

# CHAPTER 6: REPORTING ON USER AND PERFORMANCE TESTING

## Chapter outline

- The testing record
  - Purpose of the testing record
  - Ethics and the testing record
- Elements of the formal record

As explained in Chapter 5, testing is the hub of the design process. The ideas your team generates through brainstorming, research, and expert consultations must be tested repeatedly to help you understand how your design will behave and be used in a real-world context. Testing is an indispensable way to measure your early ideas against user requirements so that you can eventually translate those requirements into measurable specifications.

Design testing may take many different forms. In the first quarter of EDC, you typically assess your design ideas by asking users to interact directly with your mockups. In EDC 2, you often conduct user testing in addition to devising other ways to evaluate the strengths and weaknesses of your early ideas. But whatever your methods, the information you gain from testing plays a vital role in helping your team determine the final design.

For this reason, it is essential that readers of your reports and project notebooks understand your testing strategy as fully as possible. What did you hope to learn? What was the rationale behind your test methods? Did testing go well, or did you run into difficulties? Answers to all these questions and more must be provided in writing. This chapter explains the purpose of the testing record, ethical guidelines, and the basic elements of documentation.

## 6.1 THE TESTING RECORD: ITS FORMS AND FUNCTIONS

What does documentation mean in the context of the design testing process? Broadly speaking, the testing record, or documentation, is the full record

(including things like sketches, photos, and video) of your formal efforts to evaluate the capabilities of your design. It comprises both the team's preparation for tests as well as what you learned from them, including results and interpretation.

As an engineer, you have a professional obligation to document your work—good record-keeping is required, not optional. Every branch of the profession, however, has its own specific standards and practices regarding documentation; you will learn more about them as you progress in your chosen field. This chapter is intended to make you aware of some fundamental principles for good record keeping and clear documentation.

The testing record takes two basic forms: notes from testing and formal documentation. In Chapter 5, you studied the first part of the testing record—good note-taking. If you do a good job of organizing your notes initially, it is much easier to write your formal documentation.

### 6.1.1 Purpose of the testing record

Formal documentation, in contrast to your testing notes, is the refined record of the full design testing process as it appears in reports, proposals, and professional publications. Formal documentation is written to explain the testing process to a reader who may know little about the design problem, appropriate testing methods, or the full range of possible solutions. For that reader, your formal documentation of the testing process serves as important evidence of the design's (and the team's) credibility, and should foreground information that anticipates and answers concerns of experts. Thus, it is important to provide readers with a clear, logically organized, and economical account of the testing process so that they understand how your results informed the team's decision to select one design solution (or one set of features, functions, materials, or construction methods) over another.

Moreover, a well-written account of your tests and findings will tell the reader about much more than just the design itself. Thorough documentation allows an experienced reader to assess both the complexity of the design challenge and the quality of the team's performance, providing answers to questions like the following:

- Were the tests appropriate and sufficient? Could better tests have been devised? What were key obstacles to testing the design?
- How skilled was the team at preparing for and conducting its tests? Did the tests get them the information they anticipated?
- How complete is the testing record?
- How careful was the team's analysis of test results? Do the results support the team's decisions, or could the data support other choices as well?

Teams should always make sure that the formal testing record accords with their rough notes from testing, since both are part of the official record of the design's development. Among other things, documentation provides legal evidence of the team's due diligence in testing, showing that the team took steps to ensure that the design addressed the design problem adequately and safely. Moreover, should you wish to patent your design, such records will testify to your detailed insider knowledge of the development process that created the design. Finally, in the event of design failure, a full record of testing can help investigators pinpoint where potential failure modes and effects (see Chapter 8) were overlooked or not fully accounted for.

### 6.1.2 Ethics and the testing record

Testing doesn't always go exactly as planned, regardless of the experience, diligence, or ingenuity of your team. Maybe the user was able to work with you for only a short time. Maybe you tested with one or two users and are pretty sure that a broader range of users might make some unsuspected defects apparent. Or perhaps the testing apparatus broke down. In any case, such difficulties may mean that your team does not get the kind or amount of information you had hoped.

Whatever the results from testing, you must record them scrupulously, even if you believe that the findings do not adequately reflect the possibilities inherent in your design. Failure to document problems that crop up in testing, carelessness in acknowledging limitations of your testing methods, suppression of undesirable results, or worse, fabrication of data all constitute serious breaches of recognized ethical standards. The National Society of Professional Engineers' *Code of Ethics for Engineers* (2007) leaves little room for misunderstanding:

Engineers shall acknowledge their errors and shall not distort or alter the facts.... [They] shall be objective and truthful in professional reports, statements, or testimony. They shall include all relevant and pertinent information in such reports, statements, or testimony, which should bear the date indicating when it was current.

