

# Design as a Discipline

One of the principal assumptions behind the launching of this new journal is that Design can be identified as a subject in its own right, independent of the various areas in which it is applied to practical effect. The Editorial Board is therefore proposing to publish a series of papers by leading members of the international 'invisible college' of Design Studies, which will aim to establish the theoretical bases for treating Design as a coherent discipline of study in its own right.

The questions or issues that these papers are expected to address include: Can design be a discipline in its own right? If so, what are its distinguishing features? (What are the kind of features that distinguish any discipline?) To what questions should the discipline address itself – in both research and teaching? What methodology does it use? What results – what applications – should it be trying to achieve?

To start the series we are publishing two contribu-

tions by Bruce Archer. The first is a short statement prepared specially for this first issue of *Design Studies* by Professor Archer, entitled *Whatever Became of Design Methodology?* The second is an extract from a lecture delivered by Professor Archer at the Manchester Regional Centre for Science and Technology on 7 May 1976, under the title *The Three Rs*. This latter paper argues not only that Design should be regarded as a fundamental aspect of education (in no sense a specialized subject) but that Design is (or should be) on a par with and distinct from science and the humanities.

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## Whatever became of Design Methodology?

BRUCE ARCHER

Design methodology is alive and well, and living under the name of Design research.

To tell the truth, I never did like that hybrid expression 'design methodology'. My objection was not only to the corrupt etymology, but also to the impression, conveyed by the term, that the student of design methods was exclusively concerned with procedure. For my own part, the motive for my entering the field (25 years ago, God help me) was essentially ends-directed, not means-oriented. I was concerned to find ways of ensuring that the predominantly qualitative considerations such as comfort and convenience, ethics and beauty, should be as carefully taken into account and as doggedly defensible under attack as predominantly quantitative considerations such as strength, cost and durability. Moreover, it is demonstrable that the assumptions upon which even the quantitative considerations are based can never be wholly value-free, and I wanted these assumptions to be at least acknowledged in the design process. The study of methods was thus not an end in itself, and was certainly not motivated by the desire to eliminate or down-grade the qualitative considerations, although a lot of people interpreted it that way.

In retrospect, I can see that I wasted an awful lot of time in trying to bend the methods of operational research and management techniques to design purposes. The earlier check-list type models of the design process, such as that published in *Design* magazine in 1963-64 under the title *Systematic Methods for Designers* turned out to be very helpful to quite a lot of designers, and hardly a week goes by even today without my receiving a request for copies. It went out of print a decade ago. The later mathematical and flow-chart type models, although in many respects less normative, were never accepted by working designers in quite the same way. The reason, I think, is that mathematical or logical models, however correctly they may describe the flexibility, interactiveness and value-laden structure of the design process, are themselves the product of an alien mode of reasoning. My present belief, formed over the past six years, is that there exists a designerly way of thinking and communicating that is both different from scientific and scholarly ways of

thinking and communicating, and as powerful as scientific and scholarly methods of enquiry, when applied to its own kinds of problems.

It is widely accepted, I think, that design problems are characterized by being ill-defined. An ill-defined problem is one in which the requirements, as given, do not contain sufficient information to enable the designer to arrive at a means of meeting those requirements simply by transforming, reducing, optimizing or superimposing the given information alone. Some of the necessary further information may be discoverable simply by searching for it, some may be generateable by experiment, some may turn out to be statistically variable, some may be vague or unreliable, some may arise from capricious fortune or transitory preference and some may be actually unknowable. In addition, once known, some of the requirements may turn out to be incompatible with one another. As it happens, most of the problems that most people face most of the time in everyday life are ill-defined problems in these terms. Not surprisingly, in the course of evolution, human beings have found quite effective ways of dealing with them. It is these ways of behaving, deeply rooted in human nature, that lie behind design methods.

