Cleverness aside, the Winograd program is substantively important in several respects. It shows how a systemic or feature grammar can be used in a practical parser to handle some very thorny syntactic constructions. He and William Woods, who earlier wrote a good parser from a seemingly different point of view, have been the major figures responsible for a total overturn in the last few years of the prevailing view about the feasibility of good practical parsers. Winograd's parser is successful in part because the syntax is not isolated from the semantics; the program's knowledge of its world is used to help during parsing. Semantic 'specialists' can be called in the middle of parsing to see whether it is worth continuing the parse, or whether it is better to back up and try another interpretation because a nonsensical situation has been encountered. Winograd's system makes the most likely interpretation it can at any given point and if it gets into trouble, it backs up and tries again. There is a certain risk of misinterpretation or total failure of comprehension with this strategy, but after all, human interpreters are subject to the same risks. This is one reason the 'new linguistics' is much more psychological.

ANOTHER very fundamental feature of Winograd's system is its total emphasis on knowledge stored as "procedures" rather than as data. Knowledge as 'how to' offers many advantages, especially when seemingly static propositional knowledge is converted to this useful dynamic form. The proposition "All objects with property X have property Y" can be rendered, "If you want to show that something has property Y, one way to do this is to show that it has property X, or give it property X if you can." The actions of Winograd's robot are continually guided by such dynamic propositions. For example, consider the proposition that if a block has nothing on top of it, it is graspable. This bit of functional knowledge is stored as a "consequent theorem" in the PLANNER language. In practice for the robot, proving that a block is graspable is equivalent to successfully grasping it ('To do is to know'—the basis of procedural knowledge). The consequent theorem guides a grasping attempt by a check of whether the top is already clear, or if not, an attempt to clear it. The knowledge available to Winograd's parser is also procedural: A sentence is understood if a parse can be constructed.

The 'constructionist' view of cognition is consistent with recent trends in cognitive psychology, and some psychologists have eagerly adopted procedural representations. (Donald Norman and David Rumelhart have a forthcoming book on 'active semantic networks.') Recent discussions in the artificial intelligence literature suggest that theories of knowledge representation are moving toward eclectic mixtures of data and procedures, stored in flexible units called "frames." (Three theorists promoting frame concepts are Newell, Minsky, and recently Winograd himself.)

The reader who wishes to keep abreast of the new psycholinguistics might warm up on the two volumes reviewed here, then move on to *Computer Models of Thought and Language*, edited by Roger Schank and Kenneth Colby. Three more important books due to appear in Spring 1975 are the Norman and Rumelhart work; a psychology and artificial intelligence conference collection edited by Allan Collins and Daniel Bobrow; and a major presentation of the powerful paraphrase, language translation, and psychological inference possibilities developed by Schank and three of his students, Charles Rieger, Niel Goldman, and Chris Riesbeck. Things are moving so rapidly in computational psycholinguistics that it is hard even to remember anymore exactly how long ago it was that Chomsky was overthrown.

Can Psychology Count Past 100?

Robert E. Ornstein

The Psychology of Consciousness. San Francisco: Freeman, 1972. Pp. xii + 247. $3.50 paper.

Reviewed by CHARLES T. TART

Robert E. Ornstein is a Research Specialist with the University of California Medical Center, Los Altos. A PhD of Stanford University, Ornstein has been a Teaching Fellow at Stanford and a postdoctoral Fellow at the UC Medical Center. He won the American Institutes for Research Creative Talent Award, first and overall, for 1967–68, and in 1972, the Unesco Award for the best contribution to psychology. His earlier books are The Nature of Human Consciousness *and* On the Experience of Time.

Reviewer Charles T. Tart is Associate Professor of Psychology at the University of California, Davis. He earlier taught at the University of Virginia Medical School and at Stanford. Tart, a PhD of the University of North Carolina, also currently serves on the Board of Directors of the Institute for the Study of Human Consciousness, San Francisco. He is author of On Being Stoned: A Psychological Study of Marijuana Intoxication *and editor of* Altered States of Consciousness *and* The Spiritual Psychologies.

ORNSTEIN has written one of the most important psychological books in many years. The best way to introduce it is to quote the brief Sufi teaching story that appears at the beginning of Chapter 1.

"A man, having looted a city, was trying to sell an exquisite rug, one of the spoils. 'Who will give me 100 pieces of gold for this rug?' he cried throughout the town.

"After the sale was completed, a comrade approached the seller, and asked, 'Why did you not ask more for that priceless rug?'

