15. Edge Cases

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Definition and Background

Designers need to anticipate the ways a system will be used, not only to optimize user experience, but also to ensure that a design functions as intended without catastrophic failure. The term *edge cases* is used to describe uses of the product that are not prohibited but fall outside the mainstream of expected use. Designs are also structured around intended use, anticipating failures or hazards that emerge in ways that are not always obvious. In computer-based systems, engineers may anticipate the peak processing loads a system will undergo while still functioning as the customer or user expects. Structural engineers design for peak loads, weather conditions, and other factors that will affect the life of a piece of equipment, building, bridge, or its component materials. Increasingly, social justice concerns have revealed that the profile of a user is too narrow and that use cases do not account for cultural or environmental differences. The study of edge cases is of particular interest in technical and professional communication (TPC) because the analysis of these cases requires diverse perspectives in order to anticipate the context in which a product will be used.

Edge cases refer to unusual use conditions, stresses, or potential for harm that fall outside the expected use of the system. These cases are rare, but the design should function when they occur. Even in innovative or "next generation" products, a system should respond in ways that do not cause loss of life, loss of data, or loss of property to the user, the customer, or other stakeholders. While designers may specify parameters or conditions under which a product or system may be used, it is desirable for systems to exceed those specifications. In projects with a defined customer or client, design teams often devise a user contract, which outlines the intended use of a device and the types of stresses it will be exposed to.

Design Application

Design has become increasingly complex and interdisciplinary. While the term *edge cases* is often understood to apply to computer systems, design pedagogy is applied to a wide variety of technical courses in engineering and the sciences. Design pedagogy is taught in such courses as medical device design, materials science, and chemical engineering project labs that focus on the creation of biofuels and the manufacture of vaccines. All of these classes require a combination of

technical knowledge, empathy for users, and understanding of the ethical impacts an innovative design may have on the community and the environment.

Edge cases are considered from two perspectives: peak stresses and user interaction. In the case of peak conditions, worst-case scenarios are evaluated and tested. These worst-case scenarios may be situations such as high demand for network usage, catastrophic weather conditions, disasters, or "perfect storm" scenarios in which a combination of unusual phenomena occur at the same time. In cases where failures occur, the aim of designers is to have the system fail in ways that can be predicted or from which stakeholders can recover. When evaluating user interaction, designers observe the behavior of a wide range of customers or users that make up the audience for a product or system. Edge case audiences may be defined as having physical or cognitive limitations; lack of familiarity with the technology, language, or culture; or they may adapt a product in a way that differs slightly from—but does not violate—the conditions in the customer contract.

■ Pedagogical Integration

As user profiles and user stories evolve, awareness of edge cases becomes an opportunity for collaboration between designers with a variety of technical backgrounds and perspectives on users' encounters with devices and technology. Design education aims to teach habits of projecting, through techniques such as quantitative modeling, resilient design, and study of previous catastrophic failures—the scenarios in which design can fail. In his thesis for an MFA at Iowa State, Edward Cupps (2014) noted that, while design education emphasizes anticipating problems, the process for making predictions has become increasingly complex. Understanding a diverse body of conditions, *prototyping*, and *testing* recursively are part of a method that should be taught to design students. In design pedagogies such as MIT's Design of Medical Devices and Massachusetts College of Art and Design's class in Design Research, exploring edge cases of high functionality and *usability* are an intrinsic part of the work on the final design project.

In a TPC course, instructors may assign students the exercise of designing edge cases by considering general versus extreme user scenarios. First, ask students to choose a mobile live-casting application (e.g., YouTube, Vimeo, Periscope, Meerkat) or any specific services of interest. Then, identify the general user base and user requirements (e.g., setting their location, scheduling livecasts, generating fanbase, managing comments, monetizing broadcasts). Once students have a general understanding of the likely interactions that users may have with the app, ask them to sketch a scenario or two where users may experience catastrophic errors or boundary conditions that would make the user quit the app. Have students write those scenarios in a complete story form and then share it with their peers. Ask students how they would react if they found themselves in

those edge cases, and then have them generate potential solutions that could be built into the app to debug those extreme scenarios.

Courses that focus on the design of larger, more complex systems may ask students to model the effects of conditions such as catastrophic climate change on materials and structures. Students may also be asked to create computer-based scenarios that show the way a user with physical challenges or assistive devices interacts with a product or system.

■ References and Recommended Readings

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