The problems of education that concerned Ortega in 1930 are essentially those which contemporary thinkers are trying to resolve. Ortega proposed separation of teaching and research, curtailment of the curriculum, demands for a high level of mastery, and a compulsory core of essential subjects. Because of the role of culture in life, the university must be remodelled if science and rationality are to endure. This solution faces great obstacles, but there may be no alternative.

A. MacCRAGH

ORTEGA Y GASSET'S IDEA OF THE UNIVERSITY

"The youth must also be taught to have consciousness in all things, and must strive not only to appear, but to be."

KANT, *Lecture-Notes on Pedagogy*

In 1930 Ortega published an analysis of the role of higher education that embodied, inextricably, a proposal for the complete re-structuring of universities.[1] I shall try to explicate this proposal and to show that it is still pertinent to contemporary concerns for the organization and purposes of the university. Ortega was led to this study by the failure of all the reforms, excellent as many of them appeared to be on paper, that had been attempted in the universities of Spain and which, for the most part, had been copied from the supposedly exemplary institutions of Germany and England.

I. Culture and its Lack

The university, Ortega finds, is at fault for two reasons: *it does not teach enough of what it ought to teach,* and *it tries to teach more than it can,* that is, more than the average student can learn well.

Because of the first deficiency most of the professionals of our age are adrift in the midst of a civilization of which they are to a large extent ignorant. The consequence of trying to learn what cannot be learned is that at the crucial point of choosing their life's work, the young are involved in a farce from which they cannot escape. Withdrawal relegates them socially and compliance, which would satisfy their conscience, is beyond reach.

To lack certain vital elements of culture is to be adrift, because for Ortega culture is primarily a kind of map. Indeed, it is the most important map of all: the guide to what to make of the world. Within, it gives assurance. Without, culture enables man to live and to act at the level to which history

[1]José Ortega y Gasset, "Misión de la Universidad," *Obras Completas, IV,* 6th edition (Madrid: Revista de Occidente, 1966), pp. 312-353. There is an English translation by H.L. Nostrand, *Mission of the University* (Princeton University Press, 1944), reprinted by W.W. Norton (New York, 1966). All of the translations from Ortega in this paper are mine.

Adolfo MacCragh was born in Spain and holds a Ph.D. in physical chemistry from The Johns Hopkins University. First-hand experience with inconsistencies between the academic, professional, and commercial aspects of his field has led him to study some of the foundations of higher education.

has taken each age, a level not only of unique opportunities for the discovery of certain values, but also of unique problems. These have been thrust upon us by the mechanical accumulation of generations and, therefore, invariably carry the achievements and faults of the past, whose answers become, inevitably, the questions of the present. Their solution, such as there may be, must come about, not by the exercise of a diffuse collective wisdom, but through the efforts of individuals whose repertory cannot be out of date if they can hope for success.

Ortega places all university education in one of three groups: training for the *professions* (for the large numbers who are to become lawyers, physicians, druggists, accountants, Latin teachers, etc.)[2]; training for *science* (for the much smaller class of all researchers, e.g., jurists, physiologists, biochemists, theoretical economists, classical philologists); and the teaching of *culture,* "the system of the living ideas of the age."[3]

"Culture" in contemporary practice is mostly an appendage to the other two, a luxury of which any portion can be considered as relevant as any other. The consequence is that the professionals and researchers, competent as many of them are in the narrow exercise of their work, fail in another of equal import, for they are unable to lead society. That is to say, they do not exert a diffuse and responsible influence on the whole body of the population. On the contrary, more often than not they seem to bring the weight of authority to bear upon arguments where it does not apply, and in particular, upon those fundamental questions of universal appeal where the learned ought to exercise the greatest caution.[4] The problem does not lie so much in the deficiences of those who write, for many are splendidly equipped, but in the weaknesses of their lesser colleagues and of the reading public at large, which create the climate where so many works can be presented with unwarranted boldness and, therefore, create unease and confusion.

II. The Intrinsic Problem of Study: The Willingness to Learn

Even now, says Ortega, when the universities only endeavor to prepare for the professions and for research, the amount of material that they feel must be taught is far in excess of what the average student can learn. Yet the universities exist just because the average student exists. If there were only exceptional ones, it is very likely that life would have developed in such a way that no institutions, pedagogical or otherwise, would have arisen.[5]

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[2] American colleges have been much concerned with education for those who are preparing for no particular kind of job. Ortega does not deal with this matter. The trend in the United States seems to me to be away from non-professional education.

[3] "Misión de la Universidad," p. 323.

[4] As Sir John Eccles puts it: "I have no objection to scientists expressing these views so long as they do not claim to speak with the authority of science, which is assumed by the public to provide certainties that must be accepted unreservedly." *Facing Reality,* (Berlin: Springer-Verlag, 1970), p. 7.

[5] 'Misión de la Universidad," p. 326.

Higher education is organized as if the exceptional student were commonplace. And that is its basic problem, for in truth the very bright ought not, strictly speaking, even to be called students.[6] The difference between the true students and the exceptional cases is that the latter, even before they have begun their formal college training, have felt the need to solve some genuine problems of the sciences or the professions. But for the majority, study, although it may be palliated by a certain pleasure in the elegance, the beauty, or the unexpectedness of what is learned, is the result of an imposition that comes from outside the natural desires of their lives.

