Building the Conceptual Model and Metaphor: the "3x3"

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Introduction

In this paper, I will discuss a methodology for helping to build a conceptual model and metaphor, a key element of interface design. The "3x3" gives interface designers a way of seeing the conceptual model through the eyes of the user. I first define a conceptual model, explain its importance, and provide several examples. Then I discuss the 3x3— what it is, and how to use it to help build a conceptual model and select a metaphor that will meet users' task needs while being easy to use and pleasant to experience.

What is a conceptual model?

The term "model" is used in many different ways by cognitive psychologists, software designers, and human factors engineers. Let's first distinguish a "mental model" from a "conceptual model." A mental model is a conception of how the world works, the way it's structured. Everyone has mental models; they help us understand and predict the behavior of new events by processing them in terms of existing concepts.

While a mental model is individual, a conceptual model is shared. The conceptual model of an application or solution is created by designers and surfaced to users via the interface. The conceptual model consists of the objects it contains (and by implication, the tasks it supports); their behaviors; and the relationships among these objects. Integral to the model is its metaphor, which is intended to communicate the nature of the model to users by comparing it to something familiar to them.

Why be concerned with mental models and conceptual models?

Conceptual models, by tapping into users' mental models, can make a system easier to use. If a user encounters a new interface that looks like something familiar, the user will already know what to do, and will have expectations about how the system will respond. Therefore, the goal for an interface designer is to build a conceptual model that taps into existing mental models.

A classic example of a conceptual model and its metaphor is the desktop. The desktop represents the conceptual model of the operating system. It takes advantage of users' experiences with using a desktop in an office environment (their existing mental model). The desktop model helps make the system easier to use because a user already knows how to interact with a desktop.

The objects in this conceptual model are represented as metaphors related to the overriding desktop metaphor: To write a letter, you access writing tools. To discard something, you throw it in the trash. To organize documents, you put them in folders. Building a conceptual model for the operating system that employs a common overriding metaphor and associated metaphors makes this system easier to use.

The "3x3" is a tool that has been traditionally used by advertising agencies and multimedia developers, among others. In a traditional 3x3, a designer or design team will generate three high-fidelity alternatives of a solution. They'll produce each to a depth of three levels. For example, in a multimedia application, a designer will develop screens that represent the first three screens of a user's path. In an advertising brochure, a designer might develop the cover image and two internal images of a brochure. These 3x3 "studies" are then shown to the client for approval.

However, the 3x3 that is used by interface designers has a different nature and goal. Rather than to obtain client approval, the 3x3 is used to explore conceptual models and metaphors with users. In this type of 3x3, three alternative models are developed as low-fidelity prototypes (hand-drawn sketches). Each is developed to a level of three-screens-deep. Then these proposed models are shown to users. Users work through a couple of common tasks while thinking aloud. The models are tested to determine if the users can understand the metaphor, and whether they support users in the completion of their tasks. Once a model is selected, a second round of the 3x3 is undertaken. The model

is rendered as higher-fidelity screens to determine which visual treatment is most appealing, most appropriate, and most supportive of users' tasks.

The main advantage to implementing the 3x3 early in the design of a product is to allow alternative solutions to be explored with users prior to expending precious development resources. Unfortunately, under the pressures of time, a single solution is frequently chosen and driven forward without having validated that it is the best possible solution. But it is equally important to use the 3x3 only when necessary prerequisite design information becomes available. Prior to the 3x3, you must have gathered user tasks and requirements from representatives of your intended audience. These will dictate the content, structure, and organization of the proposed models, and will suggest appropriate metaphors. Also, if appropriate, you should have done a competitor evaluation. Competitor information allows you to determine which models will be competitive once they are developed. The design team then, using these data, engages in a brainstorming session. Model choices are considered in light of any constraints, and are pared down to three. At this point, a 3x3 is done.

