

# A UIMS Architecture for Focus Processing in a Graphical User Interface

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## **ABSTRACT**

Today's graphical user interfaces remember little from one transaction to the next; each command exists nearly independently. Humans, however, typically draw on previous elements of a dialogue in their communications. We are seeking to add some of the characteristics of human dialogues to graphical interfaces. This paper describes our research into this problem and our initial results in answering three questions: What are the appropriate analogues of conversational focus in a graphical human-computer conversation? Where does this type of processing best fit within a user interface management system paradigm? What mechanisms can be used to realize it?

## **NATURAL DIALOGUE IN A DIRECT MANIPULATION INTERFACE**

In a direct manipulation or graphical interface, each command or brief transaction exists as a nearly independent utterance, unconnected to previous and future ones from the same user. Real human communication rarely consists of such individual, unconnected utterances, but rather each utterance can draw on previous ones for its meaning. It may do so implicitly, embodied in a conversational focus, state, or mode, or explicitly ("Do the same sorting operation you did before, but on these new data").

Our goal is to connect these properties of human dialogue to direct manipulation or graphical interaction styles. While some natural language human-computer interfaces attempt to exploit these characteristics of human dialogue, they have been notably absent from graphical interfaces. Natural dialogue is by no means restricted to natural language. Most research on the processes needed to conduct such dialogues has concentrated on natural language, but some of them can

be applied to any human-computer dialogue conducted in any language. A direct manipulation dialogue is conducted in a rich graphical language using powerful and natural input and output modalities. The user's side of the dialogue may consist almost entirely of pointing, gesturing, and pressing buttons, and the computer's, of animated pictorial analogues of real-world objects. A dialogue in such a language could nevertheless exhibit useful dialogue properties, such as following focus.

In natural language, focus represents the attentional space of the participants in a dialogue [14], and it is a property of a dialogue between two (or more) participants. It contains the objects and actions that are most relevant to the conversation [3, 4]. Natural language processing systems use focus to resolve ambiguous utterances. Focus contributes to the connectedness of dialogue by allowing economy of expression (e.g. pronoun references and anaphora). One approach to focus processing in the computational linguistics field [3, 4] uses a semantic net partition to represent those items from a conversation that are in focus. The net is partitioned into spaces, classified as explicit or implicit. Explicit focus spaces contain objects and actions that have been used in a conversation. Implicit focus spaces contain items that are closely related to the items in the explicit focus spaces. For example, while talking about cars, the concept car would be in an explicit focus space, while the parts of the car would be in an implicit focus space. This type of focus partitioning is used to resolve pronoun referents, and to detect topic shifts initiated by references to items outside of the current focus.

The work described in this paper is part of a collaborative project at NRL, see submission by Marsh and Wauchope [13].

## **Focus and Direct Manipulation Dialogue**

The most popular design for today's graphical interfaces is an object-action paradigm. These interfaces require the user to select an object followed by the selection of the action to be performed on the object. Because objects have to be