Young persons choose a career because it seems to them that they can do less violence to their total individuality within that particular mold than within any other.[7] A fit that does not cause at least some degree of very real anguish is practically unknown, because the reality of study always bears little resemblance to the reasons for the choice. Certain social functions can be accomplished to a sufficient degree without the intimate acquiescence of those involved: household chores, tax paying, stopping for red lights, or turning bolts in a factory. But study, to be done well, demands a large measure of assent. If not, ". . . underneath a received but unassimilated culture, man remains intact, therefore, a barbarian."[8]

Ortega proposes that teaching in the universities should, to a large extent, be devoted to inducing among the students the need to learn, that is, the need to form an authentic link between the men who created the sciences and the professions, and the students who must follow.[9] It is even more important to do away with the inner falsehood that is involved in most acts of study than it is to eliminate the outer falsehoods of the curriculum. Reality exhibits here a subtle curvature, namely, that knowledge is an indispensable contributor to our survival, and yet the labors it requires cannot originate in the mere comprehension of this fact, nor can they be simply the means to the practical satisfaction of daily comforts:

> If by work we mean the effort that is imposed by need and controlled by usefulness, I maintain that there are no things of value on earth that are the products of work. On the contrary, they are the spontaneous efflorescence of those superfluous and disinterested efforts which most full natures seek for their amusement.[10]

With the present structures and attitudes, it is not surprising that a few years ago it was estimated that less than 10% of the science teachers in the primary and secondary schools of the United States "hold any real awareness of the basic nature of science"[11] or that in Spain today, only 11% of university students believe that they are being prepared well for their profes-

[6]Ortega, "Sobre el Estudiar y el Estudiante," *Obras Completas, IV,* p. 549. This paper was published in 1933.

[7]Ortega, "Sobre las Carreras," (1934), *Obras Completas, V,* 7th edition (1970), pp. 167-183.

[8]"Sobre el Estudiar y el Estudiante," p. 552.

[9]*ibid.,* p. 554.

[10]Ortega, "El Quijote en la Escuela," (1920), *Obras Completas, II,* 6th edition (1963), p. 302.

[11]By James Harlow, in Bentley Glass, "The Revolution in Biology and Medicine," J. Steinhardt (ed.), *Science and the Modern World,* (New York: Plenum Press, 1966), p. 204.

sions.[12]

Few genuine students, that is, those for whom the universities exist, whatever their dedication, can have been fortunate enough to go through their curricula without spending many hours of fruitless struggle with intractable material,[13] or even, which is worse, without fully realizing that they had reached the end of their courses and yet not gained a clear understanding of the foundations of their professions. This cannot be attributed to the lowering of standards that has presumably accompanied the steep increase in enrollments in both halves of the North Atlantic world, because when higher education was, even more than now, the preserve of the economically fortunate, very many of the latter went to the university, regardless of their personal endowments.

In a recent article on popularization, Roy Shaw, the director of adult education at the University of Keele, remarks:

> . . . it is at least thirty years since I.A. Richards, after experiments with Cambridge undergraduates, wrote that in general education, the prime obstacle was "a feeling of hopelessness before the unintelligible." I have long believed that this feeling is at least an ingredient in student unrest - although it may be one unrealized by the students themselves, since they generally tend to blame themselves for their bewilderment.[14]

In Ortega's country the situation is worse, to the point that in some university departments, a text opened at random and found to be readily intelligible can be identified as a translation, the native product being so often impenetrable.

> . . . I believe that we have, unavoidably, to turn the university upside down . . . Instead of teaching what Utopianism says *ought* to be taught, we have to teach *only* waht *can* be taught, that is to say, what can be learned.[15]

And what can and must be learned ought to be presented in such a way that it may be learned, instead of being dispensed, as is so often the case, in a vacuum, without thought to purpose or clarity. Arnold Kettle, professor at the Open University, writes:

> Most of the academics now involved in preparing material for the Open University have found the experience chastening because it has brought home to them so remorselessly how seldom . . . they had ever had to ask themselves precisely what they were doing. Such simple questions as 'What exactly am I expecting the student to get from this lecture' are rather seldom asked.[16]

The universities must change in such a way that they can confront each student personally with the fundamental problems of number and energy, justice and want, beauty and ruins, breathing, meaning and style, so that he, too, may come to feel that at least some manifestations of these questions

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[12]But about half think that the university provides a satisfactory way to a degree, which may be optimistic. The attrition rate in medical schools is about one-half; in the social sciences, 80%. *Informe . . . sobre la Situación Social de Espana,* (Madrid: Fundación Foessa, 1970), pp. 986 and 1043.

[13]G. Polya tells of the professor who counsels his students that " . . . in order to solve this differential equation you look at it til a solution occurs to you." In "How to Solve It," in J.R. Newman (ed.), *The World of Mathematics, 3,* (New York: Simon & Schuster, 1966), p. 1987.

[14]*The Times Literary Supplement,* 8 October 1971, p. 1225.

[15]"Misión de la Universidad," p. 327.

[16]*The Times Literary Supplement,* 1 December 1970, pp. 1439-1440.

are also his questions.

III. The Extrinsic Problem of Study: The Choice of Curriculum

Teaching should be directed towards the true students, who form by far the larger number among the learners. This requires, first of all, a pedagogy that, without doing violence to the individuals, will equip them for their social destinies. Such a pedagogy does not exist today[17] but it is a matter of general belief among those who think of these questions that it *could* be created if university education could be thought through anew, if wide-ranging experiments were conducted intelligently and objectively, and if the teaching staffs were capable of adapting to radical alterations of their routines. Indeed, it is a part of this belief that the new pedagogy will reveal that most students are capable of much higher attainments than has hitherto appeared.

However, there are limits of time and mental capacity which no method will manage to surpass. These limits are going to be narrow with regard to an ideal command of any profession or science. For any item of professional learning to be included in a curriculum, Ortega therefore proposes that it be judged by whether or not it is likely to be needed in practice. And then, within the totality of necessary learning only that which could be learned thoroughly by the average student would actually be taught.

With regard to this criterion of pertinence, it seems that no studies are available concerning the items of knowledge that are generally and actually put to use by graduates. What do ophthalmologists, systems analysts, social workers, chemical engineers, librarians, patent attorneys, bookkeepers, and teachers of French know of their professions, and of that which they do know, what part do they apply?

