REFERENCES

Paton, A. (1987). *Cry the beloved country*. New York: Collier.

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Marshall, S.P. (1995). *Schemas in problem solving*. New York: Cambridge University Press, 424 pp. (Hardcover).

This book covers a lot of ground. The main purpose of the book is to describe and validate a specific schema for solving arithmetic word problems. A number of sophisticated and clever research methodologies are used to provide supporting evidence. In addition to presenting these methodologies and the results of a number of experiments, Marshall describes the implementation of a series of computer-based models designed to replicate the results of these experiments. In the process of providing theoretical support for these ideas, Marshall addresses a number of important related issues in considerable depth. These include discussions of the history and philosophy of schemas and implications of this work for curriculum planning, assessment, and computer-based instructional design. Although some parts of this book will be of interest to philosophers and educators, this is mainly a book for cognitive psychologists.

The book starts with a broad historical perspective on what philosophers, psychologists, and others have considered schemas to be. This is followed by an update on current views on schemas in general and, finally, a very specific discussion of the schema Marshall proposes as appropriate for arithmetic story problem solving. The level of detail presented is at the appropriate level to remind readers already familiar with this discipline of the significant participants in this field and their points of view. Readers with less background will, I'm sure, be sufficiently tantalised to follow up on many of the ideas touched on here.

The main contents of this book presents a series of experiments designed to provide evidence supporting a specific theory of the schema used to solve arithmetic word problems. This theory presents schemas as consisting of four types of knowledge: identification knowledge which activates a specific instance of the schema most appropriate to the situation, elaboration knowledge which fills in slots in the schema with information from the situation, planning knowledge to set up goals and subgoals, and execution knowledge to carry out the steps required to reach the goals. Most of the research presented focuses on identification knowledge with some emphasis on elaboration knowledge.

The first series of experiments presented addresses specific details which formed the basis of this theory. These experiments were performed on such diverse populations as sixth-grade children, teachers, and college students. Two additional series of experiments validate the usefulness of the theory when applied to computer-based instruction and assessment respectively. This evidence comes from a more restricted population – college students from introductory psychology classes identified through a pretest as having relatively weak problem-solving skills.

The experiments dealing with computer-based instruction and assessment quite clearly demonstrate that the subjects do form the type of schemas the instructional materials were intended to facilitate. Marshall interprets these results as support for the schema theory proposed but also uses them to suggest broader implications for designing instruction for other curriculum areas and for assessing the results of instruction in general. The chapters addressing these broader issues are the ones which would most likely be of interest to educators.

The concluding chapters of the book present a number of computer-based models intended to support Marshall's schema theory. The level of detail of the background provided is a bit more complete than the opening chapters of the book but some previous knowledge on the part of the reader is necessary to evaluate the more specific network design and implementation decisions. But, as with the opening chapters, the material presented is sufficiently engaging that many readers will want to explore these issues further.

The first model presented looks somewhat like a connectionist network model but it is not intended to actually teach anything. Instead, nodes (including hidden nodes) are explicitly associated with details of the schema organisation Marshall proposes for this domain and the connections in each instance of the model are hand-crafted to reflect established descriptions of schemas formed by the human subjects in a previous experiment (one

instance of the model for each subject). Although not very interesting from a connectionist learning perspective, these models do demonstrate that the processing inherent in a connectionist network can produce results very similar to those obtained for human subjects.

The second model presented will be much more satisfying to a connectionist *purist*. It uses a comparatively straight-forward back propagation network in order that students learn to classify arithmetic problems according to the schema proposed. The model succeeds at this quite admirably.

The final model presented is a hybrid model which uses the connectionist model presented above to classify arithmetic problems and a rule-based production model to actually solve them. Marshal proposes that such a hybrid is required to capture all of the aspects of the schemas humans use to solve problems in this domain though the model presented is only able to solve simple problems.

In the concluding chapter, Marshall points out that "one of the foremost challenges to schema theory in the past has been its lack of specificity" (p. 391). In contrast, the large body of work which makes up this book presents a very convincing argument for the usefulness of a specific schema theory. That theory certainly seems to work well for schemas in the domain of arithmetic problem solving and there is some basis for optimism concerning its generalizability. To that end, this book presents several methodological approaches which should prove invaluable to anyone attempting to apply variations on this schema theory to their domain.

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Maxcy, S.J. (1995). *Democracy, chaos, and the new school order.* Thousand Oaks, CA: Corwin Press, 197 pp. (Softcover).

I have seldom taken so long to read a book as I took with *Democracy, Chaos, and the New School Order* by Spencer J. Maxcy. I wish I could say that this resulted from my reluctance to part with the pleasure of reading, but precisely