The first thing to recognise is that 'the problem' in a design problem, like any other ill-defined problem, is not the statement of requirements. Nor is 'the solution' the means ultimately arrived at to meet those requirements. 'The problem' is obscurity about the requirements, the practicability of envisageable provisions and/or misfit between the requirements and the provisions. 'The solution' is a requirement/provision match that contains an acceptably small amount of residual misfit and obscurity. Thus the relationship between design problem and design requirements and design provision lies along one axis and the relationship between design problem and design solution lies along another axis. The design activity is commutative, the designer's attention oscillating between the emerging requirement ideas and the developing provision ideas, as he illuminates obscurity on both sides and reduces misfit between them. One of the features of the early theories of design methods that really disenchant many

practising designers was their directionality and causality and separation of analysis from synthesis, all of which was perceived by the designers as being unnatural

Another problem was that design theories were so often communicated in language that was alien, too. I do not mean that the wrong kinds of words were used. I mean that words or mathematics or scientific notation alone were themselves inappropriate. I and several of my students and colleagues are putting a lot of energy into examining the proposition that the way designers (and everybody else, for that matter) form images in their mind's eye, manipulating and evaluating ideas before, during and after externalizing them, constitutes a cognitive system comparable with, but different from, the verbal language system. Indeed, we believe that human beings have an innate capacity for cognitive modelling, and its expression through sketching, drawing, construction, acting out and so on, that is fundamental to thought and reasoning as is the human capacity for language. Thus design activity is not only a distinctive process, comparable with but different from scientific and scholarly processes, but also operates through a medium, called modelling, that is comparable with but different from language and notation. Moreover, modelling in various forms, covert or externalized, constitutes the vehicle for all sorts of other activities, not normally associated with design, such as navigating, surgery, dancing and even crossing a busy road. The desire to understand this better, and to follow through the implications for a balanced education for everyone, has caused us to organize ourselves into two departments. The Department of Design Research looks at fundamentals and the postgraduate education of designers. The Design Education Unit looks at the general educational implications, and their implementation in teaching and learning.

Where does this leave design methodology?

Design methodology is alive and well, and living in the bosom of its family: design history, design philosophy, design criticism, design epistemology, design modelling, design measurement, design management and design education. With luck, we shall be hearing more of all these disciplines now that we have our own quarterly journal.

## The Three Rs

BRUCE ARCHER

The world of education is full of anomalies. Take that extraordinarily durable expression 'The Three Rs', for example. It is very widely held that when all the layers of refinement and complexity are stripped away, the heart of education is the transmission of the essential skills of reading, writing and 'rithmetic'. This expression is internally inconsistent, to begin with. Reading and writing are the passive and active sides, respectively, of the language skill, whilst arithmetic is the subject matter of that other skill which, at the lower end of the school, we tend to call 'number'. So the expression 'The Three Rs' only refers to two ideas: language and number. Moreover, the word 'arithmetic' is mispronounced as well as mis-spelled, giving the impression that the speaker takes the view that the ability and the necessity to do sums is somehow culturally inferior. If challenged, most who use the expression would deny they intended any such bias, but aphorisms often betray a cultural set. Explicit or implied denigration of Science and numeracy in favour of the Humanities and literacy was certainly widespread in English education up to and beyond the period of the second world war, and was the subject of C. P. Snow's famous campaign against the separation of 'the two cultures' in 1959. The two

cultures may be less isolated from one another these days, and may speak less slightly of one another, but the idea that education is divided into two parts, Science and the Humanities, prevails. There are many people, however, who have always felt that this division leaves out too much. Art and craft, dance and drama, music, physical education and sport are all valid school activities but belong to neither camp. There is a substantial body of opinion, not only amongst teachers but also amongst groups outside that profession, which holds that modern society is faced with problems such as the ecological problem, the environmental problem, the quality-of-urban-life problem and so on, all of which demand of the population of an affluent industrial democracy competence in something else besides literacy and numeracy. Let us call this competence 'a level of awareness of the issues in the material culture', for the time being. Under present circumstances, it is rather rare for a child who is academically bright to take art or craft or home economics or any of the other so-called 'practical' subjects having a bearing on the material culture to a high level in the fourth, fifth or sixth forms. Universities and professional bodies do not usually accept advanced level qualifications in these subjects as admission qualifications for their courses, even where the course, such as architecture, engineering or even, in some cases, art and design, is itself concerned with the material culture. It is really rather an alarming thought that most of those who make the most far-reaching decisions on matters affecting the material culture, such as business men, senior civil servants, local government officers, members of councils and public committees, not to mention members of parliament, had an education in which contact with the most relevant disciplines ceased at the age of thirteen.

