauled entirely. As Danielle Koupf (2017) has argued, such version control, or as they call it, "tinkering" in the writing process develops a sense of openness, "flexibility, [and] the writer's sense of the options available to him or her." Rapid prototyping makes room for the inevitable changes in audience *and* communicator's needs, desires, and investments and promotes creativity in addressing complex communication problems.

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Design Application

While the term *rapid prototyping* was first applied in manufacturing to describe how 3D printing was used to test individual parts of a manufactured object, the concept has been extrapolated to various other communities and spaces of practice (Campbell et al., 2012). Makerspaces, for example, are collaborative workspaces that house consumer-grade technologies for ideating, prototyping, and testing designs. These spaces use rapid prototyping tools like FDM (fused deposition modeling) and SLA (stereolithography) printers, CAD software, conductive inks and threads, breadboards, sensors, and so on. Often, makerspaces will also contain lower-stakes rapid prototyping materials such as sticky notes, LEGO blocks, markers, and modeling clay that are used in the early stages of ideation and prototyping.

Because maker culture is so closely tied to start-up and design processes, which require quick production and scale, rapid prototyping in makerspaces is commonly used to develop new ideas or products through the process of prototyping, reviewing, and refining (Perkins, 2015). An example of this might be in the development of a new design for a phone case. The designer might first build a 3D model of the case using paper or modeling clay, testing whether it is the correct size. After measuring the model, they would then draft a digital 3D file of the case using CAD software and print it using cheaper filament, testing ergonomics and manufacturing times. Finally, once the designer has a good model, they may print it using different flexible materials to test which holds up the longest. This process allows the designer to isolate and test otherwise interdependent elements of a design and quickly deploy the product to its test or target market.

One of the major benefits of employing a rapid prototyping process is that it increases communication and trust between developers and their clients (Jain, 2018). By consistently testing ideas with the communities that will use, benefit from, or be impacted by the project, makers have the opportunity to build something that users will actually use, and use well, for its intended purpose.

Pedagogical Integration

In the technical communication classroom, rapid prototyping may be an exercise integrated with student assignments, especially those that integrate the expertise of students from across disciplines to design solutions to larger societal problems or issues on campus. Students may be assigned low- to high-fidelity prototyping projects following their proposed designed solutions. For example, students may create a wireframe for a mobile app they propose or fabricate their model via 3D printing and other CNC (computer numerically controlled) milling methods. It is important to consider the accessibility and learning curve in these prototyping tools when choosing which technology to deploy.

As an example, in one of my technical communication courses, students worked with a sustainable technology nonprofit to develop communication materials that would boost engagement on social media. Students created several series of mock-ups of a Snapchat filter to show the client and receive feedback. Each mock-up highlighted a different design element, such as text features, animation, color, content, and GPS functionality. Using different materials and software, the group was able to make individual choices about design incrementally rather than making a complete design and having to start from scratch based on feedback.

Another example can be found in Jason Tham's (2021) pedagogical experiment with prototyping in a TPC course, where students built analog and digital prototypes to demonstrate the viability of their ideas and proposed solutions. In his case study, Tham reported the affordances of materializing ideas as well as the constraints of a coursework setting for the purposes of experiencing design thinking. Nevertheless, Tham still recommended the use of prototyping as a meaningful learning activity for TPC students.

Apart from its active learning benefits, rapid prototyping may help students value the design process and not just the end product. While the prototyping may be *rapid*, it helps students slow down their design thinking by deliberating on their design intentions, tools or platform choices, and assessment criteria. Additionally, rapid prototyping provides opportunities for students to materialize, test, and iterate their design. This promotes attention to user needs and responsible designer reaction based on the early user experience of the prototype.

References and Recommended Readings

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