Case study: an automotive kiosk

The following describes the steps followed in the design of an automotive kiosk. The kiosk was to be housed in a mall setting, and its content was intended to provide information about vehicles manufactured by the client. The steps preceding the 3x3 will also be discussed to provide the context for understanding how and when the 3x3 was used.

1. Gather user tasks and requirements

The first step in our design process was to gather tasks and requirements from the target audience for the product. In this case, we held two sessions using our Decision Support Center, an electronic meeting room. We recruited about 30 participants from two market segments. We gathered information about the tasks these participants typically perform when shopping for a new vehicle.

We gathered the details associated with these tasks, what makes them easy, what makes them difficult, plus triggers, outcomes, etc. We also had the participants group these tasks into logical categories using an

affinity grouping exercise.

2. Gather competitor information

While we were collecting task data, we also collected competitor data. We targeted two sets of kiosks as competitors: automotive kiosks and other best-of-breed kiosks in general. For the automotive kiosk evaluation, we attended the annual Detroit Auto Show, at which about ten kiosks were examined. For the best-of-breed kiosk evaluation, we visited the EPCOT center in Orlando which houses dozens of kiosks. At each venue, the kiosks were examined heuristically, with regard to strengths and weaknesses, use of models and metaphors, and overall appeal with regard to providing a *total user experience*.

3. Brainstorm alternative conceptual models, metaphors

With marketing-, task-, and competitor-data in hand, the design team engaged in a brainstorming session. The goal of this session was to propose a set of models and metaphors for our kiosk design. The team came up with about 12 models, including both concrete models (e.g., the showroom, the road), and some rather abstract models (e.g., the elevator, the board game). As we brainstormed, we talked through what the design might look like, for example, "Each square on the game board could represent a step in the vehicle-shopping process. A user can select a game piece, which can be one of several types of vehicles. . . ." and so forth. As we brainstormed, we tapped the existing data to be sure the alternatives we were proposing could be designed to support the tasks, wants, and needs of the target market; and would prove to be competitive with existing solutions. This step also helped us determine where a metaphor worked, and where it didn't. In our board game model, for example, we found that using dice or a spinner to move a game piece broke the conceptual model:

Dice and spinners imply randomness. Our task analysis indicated that vehicle-shopping is performed rather methodically by most of our participants. Through this process, we refined and eliminated several models.

4. Weed out/Pare down models

After talking through several possible models, we revisited each, this time keeping in mind several possible constraints to the design. We considered the technical feasibility of these models: Could they be

implemented on schedule? At this early stage of design, it is difficult to gauge implementation needs; however, a rough "feel" for implementation resource needs is possible. Then, we considered whether each model could be designed to be consistent with the existing marketing materials of the corporation. Such consistency is desirable, as it reinforces a corporate image, contributes to brand recognition, and gives users a sense that a single team designed all aspects of the vehicle-shopping experience. Finally, we talked through each remaining model a bit further. More of our original models were thereby eliminated.

5. 3x3 Phase I

As a result of the brainstorming and weeding/paring, we selected our three best candidates for the 3x3. We tried to include a mix of abstract and concrete metaphors. A visual designer sketched the first three screens for each model. One model used the abstract metaphor of an elevator (figure 1). The act of vehicle-shopping starts by entering one of two elevators, which brings its occupants to various floors of a showroom. Two elevators were employed to allow users to shop either by brand or by vehicle type.

We recruited three pairs of participants and engaged them in prototype evaluation sessions. We showed the designs to them and had them work through the task of getting started at the kiosk, using a specific vehicle as an example. We watched and listened as they worked through the models. We attended primarily to how well the model and its metaphors "fit" their expectations: Were they meaningful? Did they enhance or detract from the usability of the screens? Real-time "tweaks" to the designs were made in an effort to strengthen each model. The overall goal of this phase was to narrow the choices of model representations to one.

Phase I of the 3x3 resulted in our selecting a single model to further explore: the "road." Note that this model was at first rejected by the design team for competitive reasons: We found that many automotive manufacturers use the road in their marketing materials. However, the users themselves suggested this model. We therefore sketched and included it. It turned out to be the best-received model of the three tested.