All learning must fall into one of three classifications, which can be distinguished by the differences in the mastery they require. I would call them the *foundational,* the *reflective,* and the *heuristic* kinds. The foundational are the active and indispensable accomplishments which form the primary and most obvious knowledge. A language teacher, for example, needs a command of the language he teaches: he must read it with thorough understanding, and speak and write it without undue solecisms. The reflective consists of knowledge of principles and of connections. In the example, grammar, etymology, the history of the language, the elements of philology, literature, cultural history and geography, and pedagogy, would fall into this grouping, the limits of which, both as to what can be demanded and as to what might quite easily be needed, are extremely difficult to define. And because no amount of study could conceivably be sufficient for even the brightest to attain completeness in this second layer, there is a third kind of knowledge, the heuristic, which enables us to find out and to

[17]Although it may be that Professor H.T. Epstein is guilty of slight exaggeration when he claims that: "School structures and teaching methodologies are so primitive at present that almost any education experiment devised by a reasonably intelligent person is bound to succeed . . ." *Nature, 235,* p. 203 (1972).

appraise what we do not yet know but may suddenly want to know. It is clear that despite the formal similarity in the teaching of most of the professions, the proportions in which these three kinds of learning are needed must vary greatly from one to the other. The "language" of biology is not altogether self-evident, but we know that once it has been mastered, even the absence of very substantial items of secondary knowledge is not a serious obstacle, genius and perseverance provided, to advances of the highest significance.[18] Any re-structuring of study programs should take into account that, despite the world-wide uniformity of curricula, what is known — and what is not known — bears in practice only a remote and extremely variable resemblance to what is taught.[19]

Ortega's second criterion for the choice of a professional curriculum, the need for thoroughness, whatever it may do to breadth, underlies the first, the need for pertinence. If the program must be adapted to the limits of the student, it is because honest learning demands mastery.

IV. Profession and Culture

All societies need two attainments to be spread widely but jointly: a thorough command of the professions (i.e., of all types of applied intellectual work) and an understanding of the level of the times. The latter, the requirement of culture, is a corollary to the fact that man is heir to history, and that there is no conceivable reorganization of his life that can dispense with any major part of the past — from the vocabulary and syntax of language to why we build bridges the way we do and not otherwise. No program can begin, if it is to be fruitful, without starting at the level that history has reached at the particular instant.[20] We may not ignore who we are, which unfortunately is easy enough to do.

Culture as teachable matter has a very specific meaning for Ortega. It consists of the history of the ideas of physics and biology; of philosophy (which is chiefly the history of its ideas); and of history itself.[21] The last,

[18]For example, J.D. Watson, *The Double Helix,* (New York: Atheneum, 1968).

[19]Watchers of the future base many predictions on the effect that the rapid accretion of new knowledge, together with some obsolescence of the old, will have on people's adequacy to their employment. They calculate that after a certain short number of years, any professional, unless he were expensively retrained, would know only one-fourth as much as a new graduate. Such an ignoramus would, of course, have to be retired by early middle age. These analyses do not take into account that (a) there is no assurance that universities impart the latest learning or will do so unless they are altered radically; and (b) that all items of knowledge come in a hierarchy that is unrelated to the date of their discovery.

[20]E.G. Boring in "Science and the Meaning of History" notes: "One finds that he needs to know the past, not in order to predict the future (nor to avoid repeating the past), but in order to understand the present. *History, Psychology and Science,* (New York: John Wiley, 1963), p. 89. On the absence of the sense of history, H.T. Epstein, *op. cit.,* remarks: "If I have learned anything from my involvement with high schools, it is that it is illusory to expect students to learn science . . . from teachers who do not know biology to be anything more than its current factual content . . . ".

[21]This is the solution that Ortega had offered to the puzzle more recently described by Lord James of Rusholme with regard to the natural sciences: ". . . we are still very far from knowing *what* science a future lawyer or administrator should know to make his judgments more valid and his actions more rational . . . It is absurd to . . . think that by simply learning a little of one branch of it man will equip himself to understand the problems of the new world." In E. and E. Hutchings (eds.,) *Scientific Progress and Human Values,* (New York: American Elsevier, 1967), p. 208.

taught primarily from the social standpoint, insofar as that may be possible, would be the common background of the others. These share three essential features to which I presume they owe their preferred position in Ortega's scheme, features that are not characteristic of other endeavors that may appear superficially to be equally central to the role of culture as a guide to the world.

The first is that there is at present wide agreement among scholars in the West regarding the significant ideas in these fields. Without formal coordination comparable curricula would arise naturally from Melbourne to Helsinki. The only major violations to this unanimity in recent times have come from trends that are foreign to the internal development of philosophy, physics, and biology[22], as a result of religious prejudice or political impositions. Apart from these aberrations, the main thread in the history of the living ideas of our age and society, as exemplified by a number of established great names, of their contemporaries, associates, and successors, is not in dispute. The subject matter can be made accessible in scope without drastic loss of depth, which cannot be said of literature or of the arts.

The second feature of the three great cultural topics is their antiquity: there is an unbroken line that connects Greek thought[23] with our own which makes it recognizably thought about philosophy, physics and biology. Although histories of geology, chemistry, psychology, etc., are written which take these sciences to remote times, the relationship to their modern development is more a question of coincidence in subject matter than of any continuity in ideas. There might be no chemistry today had there been no alchemy: but the thinking of alchemy bears no genealogical connection to modern chemical thoughts, even to the more naive ones. Indeed, the maturity of some of the social sciences is such that when they come to be definitely constituted, even the ideas of some of our best known scholars may not be as firmly a part of their established heritage as are some of those of Eudoxus and Aristotle today.[24]

The third feature is that the questions of biology, philosophy, and physics are the immediate ingredients of any possible reflections of a reasonable being endowed with a body, whatever the other activities to which it may dedicate its existence. They are not propaedeutic (as mathematics and logic)[25], nor must they be instruments (as engineering, medicine, or the law) for particular uses, nor necessarily pleasurable or moving (as literature and music).

In order to understand something one needs first the belief that one can

[22]In biology, the most that could be provided would be the background from which to understand a future biological synthesis.

[23]Although there are many extant facts concerning pre-Hellenic sciences in the Near East and China, it seems that we do not yet know enough to trace the history of their *ideas* before Greece.

[24]These remarks on the social sciences are not explicit in "Misión de la Universidad," but in view of Ortega's later writings he must have been in agreement with them.

[25]Ortega also expected that future secondary education would enable all university students to know the mathematics needed to follow the history of the ideas of physics and astronomy.

understand, and this belief can best be fostered by the data, the generality, and the scrupulous moderation of these fundamental disciplines.

