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ABSTRACT

This brief paper argues that structural analysis--an extended form of cognitive task analysis--demonstrates that both domain dependent and domain independent knowledge can be derived from specific content domains. It is noted that the major difference between the two is that lower order rules (specific knowledge) are derived directly from specific domains, and represented as lower order rules, while higher order rules (general cognitive knowledge) are derived indirectly via structural analysis of rules obtained at earlier stages of analysis. It is also argued that all higher order knowledge--except for a very simple goal switching control mechanism--appears in some degree to be tied to content, and that the importance of cultural (or incidental) knowledge in cognitive behavior can be viewed in a similar manner, bearing in mind that such knowledge can also be made explicit. (9 references) (CGD)

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A Short Note on Rules and Higher Order Rules

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Having introduced the concept of higher order rules in our research over two decades ago, it is truly gratifying to see these concepts playing such a central role in contemporary thinking and research on cognition. (Back in the 1960's and 1970's, most leading researchers tended to view higher order knowledge as the integration of components - either of S-R associations or of lower order rules.) For example, Perkins and Salomon's (1989) arguments to the effect that both domain specific and content independent knowledge are needed to explain cognitive behavior falls in this category as does Brown, Collins and Duguids's (1989) argument that "culture" has as significant an effect on such behavior as does explicit information.

While this is not the place to develop such issues, some brief comments and cautions seem in order: Perkin's and Salomon's analysis suggests that one can usefully distinguish knowledge that is domain dependent and knowledge that is domain independent. In effect, they too agree that general cognitive skills (higher order rules) operate on specific knowledge (lower order rules). It is important to note, however, that structural analysis (an extended form of cognitive task analysis) demonstrates that *both* kinds of knowledge can be derived from specific content domains. The major difference is that lower order rules are derived directly from specific domains (and represented as lower order rules). Higher order rules are derived indirectly via structural analysis of rules obtained at earlier stages of analysis (see Scandura et al, 1974, 1982, 1984).

Higher order knowledge, historically, has been viewed as content independent (e.g., Polya, 1960) but, in fact, such independence has always been a matter of degree. Compare Polya's (1960) informal discussion of heuristics and Scandura, Durnin and Wulfeck's (1974) analysis which represents Polya's heuristics as explicit higher order rules. Empirical tests and computer simulations have demonstrated both the validity and precise scope of applicability (i.e., transferability) of such rules. Indeed, it is very hard to come up with knowledge which is completely independent of content. Even means-ends analysis (e.g., Newell & Simon, 1972), for example, cannot be uniformly assumed as a common method for solving problems. Earlier research empirically demonstrates its lack of uniform availability (e.g., Scandura, 1971, 1974, 1977, esp. pp.248-50). All higher order knowledge, except for a very simple goal switching control mechanism, appears in some degree to be tied to content.

The importance of cultural (or incidental) knowledge in cognitive behavior can be viewed in a similar manner. It is not that some knowledge cannot be represented explicitly. It is simply that identifying such knowledge is more difficult. For example, it is difficult to reduce the acquisition of Piagetian conservation behavior to instruction on simple rules -- because the knowledge associated with concrete operations is so relatively complex and has such a fundamental impact on the behavior of young children. This does not mean, however, that such knowledge cannot be made explicit. An example of this is Scandura and Scandura's (1980) analysis of Piagetian conservation in terms of explicit higher and lower order rules.

References

Brown, J. S. Collins, A. and Dujuid, P. *Educational researcher*, 1989, 18, 32-42.

Newell, A. & Simon, H. A Human problem solving. Englewood Cliffs, N.J: Prentice-Hall, 1972.

Perkins, D. N. and Salomon, G. Are cognitive skills context-bound? *Educational researcher*, 1989, 18, 16-25.

Polya, G. Mathematical discovery. N.Y: Wiley, 1960.

Scandura, J.M., Durnin, J.H., & Wulfeck, W.H. III. Higher-order rule characterization of heuristics for compass and straight-edge constructions in geometry. *Artificial Intelligence*, 1974, *5*, 149-183.

Scandura, J.M. Deterministic theorizing in structural learning: three levels of empiricism. *Journal of Structural Learning*, 1971, *3*, 21-53.

Scandura, J.M. The role of higher-order rules in problem solving. *Journal of Experimental Psychology*, 1974, *120*, 984-991.

Scandura, J M. Structural (cognitive task) analysis: A method for analyzing content. Part 1: background and empirical research. *Journal of Structural Learning*, 1982, *7*, 101-114.

Scandura, J.M. Structural analysis, Part II: Toward precision, objectivity and systemization. *Journal of Structural Learning*, 1984, *8*, 1-28.