# Chapter 22

# A Reply to Hobbs

*Barbara J. Grosz and Candace L. Sidner*

In the introduction to his commentary on our paper, Hobbs contrasts "powerful visions" with "rather simpler and weaker procedures that are actually implemented" and then suggests that our review of previous work is merely about implementations, not visions. He is wrong on two counts, one quite serious in a volume of interdisciplinary work intended for audiences with different disciplinary training and inclinations. Before commenting briefly on several technical points, we must address the flawed premise in his commentary.

Since the mid-1970s it has been well accepted within the AI research community that one must distinguish one's theory from one's implementation and that before an implementation is useful as a tool of scientific inquiry,[1] one must have a theory on which it is based. It is also commonplace that visions, no matter how grand, are not theories. We will assume that the contrast between grand vision and theory is quite clear (one cannot, for example, test a vision as one can a theory) and not dwell on it further here.

Because Hobbs seems to have missed the determinative distinction between theory and implementation, it is worth exploring some for those who might conclude from his comments that AI is still confusing the two. Computational theories are concerned with *what* is being computed; implementations are concerned with the details of *how* the computation is carried out. The reader interested in an extensive exposition of this distinction may consult Marr's book on vision (Marr 1982). As Marr argues quite convincingly, the failure to distinguish between theory and implementation was a critical impediment to progress in the field through the mid-1970s.

Hobbs errs not only in missing this crucial theoretical level but also in claiming that our review addresses only implementations. The review is concerned with the theories investigated in alternative approaches, not implementations. Our paper presents an initial theory that is significantly different from previous work. This theory—whether or not it turns out to be correct—is the contribution of the paper.

The one substantive technical issue Hobbs raises concerns the meaning of the act-type constructor function BY.[2] Given Pollack's definitions in

chapter 5 of this volume, the use of BY must be restricted to actions that are related by the generation relation. For other types of actions, Clauses 4 and 6 of SharedPlan require instead a "Contributes" relation with the following semantics: the relation "Contributes" holds between actions $\alpha$ and $\beta$ just in case the performance of $\alpha$ (in a suitable time interval) contributes to the performance of $\beta$; $\alpha$ must be a member of a set of actions $\alpha_i$ for which $R(\alpha_i, \beta, G_i, T)$, where R is one of the specified action relations (for instance, generation, enabling, simultaneous-generation).

For example, take $\alpha$ to be the action of typing a "u"; $\alpha$ is then a member of the set of actions, $\alpha_i$, forming the action sequence type "u";type "n";type "i";type "t". It stands in a Contributes relation to the action $\beta$ of typing the word "unit" since GEN-Sequence$[\alpha_i, \beta, G, T]$. Analogously to BY as defined by Pollack, the Contributes relation provides a way of stating how one action fits into a larger action; however, by using a relation rather than a function, we are able to consider relationships among actions with different agents. For example, we can use the relation to say that *my* writing a paragraph contributes to *our* writing a paper.

Finally, one of the main claims of our paper is that the joint activity modeled by SharedPlans cannot be decomposed into some function of the individual plans of individual agents. Hobbs's reply presumes this is the case without acknowledging that it is a significant departure from previous theories. It appears we have convinced him of a most important point.

## *Notes*

1. People built useful bridges long before there was any theory to explain how the bridges stayed up. Likewise, an implementation may be useful for what it does, even if there is no underlying theory to support or explain how it does so.
2. His principal conerns about GEN-Simultaneous are addressed in our paper, in which GEN-Simultaneous is used merely as a shorthand for the longer expression that does make explicit times and agents.

## *References*

Marr, David (1982). *Vision*. San Francisco: W. H. Freeman.

Chapter 23

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