Fruits of cognition

Stuart Sutherland

Cognitive Psychology and its Implications, 2nd Edn. By John R. Anderson. W.H. Freeman:1985. Pp.472. \$25.95, £17.95.

Cognitive Processes, 2nd Edn. By Lyle E. Bourne, Roger L. Dominowski, Elizabeth F. Loftus and Alice F. Healy. Prentice-Hall:1985. Pp.404. \$28.95, £31.

IN THE early 1960s, psychologists first began to notice the discoveries of workers in formal linguistics and artificial intelligence. Not the least remarkable thing about those discoveries was that they were made solely through the use of careful introspection and pure cerebration: never slow to learn from others, psychologists wisely decided to abandon behaviourism. Of course, psychologists being psychologists, they adhered to their dictum that nothing can be known unless a flawless experiment has been performed to demonstrate it, so they continued doing experiments. They replaced their studies of that fascinating beast, the laboratory rat, by experiments on mental processes: thus was cognitive psychology born. It has since flourished to such an extent that almost every other book in psychology has the word "cognitive" or "cognition" on the cover: indeed, even books on the psychology of women's liberation are nowadays ensured a sale only if they bear a title such as *Women and Cognition*.

Cognitive Psychology and Its Implications and *Cognitive Processes*, both revisions of successful texts first published five or six years ago, are part of the outcome of the cognitive revolution. They cover much the same ground — memory, attention, language, concept formation, problem solving and reasoning, though as to the last two topics it is somewhat unclear why if you are manipulating the tower of Hanoi, you are "problem solving", but if you are working on a syllogism, you are "reasoning". It is true that the latter problem could be solved by deduction, but in fact it rarely is except by logicians.

Anderson writes with more clarity and snap than do Bourne *et al.*, particularly when describing theories: his book could be read not only by students but by anyone who wants to know what is going on in the field. On the other hand, Bourne *et al.* describe the experimental evidence in much more detail and are not afraid to say that issues have not been resolved. Thus, in evaluating the Whorfian hypothesis (that language influences how the world is seen), Anderson claims the evidence does not support it, whereas Bourne *et al.* leave the question open.

Psychology is a maddening subject: it uncovers many issues but solves few. For example, both books take too sanguine a

view of the interpretation of Saul Sternberg's well-known experiment on how a person decides whether a test item belongs to a small set stored in immediate memory. Sternberg concluded that the test item is successively matched to each stored item and that, surprisingly, the search does not stop when the item is found but continues to the end of the list. This result was so exciting that a host of other experimenters promptly repeated the experiment with modifications cunningly devised to prove Sternberg wrong: whether basically right or not, his original interpretation is certainly very far from being the whole story. Part of the difficulty of securing firm explanations in cognitive psychology is of course that a person may simultaneously use several different

strategies in performing the same task.

Textbooks must simplify, and although both do so Anderson sometimes goes too far. Textbooks should also give the student some feel for the field, and here both seem a little wanting. Neither gives a clear account of the relations between psychology and linguistics or AI, and neither gives so much as a hint that most of the theories described are lacking in rigour. The books do not stand back from the hurly-burly of the journals to ask what work is likely to stand up in 20 years time and why. But within these limitations, which are the limitations of the subject, each in its own way does a highly competent job. □

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Conversation in AI

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Introduction to Artificial Intelligence. By Eugene Charniak and Drew McDermott. Addison-Wesley: 1985. Pp.701. Hbk \$34.95; pbk £16.95.

ARTIFICIAL intelligence (AI) has migrated only recently from postgraduate programmes (or from nowhere, in places that have upheld the view that AI is not intellectually respectable and even not quite nice) to undergraduate curricula in computer science. The migration has been hastened by demand, which is based partly on the observation that AI has already demonstrated its ability to be profitable. The problem which this change has highlighted is that AI overlaps so many other subjects that a first course in AI runs the risks of presenting knowledge in fragments and of having to begin with some remedial education.

No AI text which has been offered for undergraduate courses manages to avoid this problem. Those that come closest to success follow one of two routes: the axiomatic or the conversational. In the former, the primary emphasis is on the most far-reaching, basic or influential algorithms and operational methods. The good "conversational" texts include most of the same topics, but their first aim seems to be to compensate for students' gaps in background by presenting almost a transcript of a polished imaginary lecture series. A standard part of this approach is to state an idea or method, and then justify it by listing and explaining away the objections that may have occurred to the inventor or a not-unfriendly colleague.

Explanations of individual points by discussion in the conversational method may leave a student without the necessary background unmoved; the method has to rely on cumulative effect in introducing its

audience to the AI outlook. Nevertheless, some customers prefer this to the "axiomatic" approach, of which a good representative is *Artificial Intelligence* by P.H. Winston (Addison-Wesley, 1984). The present book is an equally good representative of the conversational school.

A further two-way division of general texts on AI is possible, between those that do and do not claim any relatively deep organizing principles for the subject. In this respect Winston again comes down on one side ("to make computers more useful") while Charniak and McDermott choose the other ("the study of mental faculties through the use of computational models"). Although this earns them extra points for accuracy — for example in their treatment of low-level processing of visual and some linguistic information — and for bravery, they do not succeed in turning their ambition into a backbone which unifies the lessons that a student may expect from a textbook. Such backbones are available: for example, the fact that (by approximation, good trial-and-error methods or ingenious representation of information) minds dispose of many kinds of problems without excessive computational effort while corresponding AI programs still contain no realistic means of escaping combinatorial explosions in numbers of paths to possible solutions. But this complaint applies to most AI textbooks, not just to the one under review.

Given the difficulties of presenting effective undergraduate courses in AI, this is a thorough survey of the whole field by experienced practitioners which is particularly effective on natural-language processing and (because of the limited competition) vision. People whose teaching or learning styles are more conversational than axiomatic may find it the most pleasing text to have appeared so far.

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