

# USER MODELS AND DISCOURSE MODELS

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A user model (UM) contains information about users, such as users' goals, beliefs, knowledge, preferences, and capabilities. A discourse model (DM) contains information about the conversation, such as the linguistic structure, the attentional state, and the intentional structure [Grosz and Sidner 1986]. Given these definitions, I will argue that the UM intersects the DM. That is, the UM contains items that are missing from the DM; the DM contains items that are missing from the UM; and the two share some items.

First, Schuster (1987) argues convincingly that the UM contains items that are missing from the DM. This is especially evident in cases where the speaker and listener have a long association, and hence the speaker has a large amount of prior knowledge about the listener which is stored in the speaker's UM of the listener. However, this information is not present in the DM, which starts off empty.

Next, the DM contains items that are missing from the UM. To support this argument, I will cite an example given by Wahlster. Suppose the speaker mentions a long list of names that is not familiar to the listener. Then the speaker knows that the listener cannot know nameX, which is a particular name in the middle of the list. This is represented in the speaker's UM of the listener. However, nameX is in the linguistic structure of the speaker's DM since nameX was part of the discourse. Thus part of the linguistic structure of the DM is not represented in the UM.

Actually, Wahlster interprets his example as an argument that the DM and the UM must be different. He argues that since nameX is in the DM, then the UM must be different, or else the speaker could not represent the fact that the user does not know nameX. This argument misses a crucial point. Although it is true that the names are listed in the linguistic structure of the DM, these names are not present in the attentional structure of the DM. Since the attentional structure of the DM is that part of the DM which represents objects,

properties, and relations with which the user is familiar, this is the proper part of the DM to compare with the UM. To show that these names are not in the attentional structure of the DM, consider whether it is possible to use a pronoun to refer to nameX. If all of the other names were male, and nameX were female, then the speaker should be able to use the pronoun "she" in place of nameX. However, human speakers generally would not use such a pronoun. So there is no disagreement between the attentional structure of the speaker's DM and the speaker's UM of the listener.

Not only is there no disagreement between the attentional structure of the DM and the UM, but I would like to argue that the items in the attentional structure of the DM are part of the UM. Take the related example of when the speaker introduces a person's name, nameX, unknown to the listener. In this case, the DM model represents the fact that nameX is the name of a person and that nameX refers to some person. Later, the speaker can use either nameX to refer to this person, or a pronoun. Likewise in the UM, the speaker represents the fact that the listener knows nameX refers to some unknown person, and represents the fact that the listener does not know the person referred to by nameX. In this example, the contents of the attentional structure of the DM is a subset of the UM.

Another part of the DM that intersects with the UM is the intentional structure of the DM. The intentional structure is made up of the immediate goals of the user as expressed in the user's utterances plus some higher level goals. These are also present by definition in the UM.

Another compelling argument for the view that the DM intersects the UM is the phenomenon of multi-speaker discourses. In multispeaker discourses, each speaker needs to keep not only a separate UM for each listener, but also a separate DM for each participant. For example, consider the following dialog among three people debugging a circuit board.

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Tom: The 777 timer is really heating up.

Dick: Let's check it.

Tom (whose hands are full): OK. Dick, could you check the frequency at the output pin. Harry, could you check the voltage at the power pin here. (Tom points to the power pin.)

Tom and Dick are experts, while Harry knows little about hardware. Tom knows this, so Tom has a separate DM for Dick and Harry. In Tom's DM for Dick, Dick's attentional state includes the 777 timer in his focus space. However, since Tom knows that Harry cannot identify a 777 timer, the timer is not in Tom's DM for Harry. So, when Tom tells Dick to check the frequency at the output pin, Tom knows that Dick will understand this referent. On the other hand, Harry would not know the referent of the power pin, so Tom points this out to Harry.

If there were only a single DM for the entire conversation, then Tom would not be able to represent the different attentional states of Dick and Harry. This argues for the view that DMs are user dependent and hence are subparts of UMs.

In some sense, the above scenario is somewhat aberrant in that usually speakers assume that their listeners share the same attentional state. So it may be more efficient to only represent the separate attentional states of different listeners as differences from the norm. Thus in most cases, the list of differences would be very small and the efficiency would be effectively the same as having only one DM.

Although the DM and UM share some data, they are used for fairly different purposes. DMs are used in the generation and understanding of references such as noun phrases and pronouns. DMs are also used in the generation and understanding of connectives such as cue words and phrases. On the other hand, UMs mainly used in deciding how to respond to the user. For example, UMs are useful for detecting user misconceptions (McCoy 1983, 1985) and deciding which concepts need to be explained to the user (Chin 1986). Sometimes these differences lead to the confusion that the data stored in UMs and DMs must be different, since their applications are so different.

Another difference between UMs and DMs is in how

they are built up. Although both DMs and UMs are built up from propositions expressed in the conversation, the DM expires at the end of the discourse, while parts of the UM are kept for future use. Grosz and Sidner (1986) discuss how DMs are built up, and Chin (1986), Litman and Allen (1984), Carberry (1983), and Allen and Perrault (1980), among others, discuss this process for different aspects of UMs.

In summary, the DM and UM are not separate, but rather share common parts. Shared parts include the intentional structure of the discourse and the attentional structure of the discourse. In addition, the DM contains the linguistic structure of the discourse, which is not present in the UM. Likewise, the UM contains many items that are not present in the DM. These include facts about the user which were learned in previous dialogs and uncertain facts that were inferred from stereotypes to which the user belongs.

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