The Development of Behavior-Based User Models for a Computer System

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Abstract. This paper examines the development of user models for the graphical user interface of a telecommunication computer system used during service and sales negotiations. User models enhance the requirements gathering phase of system design by capturing the diversity of the user population and capitalizing on the variety of distinguishable and categorizable strategies that affect performance. The CDM method (Categorizing, Describing, and Modeling method) was developed as a technique to generate user models. In the CDM method, the user population is first categorized into a reasonable number of groups. The behaviors for each group are described and then qualitatively and quantitatively modeled. These models are subsequently used during the system design and operational processes to optimize performance of the entire user population.

1 Introduction

In gathering requirements for the design phase of system development, it is common practice to interview and observe the behaviors of a random sample of users from the intended user population. System design requirements typically characterize the user as one entity with a single set of behaviors, namely expert, novice, or a composite of all the users. For example, if the system development team is emphasizing the high-end performance, the behaviors and characteristics that emerge are items related to the expert user. Therefore, the designers tune their comments and suggestions towards the expert users. However, in some design projects, ease of learning, training, or novice aspects are emphasized to a greater extent. In this case, interviewers focus on the comments and suggestions by novices. If there is no overwhelming performance issue or training issue that directs the team, then anecdotal behavioral information is obtained on a variety of users. Typically, these approaches limit the overall performance when the system is implemented because not all of the users’ behaviors are accounted for during the design phase.

The development of a system that accommodates the diversity of the user population and improves the users’ performance is optimal. One method to improve the users’ performance is to categorize the system users into groups, describe and model each group’s behaviors, and then incorporate this information in the design and operational processes. Currently, there is no technique that will do all three phases of the above, rather tools and techniques exist that accomplish only small portions of the desired process.
Due to this lack of an encompassing technique that incorporates categorizing, describing, and modeling users and then applying this information to the system design and process operation, the CDM (Categorize, Describe, and Model) method was developed. The purpose of the CDM method is to build a set of precise and accurate models that represent the interaction of diverse user behaviors with the system. The results of these models are then applied during the system design and operational processes to optimize performance for all users.

Since the CDM method focuses on modeling different users’ behaviors, it is best implemented on systems where users’ behaviors are measurably different. One illustration of users’ behaviors being measurably different is shown in Figure 1.

Figure 1 presents a wide range in variability on a metric used to measure users’ performance. Note that there is more than a “500%” difference from the lowest to the highest value. In the current and previous projects, a broad range of user performance has been a key indicator that user behaviors are indeed different.

![Figure 1. Histogram of user’s performance.](image)

When it has been determined that users’ behaviors differ, the first step in the CDM method is to categorize the users. Both cognitive and performance measures are calculated for each user and the users are categorized into groups with similar results.

Next, a subset of users from each group are selected and their behaviors observed and documented. Behaviors are examined and should demonstrate similarities within a group and differences between groups of users. The emphasis of these descriptions focuses on behaviors that affect performance and are incorporated into the user models (Eberts, 1994; John and Kieras, 1996; and Kieras, 1996).