

ENGINEERING AND HUMANITIES

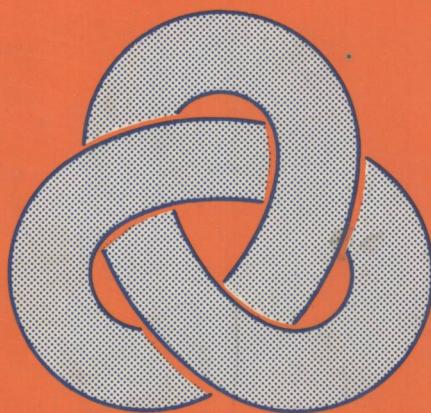
edited by

James H. Schaub

and

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HUMANITAS



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with M. D. Morris



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Engineering and Humanities

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Engineering and Humanities

This book is dedicated with gratitude to
the University of Florida and the National Endowment
for the Humanities, whose combined encouragement made its
conception and completion possible

Preface

As we write the preface to this book, we have been discussing two recent and significant publications that define our reasons for assembling this selection of readings far better than we can. *Newsweek* (October 13, 1980, p. 113), in "The Humanities Crisis," reports on the recently issued report of the Rockefeller Foundation, *The Humanities in American Life*. The article states, "The greatest challenge facing humanists . . . is . . . to demonstrate the importance of the humanities to education and to society."

Earlier this year the *Brookings Bulletin* (spring 1980) featured an article, "The Humanities in a Technological Society," by David W. Brennan. He states unequivocally:

... the humanities are also a source of fundamental human skills much needed in a technological society. I refer to the skills of writing and analysis, to the appreciation of logic and reason, and to the possession of an historical sense, of cultural awareness, and of ability with other languages. Completed with a knowledge of mathematics and science, a person possessing such skills is well equipped to function effectively in a complex society.

We developed this book of readings for the purpose stated by Brennan and the Rockefeller Foundation report and directed it specifically toward the engineering profession with the intent that relating the career interests of engineers to the humanities would generate greater interest in the humanities and encourage readers to pursue them beyond the introduction this book provides.

The readings included in our book are not intended to provide a comprehensive coverage of the humanities. They were chosen to act as an introduction and, hopefully, to serve as an hors d'oeuvre for the intellectual feast the humanities offer. The references with individual articles and the selected additional readings at the end of each part are intended to provide some preliminary guidance for further reading. We are well aware that this effort to provide additional references is not complete but believe the suggestions given will be helpful to the interested reader.

The organization of the book requires brief explanation. The opening part develops the argument for the study of humanities by engineers. The next four parts deal directly with areas of study commonly accepted as humanities disciplines: literature, art, philosophy, and history. The last two parts intend to illustrate that many important engineering problems require a wide range of problem-solving skills, including those that a humanities perspective can provide.

We owe a debt of gratitude to many individuals and organizations without whose help this book could not have been completed. Unfortunately, we cannot acknowledge them all, but we would like to note particularly the help and encouragement of

the National Endowment for the Humanities, the University of Florida, and Dr. Gareth Schmeling, principal investigator of the Humanities Perspectives on the Professions program. Credit also goes to those authors and publishers who have graciously permitted us to use their works. Specific acknowledgments follow this preface. Finally, we appreciate the patience of our students over several years of trial runs with the text material and the secretaries whose typing services were invaluable.

Gainesville, Florida
February 1982

JAMES H. SCHAUB
SHEILA K. DICKISON

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PART

1

Engineering and the Humanities—Why?

... we must remember that man is more than a scientist [engineer], more than a worker. He delights in painting, dancing and dreaming, and finds unspoken joy in the beauty of friendship, or in the smile of a child. He is an artist, a poet and a player.

Howard W. Johnson

There can be no adequate technical education which is not liberal, and no liberal education which is not technical: that is, no education which does not impart both technique and intellectual vision.

Alfred North Whitehead

The engineering profession has been concerned with the role of humanities in engineering education for many years. The question in its simplest form is, should the basic education for an engineering student be limited to the sciences, engineering sciences, and engineering studies necessary to prepare the student to function effectively as an engineer in today's world or should the curriculum prepare the student to perform effectively not only as an engineer but also as an informed citizen? There is little agreement among engineers [see Kent (1)] on this question and American Society of Civil Engineers (ASCE), for example, has been discussing it since at least 1874 when Thomas C. Clark (2) advocated the

Portions of this introduction were published in a slightly different form under the title "Humanities, Engineering and Education," J. H. Schaub, *Civil Engineering Education*, Vol. I, American Society of Civil Engineers, New York, 1979, pp. 644–650.

education of engineers to be strong in both the natural sciences and the humanities.