6. 3x3 Phase II

We then engaged two visual designers to create three visual treatments of this model. We sought their guidance in suggesting which types of treatments might be appealing. They created one "cartoonish" treatment, one "abstract" treatment, and one "photorealistic" treatment. They created three screens for each, similar to what was done in Phase 1. We then showed these three treatments to users. The focus this time, however, was not on the model itself, but on the visual implementation of the model. We focused on whether the treatment supported the model; for example, were the screen elements and their significance in the photorealistic treatment easier to comprehend than those in the abstract treatment? We also focused heavily on overall aesthetic appeal—that is, which of the three treatments was most pleasing to participants. The photorealistic road model ultimately was most users' preferred choice.

Some methodological considerations

The 3x3 is facilitated and can be supplemented by other user-feedback methodologies. User comments are gathered through interview and think-aloud, as in a typical prototype evaluation. Single users or pairs of
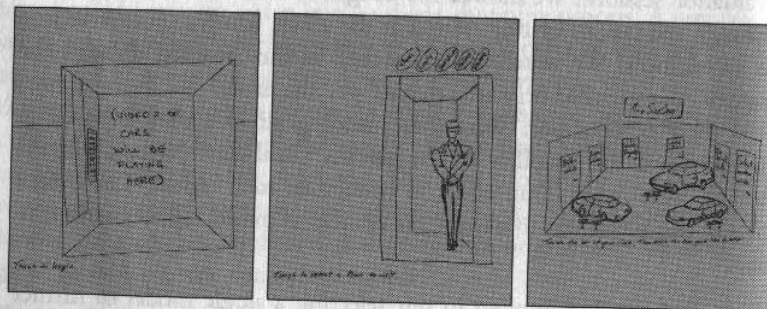

Figure 1: Elevator metaphor.

These three images comprise one of three conceptual models/metaphors tested in a 3x3. Representative users were given a scenario and a task to complete. In this case, the task was to use this kiosk to find information about a certain mid-sized car. The users attempted to complete this task using this solution and two alternative solutions.

users can be employed. Designs can be presented as complete, or as simpler frameworks for participatory design sessions. Multiple designs can be shown to each user (within-subjects experimental design), or

each set of users can respond to a single design (between-subjects or between-groups experimental design). The World Wide Web can also be used to gather large "n" feedback, for example, about the aesthetic appeal of the visual treatments. As with all usability engineering, the methodology should be appropriate to the situation.

The number of models and their metaphors presented in either Phase I or Phase II can also be altered. Three is a good "rule of thumb" number, but need may dictate using fewer or more models. If users suggest a metaphor other than those shown in Phase I, that model can be sketched and presented. On the other hand, if none of the models in Phase I proves desirable, it may be necessary to do a second brainstorming session. It is also advisable to present a range of concrete and abstract metaphors in Phase I to get a sense of whether users want a more accessible, straightforward representation of their tasks, or if they're willing or prefer to work through a more abstract approach. If the model proves appealing, but the treatments do not, then revisiting Phase II may be necessary. In short, you can alter the 3x3 to meet your needs.

Summary

The 3x3 gives interface designers a way of designing the conceptual model by exploring alternative models and metaphors through the eyes of their intended users. Rather than selecting a single solution and driving it toward implementation without first validating it with users, the 3x3 allows designers to explore alternatives early in the design of the interface. By focusing first on selecting from alternative models and metaphors, and second on alternatives for their visual implementation, the designer can explore whether an intended solution will meet users' task needs while being easy to use and pleasant to experience.

The author would like to hear about your experiences using the 3x3. Please write to Carol Righi at righi@us.ibm.com.

Some readings on conceptual models and metaphors:

Collins, D. (1995). *Designing Object-oriented User Interfaces.* Redwood City, CA: Benjamin/Cummings.

Mandel, T. (1997). *The Elements of User Interface Design.* New York: Wiley.