A FRAMEWORK FOR THE DESIGN, EVALUATION, AND IMPLEMENTATION
OF
USER-COMPUTER INTERFACES

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ABSTRACT

In this paper we develop a framework, that is, a methodology, for dealing with the design, evaluation, and implementation of user-computer interfaces. The framework is based on the semantic-syntactic-lexical trichotomy of formal language theory, extended to encompass not just the input (user to computer) language but the output (computer to user) language as well. The semantic level has to do with the meanings of input and output tokens and sentences; the syntactic level, with the temporal and spatial juxtapositioning of semantic tokens; and the lexical level, with the binding of tokens to hardware.

A top-down design of a user-computer interface begins at the semantic level, then proceeds through the syntactic to the lexical level. At each step, emphasis is placed on considering alternatives and making decisions based on user characteristics, task requirements, and design principles.

Design principles, based on experimental and experiential observations, can be applied both to the design of a new user-computer interface as well as to the evaluation of extant interfaces. We show how design guidelines concerning feedback, response time, consistency, and error correction apply at the semantic, syntactic, and lexical levels.

Interactive application programs can be modularized based on the three design levels. Such modularization pays dividends when details of the user-computer interface are to be changed. Going even further, the syntactic and lexical designs can be implemented using software tools driven be formal specifications of the user-computer interface. A partial set of such software tools are briefly described.