V. Science

The essential condition for any achievement to be possible, says Ortega, is to understand the limitations in the situation within which one is to act.[26]. One of the shortcomings of man today is the rarity of the researcher[27], of the person whose goal is to struggle with certain problems to their solutions, who would not think his life well spent if he were not to attempt them; for whom, in a decisive way, the problems and the meaning of his own life have become inseparable. In this sense the half-hearted researcher is a contradiction in terms. The limitations of most minds are such that all real problems demand, even from the best, an intense dedication, if not of all of their time, then certainly of their whole attitude.[28]

It seems to me that those who believe that the coming general numeracy of the world's population will soon bring about a vast army of part-time researchers laboring with enthusiasm at their home computers, will be as disabused as those who, in the 19th century, awaited a splendid flowering of knowledge from the literacy of the proletariat.[29] Nor should we be surprised, for we cannot expect that the average man will use the leisure that the prodigious advances of applied science afford him, in order to continue the work that the inventors had chosen for themselves, under conditions in which the need to invent was all the greater for the fact that those discoveries were still unmade. Literacy has meant wealth and longevity, but not the spread of culture, certainly not in the direct and rapid manner that had been anticipated. Intellectually it has meant self-assurance for the average man. Ortega puts the problem of culture in the new age as follows:

> At least in the history of Europe until now, the masses had never believed that they had 'ideas' about things. They had beliefs, traditions, experiences, proverbs, mental habits, but did not imagine themselves possessed of theoretical opinions concerning what things are or ought to be . . . An idea is a chellenge to truth. To wish to have ideas demands that we be disposed to wish for the truth and to accept the conditions that it imposes. We cannot validly talk of ideas or opinions if we are not allowed the right of appeal to the standards that regulate them. These standards are the principles of culture.[30]

The most obvious manifestation of general literacy has been an excess of writing which has so hidden from view the masterpieces of our time that Roy Fuller, the professor of poetry at Oxford, was recently moved to remark:

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[26]"Misión de la Universidad," p. 338.

[27]Science *is* research to Ortega. *Ibid.*, p. 336.

[28]". . . all dedication, if genuine, is the dedication of one's whole life. Nothing less." *Ibid.*, p. 345.

[29]Even today: "In English working-class speech the word 'book' is used to describe an illustrated magazine, so little do real books impinge on their experience . . . For the past year I have been directing an attempt to develop university adult education in working-class areas where the only regular reading is the *Daily Mirror* . . . The people we are working with, 'the common people,' constitute the vast majority of the population," Roy Shaw, *op. cit.*, p. 1226.

[30]"La Rebelión de las Masas," *Obras Completas, IV,* 6th edition (1966), p. 188. (English translation, *The Revolt of the Masses* (New York: W.W. Norton, 1932).

> Certainly it is not possible, without condemning oneself to . . . harshness, to judge the literature created by one's contemporaries by the standards of literature that has survived from the past . . . [31]

In science the problem can be seen more clearly than in Ortega's time and some of its aspects are not too dissimilar from the situation in literature that Professor Fuller laments.

It is not generally recognized, I think, that scholars are an uncertain mixture of very different kinds of men, different not so much in their capacity for complex thought as in their capacity to dedicate themselves to it. For historical reasons it so happens that most scholars now are, in addition, professionals who teach at the universities. The two activities are associated because before it was widely held that science is an enterprise worthy of public support, teaching was the likeliest way for the researcher to make a living. In many countries the decline of astrology, of the monasteries, and of independent wealth have severed most of the other ancient professional associations of the pure researcher. (In some countries, of course, the independent institutes of science have gained the highest significance.)

University training does not now, in general, distinguish among the future professors, researchers, and professionals, which is not so important as its consequence: that they, in fact, do not distinguish among themselves. From time to time a case comes to light that gives us some idea of what is involved in trying to play the role of the scientist, to gain a place in the annals.[32]

A recent example has been the supposed synthesis of a high polymer of ordinary water substance. This has taken up many years of effort in scores of laboratories throughout the world. Upon reading the very numerous papers on this question, one learns that for many of our contemporaries who are well placed in scientific work, once the startling nature of an apparent discovery makes them immune to the objections of referees, the violation of elementary laws does not offer major obstacles to the advancing of private dreams.[33] There has been no cultural side, no moral side, to their physics. More serious is the troubling variability in chemical analyses on the early specimens from the moon. If such results obtain in an enterprise of this magnitude and publicity, one cannot but wonder at how many mistaken conclusions lurk in numberless innocuous sounding papers of impenetrable prose; no new bits of shining fact that must be learned in order to keep up with knowledge, but bulk that will be suffocating the libraries for generations.

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[31] *The Times Literary Supplement,* 5 February 1971, p. 151.

[32] L.S. Kubie remarked twenty years ago: "Certainly the idyllic picture of the innocent, childlike scientist who lives a life of simple, secure, peaceful, dignified contemplation has become an unreal fantasy. . . . the emotional stresses of his career have increased to the point where only men of exceptional emotional maturity and stability can stand up to them for long, and remain clear-headed and generous-hearted under such psychologically unhygienic conditions." "Some Unsolved Problems of the Scientific Career," in B. Barber and W. Hirsch (eds.), *The Sociology of Science,* (New York: Free Press of Glencoe, 1962), p. 229.

[33] Particularly revealing contributions on both sides are those by B.V. Berjaguin, *Scientific American,* No. 5, *223,* (1970), p. 52; V. Zhvirblis, *Khimiya i Zhizn', No. 12 (1969), p. 37 (English translation, U.S. Report JPRS-5006, March 1970); and P. Barnes et al., Nature, 230,* (1970), p. 31.

