

### **Quantitative measures to evaluate Human-Computer Interfaces.**

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#### **Aim**

One of the main problems of standards (ISO, DIN, etc.) in the context of software ergonomics is, that they cannot be measured in a quantitative way. There are three different views on human computer interaction to measure interactive qualities: (1) the product-oriented view, that usability can be measured in terms of the ergonomic attributes of the product; (2) the user-oriented view, that usability can be measured in terms of the mental effort and attitude of the user; (3) the user performance view, that usability can be measured by examining how the user interacts with the product. In this paper measures based on the product-oriented view will be presented.

#### **State of the art**

Several catalogs of criteria of user oriented system design are available (e.g. Ulich et al. 1991). The gap between the impact of criteria of work psychology and technical design requirements must be filled. There are different approaches to measure usability based on the user performance view, and based on the user-oriented view (Rauterberg 1992). No approaches to measure usability based on the product-oriented view are known.

#### **A descriptive concept of interactive interfaces**

To come up with a set of metrics of usability based on the product-oriented view, a concept of descriptive terms is necessary. We differentiate between two types of "interaction points": (1) representational interaction points, (2) functional interaction points. These two types of interaction points can be applied to the dialog interface and the tool interface (IFIP model: i/o-, dialog-, tool-interface).

#### **A quantitative measure of "feedback"**

In the context of an actual dialog state, the user must know what he can do next. To support the user in this sense, different kinds of menus have been developed. If each functional interaction point has its own representational interaction point, then the user has 100% feedback of all available functions.

#### **A quantitative measure of "interactive directness"**

The physical limitations of the i/o-interface (-> screen size) are the reason, not to present all available functional interaction points with a specific representation on the screen. So, the user has to navigate through menu structures to come down to the desired functional interaction point of the tool interface. The average length of all possible sequences of dialog operations to reach all functional interaction points of the tool interface is a good quantitative measure of interactive directness.

#### **A quantitative measure of "flexibility" of the dialog interface**

The number of ways to leave the actual dialog state is a precise measure of dialog flexibility ("fan"-degree). A modeless dialog state has maximal dialog flexibility (eg. "command" interfaces). The implications of a hierarchical and a net like dialog structure will be explained in the context of "flexibility".

#### **A quantitative measure of "flexibility" of the tool interface**

The more the user can combine the implemented tool functions in different ways, the more flexible is the tool manager. A quantitative measure of "tool" flexibility will be presented

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and applied to an example (desktop interface of the relational database system ADIMENS).

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