There are other good reasons to keep careful records of all testing efforts, especially those that don't go according to plan. Difficult testing sessions can lead to breakthroughs, encouraging you to seek information about the design or users that you hadn't thought to look for. If your test failed, what new information or opportunities did it reveal? If you didn't get the answers you needed, did you find out how to ask better questions? For many reasons, ethical record-keeping and good design go together.

## 6.2 ELEMENTS OF THE FORMAL RECORD

Your formal documentation of design tests should include the following four elements:

- Purpose
- Methodology
- Results
- Analysis, conclusions, and limitations

Each element is discussed in greater detail below. Examples of reports on performance testing and user testing appear in Appendices G and H.

### 6.2.1 Purpose

The first section of the report states the purpose of the test clearly and concisely. Keep in mind that in the course of design testing you may gather information that you had not anticipated. In such cases, you should neither revise your description of the design test's purpose nor ignore the additional data. Instead, make sure your account of the results from testing includes the unexpected findings with a simple notation stating that while the test had not been designed with the express purpose of discovering that information, your team will be taking those findings into account in the final design.

### 6.2.2 Methodology

The process of writing up your testing methodology serves a dual function. First, it documents the testing plan in sufficient detail so that an educated generalist reader can understand how the design was tested. Second, it can also help your team double check the plan and make sure that the testing procedure will get you the information that you want.

A complete record of the testing plan should include the following:

- A description of the procedure you plan to follow (or followed) in order to collect information. Include specific, quantified information about mockup construction, user questions, mockups, sample preparation, and similar matters.
- Justification for the testing method(s). This is not always required, but in cases where the reader may be unfamiliar with the rationale for the testing methodology, you may wish to include a short explanation of your choice. If you choose, for example, to create a computer model of the design using specialized software for that purpose, you might explain that this method was recommended by experts and is standard industry practice.

### 6.2.3 Results

The results of design testing should not be confused with the team's analysis and interpretation of those results. Results of design tests themselves should initially be presented objectively, without interpretation. Detailed information on tests (including contextual information) is generally relegated to an appendix.

In addition, you should provide a short overview of any changes in the testing methodology or unexpected circumstances, including the reasons for the changes. This should be considered part of the basic contextual information about your tests (date, time, location, duration, etc.) and should appear in a short paragraph at the beginning of the detailed account of test results. Be sure to provide reasons for the changes. Were the users too fatigued to work with you for long? Had you been unaware of the limitations of your testing equipment? This information can both give your reader a better understanding of your user group and help future teams think about how to avoid such obstacles in future tests.

### 6.2.4 Analysis, conclusions, and limitations

#### Analysis

The most common mistake that teams make is to provide the reader with data gathered from design tests but little else, assuming that the results “speak for themselves”—that the conclusions to be drawn from the data are obvious and incontrovertible. However, as experienced designers and researchers know, this is rarely if ever the case. The team must explain how they interpreted results in order to justify their decisions about the form of the final prototype and recommendations to readers.

The analysis of results from testing is distinct from the results, though sometimes your results may seem to speak for themselves. For example, if your design simply did not work as you expected under real-world conditions, it may earn low ratings both in user and performance testing.

In other cases, however, findings may result from something that the team had not intended to test. At such times, your analysis will need to provide the reader with a theory that explains the user response. In one case, a team designing a computer lap tray for users with disabilities presented their client and users with four alternatives: three foamcore “looks-like” models, and one commercially available product that lacked key features required by the users. In spite of the fact that the commercially available product lacked what the team had determined to be key requirements, the client and users expressed strong preferences for that design. After discussing the results of user testing, the team determined that the client's and users' favorable responses to the design had been determined less by the design's working features than by its

aesthetic qualities. The team decided to develop new mockups that addressed both functional and aesthetic requirements.

For performance testing, your analysis should provide the reader with an explanation of what the raw data mean in terms of design requirements and user needs.

### **Conclusions and limitations**

A short summary of the team's conclusions should usually appear in the main body of the final report, leaving detailed discussions of your reasoning for the appendices. This part of the formal testing record is also a good place to mention the limitations of the testing. For example, if, at the end of the project, your team believes it has developed a promising design idea but has not been able to conduct enough tests to determine what materials would be best suited to ensure the user's safety, that should be noted as a limitation. You should then suggest additional testing in your "Limitations" section.

## **6.3 REFERENCES**

- Long, A., Rein, J., Smith, A. & Smith, L. (2006). *Glowcrete: A Thin-Layer Approach to the Development of Self-Illuminating Concrete*. Engineering Design and Communication, Northwestern University.
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