Title: Computer Experience and Cognitive Development: a Child's Learning in a Computer Culture

Author: R. W. Lawler
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The 'computer experience' in the title refers to the *LOGO* project with which the author was associated at MIT, where part of his in-depth observational study of his children's encounter with the world of numbers took place. It is essentially the study of his daughter, Miriam's development, which is the foundation of the book.

The 'cognitive development' aspect is the process of change described in a way deeply influenced by the Piagetian theory of cognitive development. Another strong influence is that of the 'societal' view of the mind espoused by Minsky and Papert, the latter being very much a Piagetian (Minsky, 1977; Papert, 1980).

Hence, this is not so much a book about Piaget translated into computational terms (although we suspect that, like Boden, 1979, the author is aware of the compatibility) as a detailed description of a child's experiences with the programming language *LOGO*. Through *LOGO* we are allowed to witness the child's developing mind.

This is only part of the author's intimate study' (as he calls it). The world of numbers is met through arithmetic, programming, tic-tac-toe and *LOGO* geometry, and all interaction is meticulously recorded in a running log, on video and audio-tape, and by a series of 'vignettes', which are "like snapshots of thinking or "short stories". The 'core' of the study consists of the continual monitoring of Miriam's behaviour, both within the laboratory and in the family environment, in both structured and unstructured situations. We see, for example, Miriam's 'progressive structuring of mind', up to the time when she integrates disparate concepts concerning the world of numbers (the 'count' world) and specific contexts (two packs of gum at 15 cents equals 30 cents, Miriam's pocket money), in order to achieve a fuller understanding of numbers and the relations between them.

This is an unusual approach as, typically, psychologists do not favour this straightforward method for observing an individual acquire new strategies by repeatedly confronting the same problem. The section on one child's development of arithmetical concepts gives a fascinating insight into the mind of the developing child. A good example is the instance when the author pinpoints the precise time when a moment of Miriam's insight occurs: the 'carrying breakthrough' in standard addition sums.

By Miriam's repeated attempts at number problems from her own perspective we learn, just as she does, the process by which the acquisition of number skill comes about. We see Miriam modifying old strategies and integrating the new. This is described in a way so persuasively Piagetian in form, that it is difficult to conceive an alternative explanation. The account of development is more accurately neo-Piagetian, as Lawler revises aspects of the concept of stage, but the account is still consistent with Piaget, as even the most radical departures may be (for example, Feldman, 1980).

The structuring of the mind is explained by the use of Levi-Strauss' notion of 'bricolage'. This is the activity of the 'bricoleur', who is characterized as a 'jack-of-all-trades' who solves problems with the tools (knowledge and knowledge structures) at hand, where these tools are not transferable from specific tasks. The 'bricoleur' is contrasted with the engineer who understands principles gained through the abstraction from task-specific knowledge. This is consistent with the author's revision of the societal view of mind, stressing the competition of structures ('microviews') rather than co-operation. Lawler does not skate around the important issues here. He has identified, in a convincing way, the structures which impinge on the problem-solving activity. When dealing with these disparate structures, the central notion of control is explicit in the process of computation (see especially chapter 7 and the concept of 'microview'). To avoid misleading the reader it should be remembered that the theory is in no way complete. The work is an attempt to identify the fundamental structures and processes in the development of the mind.

There are, of course, problems that go hand-in-hand with the benefits of Lawler's

'naturalistic' approach. One is all too aware of the subjective nature of the study, but the author appears scrupulously objective about the whole account. And one still finds Freud's method and theory useful due to similar systematic qualities (see the citation 'On Objectivity' by Langer, p. 244). There is no doubt that studying specific skills provides us with insight, not just about the child's conception of number, but about learning *per se* (" . . . the individual case does not merely illustrate the general law; it embodies the general law", the author paraphrasing Lewin). However, the ecological validity of the approach is undermined when we ask the following questions: to what extent does the author intervene in the child's understanding? Has Lawler by his very intervention condensed or changed the natural process in a way that is perhaps different from normal development? And finally, what is being described here, development or learning? How are we to distinguish between the two?

These are not questions which apply only to the study in question, but to general issues at the heart of the developmental process. There is also the question of the nature of intervention. How important is the role of the computer environment? The author would like us to believe that this special environment is a playground for the development of 'powerful ideas', but it may be that other well-constructed and flexible environments or teaching methods would serve equally well. Currently, the computer environment does appear to be the one with the most potential.

There is also the related moral question concerning the level of intervention for scientific ends. On this point all that can be said is that his children took part willingly and seemed to enjoy the 'intimate study', and without their co-operation. Lawler could not have gained such fascinating insights. The book concludes with a section of extended citations which not only serve as an indication of the author's intellectual roots but also as an interesting pointer to related ideas.

It is hard not to be enthusiastic about this book and not be impressed by the breadth and depth of thought, despite the excessive amount of detail in the study. But it could be argued that in order to understand complex structures and processes, a detailed and complex study must be expected. This book is likely to be included in reading lists for cognitive science and (developmental) psychology courses.

References

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S. ROSS
Department of Computer Science
University of Exeter