"'Is there any number higher than 100?' asked the seller."

Orthodox psychology has long acted as if there were no numbers higher than 100 and, indeed, frowned on those who even suggested that there were.

Psychology was early defined as the study of the mind, and, for a multitude of historical reasons, got into trouble that way. The early psychologists were anxious to discover the Fundamental Laws of the Mind, and be considered 'real' scientists, just like chemists and physicists, instead of as a branch of the philosophy department. In retrospect, it looks as if they did not adequately recognize the enormous expanse of phenomena that we can put under the term *mind,* nor give sufficient recognition to individual differences. There were many contradictory results and not very much progress, and so rather than think about numbers in general, we decided to settle for numbers of less than 100 and we got behaviorism. This was probably a necessary step for advancing the science of psychology. By greatly limiting the scope of inquiry, we were able to develop some rather good tools within those limited areas.

Now we live in a time of great cultural flux, where our students (and some of our colleagues) are experiencing altered states of consciousness, where they feel they have experienced profound insights into the meaning of life, or transcendent love, or a paranormal communication with others, to cite some of the outstanding examples. They are not satisfied with being taught about operant conditioning or psychopathology, or told to wait until some day when brain research explains it all. The numbers beyond 100 are very powerful and very much with us, whether we like it or not.

Ornstein's book is of great value for the student and the psychologist who is not willing to give up his scientific background, who recognizes the value of the tools we have for dealing with numbers below 100, but who wants to move outward from this foundation to the wider phenomena of consciousness. In this way Ornstein's book is a major step in redefining psychology as the science of consciousness, and doing so from firm scientific foundations and past accomplishments. This is in sharp and valuable contrast to what happens to some psychologists who discover the intriguing phenomena of consciousness and react against their earlier scientific training, throwing out the baby with the bath water.

This book is too rich to summarize in any kind of review, other than to point out a few highlights. Among other things, Ornstein deals with the important notion that our 'ordinary' state of consciousness is a semi-*arbitrary* construction, rather than its being an obvious baseline from which to assess everything. He summarizes the emerging research on the different modes of functioning of the right and left hemispheres of the brain and their implications for consciousness, and with the very basic variable of time as a psychological construction rather than as something given to us naturally. He deals with what he calls the "esoteric psychologies," the psychologies inherent in many religious and spiritual systems which we usually dismiss without examining, but which do deal in many ways with the phenomena that are 'esoteric' to our academic psychology, with numbers over 100. This includes some very valuable discussions of the nature and effects of meditation, and of the intuitive mode of consciousness. Finally, Ornstein g. us the beginning of a synthesis of so.. of the esoteric and conventional psychologies, an extended concept of man in which man is seen as having a much greater capacity for self-regulation and extended experience than we have been prone to give him in our classrooms.

ONE of the greatest charms of this book is its lucidity: It is so clearly written and so free of jargon that it is as understandable to the introductory psychology student as to the professor. I believe both the introductory student and the professor have an equal need to read it. The student, who may be rebelling against the scientific tradition, needs to read it to find out that scientific psychology can be capable of dealing with the important human experiences that seem so frequently ruled out. The professor, too, needs to read it to find out that scientific psychology is capable of dealing with many human experiences that have been ruled out of academic psychology, and also that it *must* deal with these human experienc. if it is to be a complete psychology.

A Book for No Seasons

Joachim F. Wohlwill

The Study of Behavioral Development. New York: Academic Press, 1973. Pp. xii + 413. $19.00.

Reviewed by ROBERT M. LIEBERT

Joachim F. Wohlwill is Professor of Man-Environment Relations at Pennsylvania State University. Wohlwill, a PhD of the University of California, Berkeley, spent 1957–58 as a postdoctoral Fellow with Piaget at Geneva, and during 1968–69 he was a special Fellow at Educational Testing Services. Wohlwill was also formerly Professor of Psychology at Clark University. He is coeditor (with Daniel Carson) of Environment in the Social Sciences.

The reviewer, Robert M. Liebert, a PhD of Stanford University, is now Professor of Psychology and Psychiatry at the State University of New York, Stony Brook. He has also taught at Vanderbilt, Antioch, and the University of Minnesota. He has authored or coauthored numerous articles and chapters, and seven books, including Science and Behavior: An Introduction to Methods of Research *(with John M. Neale).*

ALTHOUGH methodological adequacy is the *sine qua non* for all areas of psychological research, efforts to i. tegrate methodological and substanti.. issues in a single volume are almost non-