## A THIRD AREA IN EDUCATION

The idea that there is a third area in education concerned with the making and doing aspects of human activity is not new, of course. It has a distinguished tradition going back through William Morris all the way to Plato. When Saint Thomas Aquinas defined the objects of education in the thirteenth century he adopted the four Cardinal Virtues of Plato (Prudence, Justice, Fortitude and Temperance) and added the three Christian Virtues (Faith, Hope and Charity). These have a quaint ring in modern English, but Plato's virtues, rendered into Latin by Saint Thomas Aquinas, were taken to mean something quite specific and rather different from their modern English interpretations. To Saint Thomas Aquinas PRUDENTIA meant 'being realistic, knowing what is practicable', JUSTITIA meant 'being ethical, knowing what is good', FORTITUDO meant 'being thorough, knowing what is comprehensive', TEMPERENTIA meant 'being economic, knowing when to leave well enough alone'. It is no coincidence that in our own day Dr E. F. Schumacher, in the epilogue to his book *Small is Beautiful*, quotes the four cardinal virtues of Plato as the basis for the socially and culturally responsible use of technology in the modern world. Certainly the craft guilds, who bore a major responsibility for the general education of the populace following the Renaissance, took the view that a virtuous education meant learning to know what is practicable, what is good, what is comprehensive, and what is enough, in a very broad sense. It is a curious twist in fortunes that when the craft guilds lost their general educational role somewhere between the fourteenth and eighteenth centuries, it was the rather narrow, specialist, bookish universities, academies and schools which had been set up to train priests to read and translate the scriptures which became the guardians of what we now call general education. No wonder our education system came to be dominated by the Humanities.

When Sir William Curtis, MP, coined the phrase 'The Three Rs' in or about 1807, he placed an emphasis on literacy which reflected the virtual monopoly that the church then had in the running of schools. I had an old great-aunt who protested fiercely whenever the phrase 'The Three Rs' was mentioned. She swore that Sir William had got it all wrong. The Three Rs were

- (1) Reading and writing
- (2) Reckoning and figuring
- (3) Wroughting and wrighting

By wroughting she meant knowing how things are brought about, which we might now call technology. By wrighting she meant knowing how to do it, which we would now call craftsmanship. From reading and writing comes the idea of literacy, by which we generally mean more than just the ability to read and write. Being literate means having the ability to understand, appreciate and value those ideas which are expressed through the medium of words. From reckoning and figuring comes the idea of numeracy. Being numerate means being able to understand, appreciate and value those ideas that are expressed in the language of mathematics. It was from literacy that the rich fabric of the Humanities was woven. It was from numeracy that the immense structure of Science was built. But what of wroughting and wrighting? It is significant that modern English has no word, equivalent to literacy and numeracy, meaning the ability to understand, appreciate and value those ideas which are expressed through the medium of making and doing. We have no word, equivalent to Science and the Humanities, meaning the collected experience of the material culture. Yet the output of the practical arts fills our museums and galleries, equips our homes, constructs our cities, constitutes our habitat.

Anthropology and archeology, in seeking to know and understand other cultures, set at least as much store by the art, buildings and artefacts of those cultures as they do by their literature and science. On the face of it, if the expression of ideas through the medium of doing and making represents a distinctive facet of a culture, then the transmission of the collected experience of the doing and making facet should represent a distinctive area in education.