As long as the scientist, real or aspiring, occupies his present eminence in the social scale, it will be very difficult for universities to dissociate science cleanly from professional teaching. Ortega's solution would be to admit that the university is where a large proportion of the population can and do learn to be competent physicians, accountants, industrial chemists, and musicians, with their specific functions, ethics, and ideals; and that there must be another place in which "the small minority of modern monks," can develop their craft and train their successors in unisolated separation.[34]

VI. The Need for an Exoteric Science

In his essay Ortega predicted a decline in the prestige of science.[35] This decline has already begun, long before the saturation limit in the growth of science had been attained, and indeed, at a time when researchers in most fields cannot yet anticipate any slackening in the rate of appearance of new ideas worthy of exploration. This reaction against science can be understood if we recall for how long, and in many cases, how unjustifiably, a large part of the population of the West has been depending on it for an answer to all problems. From the end of the 17th century we read the argument of Charles Perrault that "the poetry of the Moderns must be better than that of the Ancients, since the physical knowledge of the heart, the seat of emotions, is now surer . . . "[36] From about a century later we hear Miss Camilla Stanley, who observed:

> I wish there were no such things as teeth in the world; they are nothing but plagues to one, and I dare say that people might easily invent something to eat with instead of them . . .[37]

Ortega's fears regarding the future of science were based neither on its supposed "dehumanizing" influence, nor on a negative assessment of the balance between the benefits and the dangers of science. We must know, his argument runs, because we need to act, to plan our lives, sometimes wholly, certainly always in their smaller portions. And since we must act, we need a guide to our options, and this guide is culture, of which another definition is:

> . . . the system of ideas *by* which the age lives . . . the repertory of our true persuasions concerning the world and men, concerning the scale of values that pertains to things and to actions: which among them are to be esteemed more and which less . . .[38]

[34] Among recent papers that appear to point in this direction is that by the president of Rice, Norman Hackerman, *Science, 175,* (1972), p. 475. He suggests the separation of graduate from undergraduate instruction because very large numbers of the highest academic degrees do not appear to be needed, and because better standards of teaching do not result from the association of the two. The idea that pure research may be beyond the scope of all universities has been advanced by Professor W.A. Noyes on more general and more dubious grounds: "If indeed the majority of young people are to be exposed to university type education and if . . . nearly all will attend tax-supported institutions, one must probably assume that the university will cease to be the center for objective thought. Since detached and objective scholarship is absolutely essential for progress, agencies other than universities may have to assume this burden." *National Science Policy,* H. Con. Res. 666, 91 Cong. 2 Sess., (1970), p. 621.

[35] "Misión de la Universidad," p. 348.

[36] *Parallèle des Anciens et des Modernes,* quoted by R. Hatton, *Europe in the Age of Louis XIV,* (London: Thames & Hudson, 1969), p. 182.

[37] Jane Austen, *Catherine.*

[38] "Misión de la Universidad," p. 341.

One of the chief sources from which culture is formed is knowledge, which is now derived mainly from science, that is, from research.[39] (A part of science is not culture but scientific technique.) The most significant contribution of knowledge to culture is that, very simply, it can render life more predictable. When knowledge becomes an impenetrable mass, the complexity and obscurity of which rival those of reality, its usefulness comes to an end. A map as intricate as the land we were trying to explore, and yet not that land itself, would be worse than impractical. A science that cannot provide clarity to the map of culture is not fulfilling its role, and men will necessarily come to neglect it.

The guidance that culture provides does not, according to Ortega, consist primarily in assistance towards the solution of practical questions. Such would be, in any particular instance, an accidental and unforseeable consequence of true research. The guidance of culture assists us to form a complete idea of our condition. Because science is very unlikely ever to approach completeness, and certainly does not do so now, such an idea has been and always will be formed by the addition of extra-scientific beliefs, and in the past was actually made up almost exclusively of these. Culture is an essential need, but science is not, and man, since he has done without it in the past, may do so once more.[40]

Often we hear calls for scientists "who know the facts" to combine their work with "advocacy on issues about which the public is ignorant." That is, it is commonly accepted that only two possibilities are open to us in our dealings with the natural sciences and their consequences. Either we are or become, *inter alia,* physicists, biologists, and psychologists, or we must allow other men, not otherwise our obvious betters, to think for us throughout enormous areas of our lives, in which we would have to be, as Ortega says, "... resigned to stupidity..."[41]

An alternative is the one which we have already considered: that universities adopt the teaching of culture as one of their two primary functions. And that can only succeed if ways are found to teach the essentials of science to such an extent that, although all educated men would not be able to do biology, physics, etc., nor aspire to do so, they would be conversant with the limitations of its methods, the significance of the major advances, the nature of the great problems, and the outline of its historical evolution.[42]

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[39]The other major source of culture, in Ortega's sense, is much more difficult to define. Proust seems to suggest it in *Le Côté de Guermantes:* ' . . . *mais pour parler de la mesure d'une facon entierement adéquate, la mesure ne suffit pas et il faut certains mérites d'écrivain qui supposent une exaltation peu mesurée.*"

[40]A complete world-view, however mistaken, is itself an indispensable condition of all science. "Effective research scarcely begins before a scientific community thinks it has acquired firm answers to questions like the following: What are the fundamental entities of which the universe is composed? . . . What questions may legitimately be asked of such entities . . .?" T.S. Kuhn, *The Structure of Scientific Revolutions,* 2nd edition, (University of Chicago Press, 1970), pp. 4-5.

[41]"Misión de la Universidad," p. 345.

[42]The call for a more widespread understanding of science is quite old, although it has not been usually based on the need for completeness of the world-view. In 1872 *Nature* (*5*, p. 233) advised:

This would, of course, also require some active knowledge of these sciences. How can such knowledge be gained without falling into the very trap that now subverts the goals of the university, i.e., of trying to teach what cannot be learned properly? Here reliance must be placed on improved teaching methods, which presuppose that all terms in the technical vocabulary of a science can either be translated without loss into those of ordinary language, or refer to intra-scientific matters of concern only to researchers. For example, the ability to decipher hieroglyphs is essential in a first study of pyramid texts, but not in understanding ancient doctrine on the rites of passage of the dead.