Jerome Kagan, a Harvard psychologist, provided a description of his educational aims during a conference. "The Educated Person in the Contemporary World," held in Aspen, Colorado, in 1974. These aims appear to be an excellent description of the educational needs of today's engineer (3):

My list of educational aims—a sense of dignity, some understanding of the laws of nature and society, mastery of a set of technical skills that permit assumption of a vocation viewed as useful or creative, appreciation of the historical forces that sculpted society, the capacity to appreciate beauty and the motivation to participate in a creative enterprise, the capacity for serenity and honesty, charity and civility.

Kagan's list of aims include those that engineers recognize quickly as being of a technological nature—understanding the laws of nature, mastery of a set of vocational skills viewed as useful and creative, and concepts of ethical concern. The others in his list are not so much technically oriented as human oriented. And here lies the need for a strong and imaginative humanistic component in our engineering education.

The need for the nontechnical stem was recognized early by comments in the Grinter report (4) of 1955, in which the attributes of the well-educated engineer were defined:

He must be not only a competent professional engineer, but also an informed and participating citizen, and a person whose living expresses high cultural values and moral standards. Thus, the competent engineer needs understanding and appreciation in the humanities and in the social sciences as well as in his own field of engineering. He needs to be able to deal with the economics, human and social factors of his professional problems. His facility with, and understanding of, ideas in the fields of humanities and social sciences not only provide an essential contribution to his professional engineering work, but also contribute to his success as a citizen and to the enrichment and meaning of his life as an individual.

Similar expressions of the need for the liberal education stem in engineering have been presented in the Olmsted report (5) and in the ASEE goals report (6). Numerous other papers since 1966, to consider only the relatively recent publications, illustrate the concerns with the liberal education of the engineering student.

If the concepts expressed by Kagan and by the Grinter report are accepted, the question still remains: Why the humanities? Kolenda (7) has stated unequivocally, "An education without humanities is a misnomer." In a like fashion, Hardy Cross declares in *Engineers and Ivory Towers* (8), "The purpose of education is to prepare the whole man to live a full life in a whole world." Much earlier, the Roman playwright Terence said, "Because I am a human being, I feel that nothing concerning a human being is foreign to me" (*Homo sum. Humani nihil a me alienum puto*). Engineers are human beings and citizens first, and their education must be more than training for the details of a technical job if they are to be equal participants in the full life.

The word *humanities* is derived from the Latin *humanitas*, which means the quality that makes a being "human." Although we speak of the humanities as if

they were a grouping of a number of disciplines, they should be looked upon as a single discipline with all the components interrelated to a comprehensive whole. Engineering might well be considered within this whole. Alfred North Whitehead wrote in 1929 (9),

There can be no adequate technical education which is not liberal, and no liberal education which is not technical: that is, no education which does not impart both technique and intellectual vision.

Unfortunately, the development of our university system has resulted in a degree of specialization in which each faculty member tends to teach a narrow field of interest rather than the unifying concept of *humanitas*.

It was at this point that the University of Florida found itself as it entered the 1970s. The general education requirement of the state university system included a block of courses entitled "The Humanities." These courses were taught as an integrated sequence intended to introduce and stimulate interest in that broad area of study. Conceptually, it was probably a good idea; however, it did not prove to be effective for engineering students. In fact, it often had opposite results. Two obvious reasons existed for this. First, the courses were offered in the first two years of the college experience. This is a time when students are least receptive to material they cannot relate to career goals. Second, the faculty teaching the humanities courses, although they were excellent teachers and well qualified in their fields of interest, were faced with the nearly impossible task of trying to be effective within a course concept that was so broad. Few, if any, mentioned the relationship between technology and the humanities in their presentations, and the results were what might be expected. The engineering students were not interested in the courses as presented, nor did they show any indication toward further work in the humanities as their education progressed.

The Florida experience is not unusual. The Olmsted report (5) quoted a study by Trent and Ruyle (10):

... engineering is likely to attract the individual who seeks direct, sure lines to follow in life. This kind of individual tends to enter a profession where he need not be confused with the tensions and anxieties of conflicting, ambiguous, or novel ideas. ...

Yet the confusion of ideas, the concern with ambiguity and complexity, and the lack of relevance is exactly what the humanities offer engineering students. No wonder they are confused and disenchanted. Yet the value of the humanities to the engineer is that they do not indoctrinate. They tend to encourage many conflicting points of view rather than the accepted solution. They do not provide ready answers but confuse issues in the same way that life and engineering are confused issues, because they are not the simple textbook problems with simple, straightforward answers as often presented in the classroom. The basic value of the humanities courses to the engineering student is that they present a way of approaching a question, a reading, or a problem that is different from the engineering disciplines. Rather, these courses cause the student to think and, in this way, they encourage mental growth and development.

Cross (11) recognized the value of the nontechnical courses.