## THE VACANT PLOT

If there is a third area in education, what distinguishes it from Science and the Humanities? What do Science and the Humanities leave out? It now seems generally agreed amongst philosophers of science, that the distinctive feature of science is not the subject matter to which the scientist turns his attention, but the kind of intellectual procedure that he brings to bear upon it. Science is concerned with the attainment of understanding based upon observation, measurement, the formulation of theory and the testing of theory by further observation or experiment. A scientist may study any phenomenon he chooses, but the kind of understanding he may achieve will be limited by the observations he can make, the measures he can apply, the theory available to him and the testability of his findings. Some sorts of phenomena may therefore be inappropriate for scientific study, for the time being or for ever. Some sorts of knowledge will be inaccessible to science, for the time being or for ever. Moreover, the scientist is concerned with theory, that is, with generalizable knowledge. He is not necessarily competent or interested in the practical application of that knowledge, where social, economic, aesthetic and other considerations for which he does not possess any theory may need to be taken into account. He would regard most of the making and doing activities of

the material culture as outside his scope, although he would be prepared to bring a scientific philosophy to bear upon the study of the making and doing activities of other people.

Amongst scholars in the Humanities there seems to be less agreement about the nature of their discipline, apart from unanimity in the view that it is quite distinct from Science. There is a fair consensus that the Humanities are especially concerned with human values and the expression of the spirit of man. This justifies scholars in the Humanities in studying the history and philosophy of science, but not in contributing to its content. There also seems to be a measure of agreement, by no means universal, that the humanities exclude the making and doing aspects of the fine, performing and useful arts, although their historical, critical and philosophical aspects would still be fair game for the Humanities scholar. It is interesting to note that writers on the science side frequently mention technology and the useful arts as being excluded from their purview, presumably because they are only just outside the boundary. Writers on the humanities side frequently mention the fine and performing arts as being excluded, presumably because they, too, are only just outside. A third area in education could therefore legitimately claim technology and the fine, performing and useful arts, although not their scientific knowledge base (if any) or their history, philosophy and criticism (if any), without treading on anyone else's grass.

## THE NAMING OF THE PARTS

Clearly, the ground thus left vacant by the specific claims of Science and the Humanities extends beyond the bounds of 'the material culture' with whose pressing problems we began. The performing arts are a case in point. There are other areas, such as physical education, which have not been mentioned at all. It would be tempting to claim for the third area in education everything that the other two have left out. However, we should stick to our last, if I may take my metaphor from the doing and making area, and clarify the question of education in the issues of the material culture. Any subject which relates with man's material culture must necessarily be anthropocentric. A discipline which claims, as some kinds of science do, to deal with matters that would remain true whether man existed or not, would be ruled out from our third area. Material culture comprises the ideas which govern the nature of every sort of artefact produced, used and valued by man. Those ideas which take the form of scientific knowledge would belong to Science. The historical, philosophical and critical ideas would belong to the Humanities. What is left is the artefacts themselves and the experience, sensibility and skill that goes into their production and use. If the human values, hopes and fears on which the expression of the spirit of man are based are shared with the Humanities, the striving towards them, and the inventiveness that goes into the production and use of artefacts, is a necessary characteristic of our third area. Any discipline falling into this area must therefore be aspirational in character, and, to take them clearly out of both the Science and the Humanities fields, it must be operational, that is to say, concerned with doing or making. Under these tests, how do the subjects ordinarily left out by the traditional Science/Humanities division fare? The fine arts, which in schools can be executed in a variety of materials such as ceramics and textiles as well as through the medium of painting and sculpture, clearly fall into the third area. In the useful arts, woodwork and metalwork would usually qualify. Technical studies are sometimes conducted in such a way that they are not actually concerned with doing and making, and therefore may or may not rank as Science, instead. Similarly environmental studies might or might not fall into the third area, according to their manner of treatment.

Home economics presents a problem. Taken as a whole, home economics is clearly anthropocentric, aspirational and operational, and therefore falls centrally into the third area. In practice, however, home economics may be taught in schools through the medium of individual subjects ranging from needlecraft taken as fine art through homemaking taken as useful arts to nutrition taken as science. So home economics, too, may fall into Science, the Humanities or the third area, according to the manner of treatment adopted.