Ortega's alternative solution cannot be accepted as readily as in 1930. The relationship of mathematics to physics is not analagous to that of hieroglyphs and Egyptology. The trend in many fields has been towards almost exclusively mathematical developments, in which the terms of our experience lose all apparent validity and where understanding is essentially knowing how the mathematical expressions can be manipulated. It is doubtful that in these cases understanding means to the physicist what it does to both scientist and non-scientist when they understand, for example, the laws of an ideal gas. The non-scientist in this case may soon forget the formulae or he may be unable to develop their further implications correctly, but at the moment of learning the principles involved his clarity of comprehension is of a kind comparable to that of the scientist.

If this trend truly represents the only way in which these particular fields can be grasped, it is certain that the non-specialist will have neither the training nor the persistence to follow. The underlying problems will not be his. Thomas Kuhn reminds us that some branches of the physical sciences were already unclear to those without technical knowledge by the Middle Ages, and that most of them had become so during the 19th century.[43] But the situation now is different, for the effects of science were far less pervasive then, and the costs of its pursuit so minor that it could easily be maintained without direct contact with the mass of the educated population. Chess of a very high order is practised today without either the support or the understanding of most of us.

The problem goes beyond whether or not the most rarefied sciences can be made accessible to the cultivated layman, to the extent that they can become part of his life. It is also whether or not they can be pursued at all. Ernan McMullin has analyzed with great clarity the long-term implications of this question: that as the physical terms derived from experience become

"Every one now-a-days should have such a knowledge of scientific principles and methods as will enable him to form a just idea of the value of science, and to distinguish between knowledge and pretence — between science and quackery." An example of a society that failed to attain this ideal is the Eastern Empire. In Greece during the 3rd century, at a time of ferment among the intellectual middle classes, the academics resorted to an archaic and esoteric language which did much to bar the former from literary pursuits. It is known that by the 6th century, Byzantine philosophers were studying the letter of Socrates . . . to Plotinus!" Peter Brown, *The World of Late Antiquity,* London; Thames & Hudson, 1971), pp. 64 and 174.

[43]op. cit., p. 20-21.

inapplicable, the making of models, the art from which so many of the great discoveries have emerged, can no longer serve as a guide to further explorations, for there will be no terms from which models can be built, but only the mathematical relationships.[44]

An excessively difficult and unteachable science cannot demand general allegiance and must wither. A stagnant science would afford no hope of completing our world-view and other forms of thought would be substituted for it.

VII. The New University

The universities, according to Ortega, must be teaching institutions whose first demand on their students ought to be a thorough command of what they can learn, neither more nor less. Within this limit, the syllabus should comprise those skills, facts, and speculations that are essential to the competent exercise of the professions and to the absorption of culture.

From this summary a number of conclusions can be drawn, of which the most significant is that the university, although intimately dependent on research both for the content of its courses and for its methods of teaching, ought to be no more of a research institution than, for example, a department of civil engineering ought to be a building contractor. The universities must be judged, not by the scholarly accomplishments of their professors or even of their graduates, but by the skill and responsibility which the latter display in their daily tasks. University professors would be entrusted with the duties of interpreting research, incorporating the interpretations into the general body of knowledge, and transmitting this mixture of information and wisdom.[45]

New scientific institutions would have to be established, physically adjacent to the universities and in intimate contact with them, but independent of their organizational structure. They would be devoted to the "generation of rigorous knowledge in all of its forms,"[46] and to the training of new scholars from among those university students or graduates who showed both an extraordinary aptitude and an overwhelming desire to engage in research. Many of the professors would also have to be alumni of the research departments, to assure that science and teaching were not severed, and it is likely that there would be a number of double appointments to the teaching and research staffs, especially in the more literary and less experimental pursuits,

[44]In "Limits of Scientific Inquiry," J. Steinhardt, (ed.), *op.cit.,* p. 37-84. For an optimistic view on teaching advanced physics at an elementary level, see H. Bondi, *Assumption and Myth in Physical Theory,* (Cambridge University Press, 1967).

[45]No mean assignment, even when research proper is excluded. Lord James of Rusholme has given a description of this task at its highest level: "The bulk of knowledge will only become manageable, in the sense of permitting fundamental creative understanding, insofar as it is unified by broad synthetic ideas; and it is precisely these ideas which are the most difficult for any but the best minds to originate or even to understand . . . It becomes . . . necessary for a society to be able to identify these exceptional synthetic minds capable of generalisation, and to possess exceptional institutions capable of educating them." op. *cit.,* p. 205.

[46] Misión de la Universidad," p. 351.

where the distinction between the two becomes less clear.[47]

Since the unshirkable demands regarding both the approximate body of skills, and the level of intellectual maturity required of the students would be known in advance, the problems of space and morale caused by the large numbers of unqualified aspirants to the university would become less acute. Indeed, Ortega thought that a student body that was deeply conscious of the role of the university, of its fairness and efficacy, should be able to take up some of its administrative tasks and almost all of the disciplinary ones.[48]

With the decline in the number of the less dedicated students and the generalized use of electromechanical devices to aid in the mastery of facts and mental routines, three advantages would be gained. First, the teachers would be freer to help by providing those insights and connections that are beyond the power of machines. The capacity of each student with regard to the various fields of study could be readily evaluated. Finally, competition among students would diminish, for the standards demanded at each degree level would be high and rigid, and the tests thorough, extensive, and fair, but still attainable by the whole body of dedicated learners.[49] Without the nervous toll of direct competition, those who were intellectually capable but poorly qualified technically would find it easier to progress than under present conditions.

In an atmosphere of unremitting honesty, where the success or failure of their efforts would be plain in a few years, a purification of the professorial staff should be possible. Those who are solely interested in the higher scholarship — an entirely legitimate inclination — would be spared the agony of lecturing the uninitiated. The minority of the incompetent or cynical could scarcely find a cozy environment in the new university.

