

Surpassing Ourselves

AN INQUIRY INTO THE NATURE AND IMPLICATIONS OF EXPERTISE

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Preface

It happens often in the physical and biological sciences, seldom in the behavioral sciences, that a line of research pursued for its theoretical interest intersects with a growing societal concern. Research on expertise is such a case. It started with efforts to understand what enables chess grandmasters to excel. Now it is being applied to finding out what it takes to be good at computer programming, medical diagnosis, instrument repair, sports of all kinds-virtually every skill that feeds society's rampant needs for high performance.

The main thing this research shows is that expertise requires enormous amounts of knowledge-far more than anyone, even the experts, had supposed. We should not minimize the importance of this finding. It radically changes the whole scale of problems related to expert knowledge and skill. But its practical upshot is the need for years of training and experience. This, it is fair to say, we already knew.

There is an important respect in which research on expertise has failed to make contact with society's interest. Virtually all the research compares experts with many years' experience to novices with very little. But as a society, we are not concerned with novices. Eventually they will quit being novices, without our having to do anything about it. The important question is what they will become. Will they become experts in their lines of work or will they swell the ranks of incompetent or mediocre functionaries? As scientists, engineers, or managers, how will they compare with their counterparts in other countries that seem to be gaining the upper hand in world commerce? As the builders of tomorrow, will they have creativity and breadth of vision? Will they be able to grasp, and make

headway against, the large problems that face us? These are social concerns related to expertise, and expert-novice comparisons do not address them. We need to know what separates expertise from mediocrity and what is needed- besides training and experience- to foster continuing growth in competence. Those are the kinds of issues we hope at least to illuminate in this book.

There is a whole other set of social concerns about expertise that get summed up in statements like, 'Today's problems are too serious to be left to the expert', or- one that we especially like- 'If you define a problem in such a way that only experts can solve it, you have just made the problem unsolvable.' Some readers will feel that we do not pay enough attention to these concerns. Others may feel that we pay too much. Priority, we believe, should be given to the more fundamental task of *understanding* expertise. Statements like those just quoted seem really to be referring to specialists, not experts; and treating expertise as if it were synonymous with specialization reveals a misunderstanding that can only lead to bad thinking. The capacity to acquire expertise is, we shall argue, one of the great and peculiar strengths of the human species. The challenge for social thought is how best to use this capacity to the benefit of all. But to meet that challenge, we need to understand better what it means to acquire expertise, what fosters and what stunts its development, and how it functions in people's lives and work.

We came to the study of expertise from an unusual direction, through the study of writing. Writing, as it happens, violates the conventional wisdom about expertise on a number of counts. Conventional wisdom has it that practice makes perfect and that expertise is the natural outcome of years of practice. But few people become good writers, no matter how much they write. For many, the effect of years of practice is simply to produce increasingly fluent bad writing. Conventional wisdom, backed by scores of experiments comparing novices and experts in various fields, sees experts doing quickly and easily what novices do laboriously, if they can do it at all. Novices have to reason things out, whereas experts know what to do without thinking. The paragons of effortless performance were fifth-graders who, given a simple topic, would start writing in

seconds and would produce copy as fast as their little fingers could move the pencil.

What can be observed in expert writers is something rarely observable in typical expert-novice comparisons. One observes the *growing edge* of expertise. We assume that every expert, in whatever field, has a growing edge. Doctors often remark that the great majority of cases they see are unchallenging. Routine diagnostic and treatment procedures suffice. But then there are the five or ten percent of cases that are challenging. Those cases test the growing edge of the doctor's expertise. The doctor who treats them in a routine way stops growing and is likely to drift into the category of the 15 percent of doctors whom the Ontario College of Physicians and Surgeons tags with "major deficiencies".

There is a growing edge to everyone's knowledge. But the poorer writers we studied approach the task in ways that minimize opportunities for growth, whereas the better writers maximize them. The result is a multiplier effect, where the more expert keep gaining in expertise while the less expert make little progress. Aided by research of our students, we went on to look at learners in other academic areas, and in music and medicine. The same results appeared. When working at the edge of their competence, the more expert people go about things in ways that result in their learning still more. Doesn't this suggest something about how they got to be experts in the first place, and why so many people with the time and the opportunities fail to gain expertise? We thought so, and this book is the result of seeing how far this insight could carry us in gaining an understanding of expertise.

We wish the research base for this inquiry were stronger. Despite intense research on expertise during the past decade, hardly any of it contrasts experts with experienced nonexperts or examines the growth of expertise over time-and these are the kinds of research most relevant to issues about the growing edge. However, we suspect that the problem will not be that readers go away from the book unconvinced. The more likely problem, and one we have run into when we introduced early versions of this material in a university course, is resistance to a

different way of thinking about expertise. That is thinking about it in terms of process-as something people do rather than as something they have.

Thinking about expertise as a process does not come easily. One has to struggle with a language that keeps wanting to change it into a thing or a state. And thinking about *creative* expertise can get one into a real tangle, because the romantic way we are brought up to think about creativity makes expertise seem like an impediment. Really to understand expertise, we shall argue, you have to pry it loose from ideas like specialization and from the individualistic bias most of us westerners are heir to. But among the rewards for doing so is ability to take a sane view of something that, according to contemporary criticism, we need much more of but already have too much of, that is the source of our gravest problems and is our only hope for solving them.

We sketched out the main ideas of this book while bumping around Southeast Asia on a study leave in 1987 and completed a major rewriting during a current study leave at the Center for Advanced Study in the Behavioral Sciences in California. The bulk of the writing was done during odd moments taken away from research whose immediate objectives were of different sorts-research on intentional learning, knowledge-building, and a computer-based learning environment that we will say a bit about in Chapter 7. But the book would not have been what it is without that research on our earlier research on the psychology of writing. So we are indebted to all the foundations, government agencies, and private corporations that have supported our research at one time or other during the 17 years that we have been working together, specifically: Apple Computer, the Charles R. Bronfman Foundation, IBM, the James S. McDonnell Foundation, the Ontario Ministry of Colleges and Universities' University Research Incentive Fund, the Ontario Ministry of Education, the Alfred P. Sloan Foundation, and the Social Sciences and Humanities Research Council of Canada. Our current stay at the Center for Advanced Study in the Behavioral Sciences enjoys support from the Spencer Foundation and the James S. McDonnell Foundation. The support most directly relevant to the present effort, however, has come from our home institution, the Ontario Institute for

Studies in Education, which, through its block research grant from the Ontario Ministry of Education, has provided the continuity over a long span of years that has made it possible for a diversity of research projects to yield something that we hope starts to resemble wisdom. Many people contributed to the research. Here we single out only those whose contributions related most directly to the present work: Jud Burtis, Carol Chan, Pam'la Ghent, Margaret Ogilvie, Evelyn Ng, and Naomi Tal.

We have also profited from two works that have tried to draw general conclusions from the diversity of research on expertise: *The Nature of Expertise*, edited by Micheline Chi, Robert Glaser, and Marshall Farr (1988), and *Toward a General Theory of Expertise*, edited by K. Anders Ericsson and Jacqueline Smith (1991). Building on, rather than duplicating, those solidly research-based contributions, we have felt free to concentrate our own efforts on a layer of psychological, educational, and social questions that research so far has left unanswered.