Outside the bounds of the material culture altogether are the other subjects explicitly left out by the first and second areas. Amongst the performing arts, music might qualify as anthropocentric, aspirational and operational. So might drama and perhaps dance. So might gymnastics, the way it is pursued these days, but probably not the other areas of physical education. But this is going too fast. Any number of objections can be raised and counter-arguments offered in respect of many, but perhaps not all, the subjects I have mentioned as belonging or possibly belonging to an alleged third area in education. The point I wanted to make is simply this. The justification for the nomination of a third area in education lies not in the existence of subjects which do not fit readily into the definitions of Science and the Humanities, but in the existence of an approach to knowledge, and of a manner of knowing, which is distinct from those of Science and the Humanities. Where Science is the collected body of theoretical knowledge based upon observation, measurement, hypothesis and test, and the Humanities is the collected body of interpretive knowledge based upon contemplation, criticism, evaluation and discourse, the third area is the collected body of practical knowledge based upon sensibility, invention, validation and implementation.

## THE NAMING OF THE WHOLE

This leaves us with the problem of finding the correct title for the third area. The term 'the Arts' would be ideal, if the expression had not been appropriated by, and used more or less as a synonym for, the Humanities. Plato would not have objected to 'Aesthetics', but that has taken on a special and distracting meaning in modern English. 'Technics' has been used, and is in the dictionary, but has not proved very popular in educational or common use. A term which has gained a good deal of currency especially in secondary schools in England and Wales, is 'Design', spelt with a big D and used in a sense which goes far beyond the day-to-day meaning which architects, engineers and other professional designers would assign to it. Thus Design, in its most general educational sense, where it is equated with Science and the Humanities, is defined as the area of human experience, skill and understanding that reflects man's concern with the appreciation and adaption of his surroundings in the light of his material and spiritual needs. In particular, though not exclusively, it relates with configuration, composition, meaning, value and purpose in man-made phenomena.

We can then go on to adopt, as an equivalent to literacy and numeracy, the term 'design awareness', which thus means 'the ability to understand and handle those ideas which are expressed through the medium of doing and making'. The question of the language in which such ideas may be expressed is an interesting one. The essential language of Science is notation, especially mathematical notation. The essential language of the Humanities is natural language, especially written language. The essential language of Design is modelling. A model is a representation of something. An artist's painting is a representation of an idea he is trying to explore. A gesture in mime is a representation of some idea. Everybody engaged in the handling of ideas in the fine arts, performing arts, useful arts or technology employs models or representations to capture, analyse, explore and transmit those ideas. Just as the vocabulary and syntax of natural language or of scientific notation can be conveyed through spoken sounds, words on paper, semaphore signals, Morse code or electronic digits, to suit convenience, so the vocabulary and syntax of the modelling of ideas in the Design area can be conveyed through a variety of media such as drawings, diagrams, physical representations, gestures, algorithms – not to mention natural language and scientific notation. With all these definitions in mind, it is now possible to show the relationships between the three areas of human knowledge according to the diagram in Fig 1.

The repository of knowledge in Science is not only the literature of science but also the analytical skills and the intellectual integrity of which the scientist is the guardian. The repository of knowledge in the Humanities is not simply the literature of the humanities but also the discursive skills and the spiritual values of which the scholar is the guardian. In Design, the repository of knowledge is not only the material culture and the contents of the museums but also the executive skills of the doer and maker.

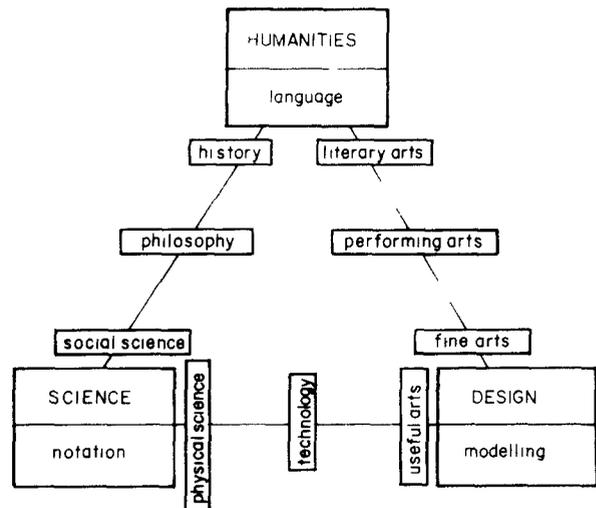


Fig 1