The rise of a widespread body of cultured men and women would compel a reorientation of the newspapers and of all other information services, from broadcasting to the publishing houses. We might even presume that those who write for the popular press would themselves be more skilled: capable of combining entertainment with adult education, and incapable of the worst forms of "sensationalism." The consequence of this change on political life would be both salutary and incalculably vast. Even before televison Ortega wrote that by the default of the church and (in liberal countries) of the state,

> . . . the journalist, one of the least cultivated classes in present-day society, has been left charge of

[47]Strikingly similar proposals for the curtailment of the curriculum and the separation of research have been advanced for the reform of the universities of the Netherlands, in the Posthumus and McKinsey reports. These suggestions have become the policy of the Dutch government. A de Kool, *Nature, 237,* (1972), p. 211.

[48]"Misión de la Universidad," p. 333.

[49]The Chinese claim that they have achieved the disappearance of competition in the Mainland universities in a number of ways, of which the most interesting is a system of examinations designed only to find the weak areas where the student needs to review. See E. Signer and A.W. Galston, *Science, 172,* (1972), p. 17. Some of the present-day methods of examination of the best universities in the Western world bear a resemblance to the Chinese. An excessively rigid selectivity, either political or intellectual, appears to be a necessary condition for these methods to be feasible.

nourishing and guiding the public soul . . . The grotesque inversion which things manifest today . . . is the result, in no small part, of the undivided empire of the press, the sole 'spiritual power'.[50]

In politically free societies of limited means, a well-informed public is the only assurance that pure research, if it can be pursued at all, will be pursued indefinitely into the future, in all fields. Like the monasteries, the institutes of science are ultimately dependent on both popular enthusiasm and respect. We cannot hope that all of the many sciences could be maintained by amateurs willing to devote to them their lives and their resources. Nor can we expect non-scientists to achieve such a state of knowledge that they will find specific reasons to support every significant project that arises from the internal development of the sciences.

The magnitude of the problems that will face us within the course of the next few generations is even now giving a strong impulse to the contrary thought among both laymen and scholars. The thought that purely technical solutions are possible has been inspired by those great triumphs of contemporary engineering (nuclear energy, inter-planetary travel, and armaments) which have been based on mature sciences.[51] Applied science is a tool that can always be tried until exhaustion proves that it cannot succeed, and often it succeeds without being quite able to explain why. But nobody has the slightest idea of the path that pure science will in fact take, except that some of its advances will be essential to the technologies of the future, while others will never be of use. No one can calculate whether the next great discovery in astronomy will reveal a new source of energy or the limits to our comprehension of reality. The principle that autonomous institutes of pure scholarship are indispensable adjuncts to any university, if it were to spread, would do much to save research, and with it all of mankind, from the perils of a directly practical age.[52]

Finally, writing, free from the compulsion of unnecessary research, would be limited chiefly to those who had the audacity to be persuaded that they still had, indeed, something to add. The essential distinction between a minority of authors and a majority of readers, of which Julian Marias wrote in 1953, would be restored.[53]

[50]"Misión de la Universidad," pp. 352-3. The fault does not lie so much with the journalists and editors as with the much less cultivated commercial and political interests who so often decide all matters of substance in these enterprises.

[51]The sure-footed advance in these fields compares strikingly with the chaos of true sciences, such as cellular chemistry or astronomy. For example, all of the chief types of commercial nuclear reactors that have been under development over the past two decades had already been proposed by the founders of this field during the forties.

[52]Dr. Philip Handler, of the U.S. National Academy of Sciences, has suggested that the proper amount of public funding for fundamental research should be directly proportional to the number of "truly competent scientists." *National Science Policy,* H. Con. Res. 666, 91 Cong. 2 Sess., July 21, 1970, p. 91. The first step in order to establish the level of support would be, therefore, to determine what is the number of qualified researchers, another difficult task for the "synthetic thinkers". "In the arts, you do have a way of codifying artistic tastes. This is the role the artistic reviewer takes. I would hope one could encourage the emergence of a cadre of scientific critics in the same sense. People who are willing to take these . . . reports and . . . subject them to a . . . penetrating analysis . . ." Alvin Weinberg in "Government Allocations to Basic Research," H. Orlans (ed.), *Science Policy and the University,* (Washington: The Brookings Institution, 1968), p. 154.

[53]"El Intelectual y Su Mundo," *Obras Completas, IV,* 4th edition, (1969), pp. 556-567.

VIII. Conclusions

The university, Ortega argues, must be a teaching institution dedicated to the education of competent and cultured professionals; it must combine changing and flexible syllabi with high and rigid standards. It must provide personal and benevolent attention such that no capable and dedicated student could fail to master his subject, and no trifler could hope to pass. The university should be staffed by a class of pedagogues, liberally sprinkled with generalizing thinkers. The scholars and researchers, strictly speaking, would work and teach mainly at independent institutes, accessible only to those of outstanding scientific talents. These institutions would by no means be the natural continuation, on a higher level, of university education. (Many suggestions have been advanced in the United States in recent years regarding new kinds of higher degrees that would not involve research.)

It is useless and probably harmful to preach radical modifications of conduct in order to resolve emergencies, however likely, that the author may foresee. But the proposals we have been considering, while they would involve very extensive alterations in the structure of higher education, would not demand new patterns of behavior. After all, clarity, competence, and thoroughness, the necessary difference between a druggist and a pharmaceutical chemist, and the regrettable distinction between, say, *Middlemarch* and *The Love Machine,* are well known from the past and from our daily experience. They can be recognized widely without either specialized knowledge or heroic morality.

Yet the proposal may not be feasible because of secondary effects to which society may also be incapable of adjusting. For example, there would be a major reduction in the number of research papers. How essential is this minor science to the healthy growth of major science? Some of it is; the question is how much.[54] We do not know, but the influence, if any, of truly minor papers on the important ones would not appear to be impossible to determine.[55] We do know that the incomparable flowering of physics in the half-century before 1940 emerged from a much smaller base than that of the last thirty years of progress.

A major problem is felt to lie in the world-wide deficiencies of much of secondary education. It is the feeling of many thoughtful young persons in the United States that by the time they enter college, the boredom of much of their previous school experience has rendered a large proportion of them incapable, both technically and spiritually, of true higher education. To begin at the university is to begin twelve years too late. The discovery and libera-

[54]"There is an implication in the genius theory that if you could only pick out the geniuses you would not need to support the rest of science. The 'breakthrough' of a genius usually rests on the lesser but essential contributions of hundreds of other people. Discovery and invention are syntheses, and you have to have something to synthesize." Harvey Brooks in "A Reply to Six Questions . . . ," H. Orlans (ed.), *op cit.,* p. 174-148.

[55]J.R. Cole and S. Cole have reported such a study in *Science, 178,* (1972), p. 368. This analysis is marred by the fact that they do not distinguish between scientists and professionals. Therefore, their paper cannot stand as a refutation of the ideas of Ortega or Harvey Brooks on the essential character of the contributions from lesser scientists.

tion of the child, of which Maria Montessori spoke, are still distressingly far away.

The next difficulty is that the average student, of whom Ortega was so fond, has been left undefined. There is a large class of average students who may perhaps be regarded as homogeneous for the purposes of assigning just standards, but on statistical grounds this class could not, at most, exceed one-half the total number of students. There would be very many others who, still without reaching the highest levels, would be much better endowed, and correspondingly, groups capable of respectable labors but with clearly much lower attainments. The present arrangement deals with this situation by the hierarchies of degrees, of professions (nurse and neurosurgeon, elementary and physics teachers, etc.), and of colleges (especially in the United States); it deals with it, above all, with grades.

In Ortega's system, where all degrees are honors degrees, grades and the ranking of colleges would have to disappear as ways for making distinctions. A larger variety of academic degrees would be needed, if many students were not to be unfairly disqualified from the start, but this variety would run counter to the trend towards the display of equality which has been such a major force in Western society over the past two centuries. The choice of degree standards would also have to be correlated to social need. It is useless to decide that nurses, in order to do their jobs well, must possess certain difficult accomplishments the demand for which would deplete their ranks; nor is it convenient to have many more engineers than can be employed; nor whatever the presumed need, can we ask people not to study whatever it is that they truly want. There is no equivalent in our society today to this delicate task of fixing standards.

Higher education has always been undertaken by many for the joy, prestige, and conviviality of some aspects of university life. At an extremely high cost, moral and material, this has promoted what the State of New York recently described as "an attitude of collusive mediocrity." Few obstacles will be more difficult to overcome than this long entrenched tradition.

The one proposal that will be even harder to practice is to instill culture. We are sure that we can teach a fairly intelligent person reasonably good French; there are grounds to believe that we can also teach him to write clearly in his native language, and to apply mathematics correctly in order to master the elements of physics, engineering, or economics. But whether or not we can make him cultured is an experiment that has never been performed on a sufficiently large scale for a convincing answer to be at hand today.

One can teach a man French given, on his part, adequate dedication and modest acquiescence. But one cannot teach him philosophy if he does not happen to be keenly involved, for there are no verbs in philosophy that

he can memorize and, *ipso facto,* know.[56] Can the need for philosophy, for history, for ideas, be taught? Here the universities have been performing poorly, for they have in general failed to convince the skeptics that their insistence on these subjects is no mere expression of an affected piety. We do not know whether or not they could have been enormously more successful than they have.

In the midst of the gigantic revolt of the masses, the consequence of the rapid erosion of the working class, we can no longer expect a sufficiently large number of people to acquire the need for culture by inheritance, which has been almost to the present the only consistent mechanism for its transmission in most countries. Let us assume that this need can be taught. There is no assurance that culture will spring necessarily from it. The need for honesty is universally acknowledged, probably sincerely for the most part, but it is practised far less assiduously. In cultures, as in honesty, the passage from a felt need to a reality makes strenuous demands, and just as it would have been too harsh before, life today, for the vast middle classes of the West, is too easy, too full of distractions, for the success of their mass cultivation to be very likely. One of the causes of student unrest in Europe is thought to be simply that, at a time when everybody works forty-hour weeks, only the student is still (or was until lately) obliged to labor sixty. When Marcel Proust was young, he asked of Anatole France how the elder man could know so much:

> The answer is quite simple . . . When I was your age, I was not, like you, good looking. Nobody, in fact, much cared for me. Consequently, I was never asked out, but stayed at home reading, reading endlessly.[57]

And that is excessive. We can expect, we can demand that colleges graduate competent business administrators, architects, home economists, and agronomists. We can hope that, with some good luck and much skill, we can convince a substantial number of them that there is indeed a body of ideas that provides the inescapable rules on which their lives, their professions, and their happiness depend. Perhaps, in the course of years, many might work their way through some of these ideas to their satisfaction, a situation to which the present system affords no evident route.

The consequences of complete failure are as obvious as they are inadmissible. Professor Kettle has described one of its signs very clearly:

> If higher education is to be *simply* a form of technical training for a job (as much of it is today) . . . the student bookshops will be full of slick textbooks and the very latest series of pseudo-scientific advice as to how to get through the next exam with the minimum of thought or energy. Nothing would be more likely to hasten this process . . . than the adoption of what appears at first glance to be the opposite policy . . . 'creaming off' the bright boys and girls, giving them culture, and leaving the rest to do the work and ask as few questions as practicable.[58]

Because, as Ortega wrote:

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[56]It appears that many members of the S.S. were familiar with the letters of Goethe and Rilke. See Goerge Steiner, in "To Civilize our Gentlemen," *Language and Silence,* (New York: Atheneum, 1967), p. 61.

[57]Andre Maurois, *The Quest for Proust,* translated by G. Hopkins, (London: Cape, 1950), p. 73.

[58] op. *cit.,* p. 1440.

> It is a grave error to believe that the practical is born from practice alone. To make a man practical one must first convince him that practicality is the best life, to do which is no longer a matter of practice but of religion. We must realize that nothing resembles the ends less than the means that are applied to gain them . . . The useful is the technical, but you can be assured that morality is the most useful foundation of a good technique. To think otherwise, to look only for the immediate result, is to deliver ourselves unarmed to the caprice of the next hour, which will arrive with its unsuspected needs, perhaps demanding the very virtue which we least hold in readiness.[59]

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[59]"Meditación del Pueblo Joven," (1916), *Obras Completas, VIII,* 2nd edition, (1965), pp. 368-9.