Design Education: Process Versus System

John Sherry
Madeley College of Education

The observation that curriculum innovation involves the importation of "new" practices into pre-existing contexts is a banal one. Similarly, to indicate that many of the practical problems connected with innovation derive from an incompatibility of purpose between the "new" practice and the setting into which it is being introduced, is only to indicate the obvious. Such points may be trite enough in themselves, but they are still worth bearing in mind, and I propose to utilise them here as starting points for a consideration of the relationship between design as a process and schooling as a system of instruction and learning. It is hoped that what such an analysis will yield is, on the one hand, some insight into the requirements of "design education" and, on the other hand, a theoretical perspective for the articulation of what is problematic about its implementation in the classroom.

The paper is divided into three parts. In the first part, a general account is given of what are taken to be some relevant features of the schooling system. At the second part I offer a broad analysis of the elements of the design process and their inter-relationship. In the third and final part, the systems requirements of schooling are laid alongside the process requirements of design activity, and from this comparison is derived a number of conclusions relating to the problem of implementing design activities within the setting of the school.

i

What I want to offer first of all is a list of those features of the schooling system that would appear, wherever they are present, to impinge directly upon the implementation of a programme of design education. It is not suggested that the present account provides an exhaustive characterisation of the educational system that we have. Nor is it suggested that all schools, everywhere in our society and for all of the time, have associated with them all of the features here identified. The point is simply that such features as *are* isolated here are, on the whole, prevalent enough to require that we bear in mind the extent of their possible influence upon innovation. That being said, I want to maintain that there are five broad features associated with our schooling system, whose presence or absence is of crucial importance for the management of innovation in design education. The five are:

(a) The assumption that physical and intellectual activities are, to some real degree, mutually exclusive;

(b) An institutionalised distribution of roles which results in the insulation of subject teachers within their own "specialist" areas;

(c) An institutionalised distribution of roles which results in the learner being placed in a subordinate positon vis-a-vis the teacher;

(d) A perception of the content of learning as something fundamentally divorceable from the learner's immediate life context, and consequently:

(e) A separation of the identity of the school from the identity of the social setting in which it is located.

Such a list is, as it stands, a little too cryptic to be of much use, and consequently some further clarification is necessary. Some supporting remarks will therefore be offered on each of these points in turn.

First, the separation between intellectual and physical activities. Such a separation has, of course, its roots in the classical tradition of liberal education – and, beyond that, in a theoretical perspective which equates the possession of knowledge, and hence the exercise of rationality, with a purely reflective and contemplative orientation towards the world (1). A part of the legacy of this tradition is the persistent superstition that practical activity vitiates the integrity of the

rational mind – a superstition which finds its crudest expression in the conviction that it is no more the business of the "thinker" to "do" than it is the business of the "doer" to "think". There has equally, of course, been a persistent tradition of dissent from the classical liberal view – an affirmation, at least from the 17th century onwards, of the pragmatic character of knowledge and the practical value of learning. On the whole, though, the spectre of a liberal education, with its emphasis upon the cultivation of an "abstract" and thoroughly "unworldly" sensibility, has continued to haunt the intelligence of the educator down to the present day. (2). On the whole, the assumption that "education" means "moulding the mind", and that "mind" cannot be "moulded" through mere practical activity, is one that retains an extensive currency. The practical consequences of this conviction are obvious enough. Access to "education" comes to men, primarily if not exclusively, access to a stipulated range of intellectual enterprises. Those who are granted access are those who are "fitted" to meet the rigours of academic study, while the rest, if they are provided with anything, are provided with the consolation prize of merely concrete and practical activity (3). This separation of intellectual and physical activity is not, nowadays, given such a severely institutionalised expression as it has had in the past (although it is open to question whether comprehensive schooling mitigates the effects of the division or simply masks them with the spurious unity of a shared location) – but it persists at an ideological level, as a conviction about what constitutes education for certain people and about what constitutes the alternative for the rest. As such, the physical/mental dichotomy is part of the "given" part of the "setting", and hence needs to be recognised and taken into account by anyone who is concerned with the management of curriculum change.

The insulation of "subjects" from one another, so that areas of study become the discrete elements of a stipulated corpus of "educational knowledge", raises no special problems in the context of the present discussion. Important issues in philosophy are, to be sure, raised by a consideration of whether there are grounds for maintaining the autonomous character of the elements which constitute the corpus (4). It is possible, as well, to link observations about the autonomy or the inter-relatedness of areas of study with observations concerning the institutional character of the setting in which study occurs (5). But neither of these areas of debate are directly to the point here. All that need be noted is that, whatever impact may have been made by the movement towards various types of "integration", the content of learning is still predominantly organised on the basis of a range of "subjects" that it is the business of the learner to assimilate in one form or another. The observation that a greater or lesser proportion of schools use an "integrated" timetable does not detract from the point being made, for integration itself often means only that a field of common focus is chosen to which a range of existent "subjects" contribute. All that is important for our present purpose is that: (a) so far as much of current practice is concerned, an activity counts as being "educational" at least partly on the grounds that it provides access to the differentiated contents of an already – existing corpus of "worthwhile" knowledge, and: (b) the movement of a programme of study, even within an "integrated" framework, is from the statement of a problem *into* whichever segment of the corpus is under review (thus, one does not utilise the content of study as a means of organising a problem – rather one uses the problem as a means of organising the content of study). Such a way of organising and directing learning is, it wil will be argued later, inimical to the requirements of design process, and hence hostile to the establishment of design education.

Our third point centres on the subordinacy of the learner. We operate, on the whole,

within an educational system that conforms broadly with Friere's model of a "banking" system. That is, status and the privilege of action are reserved largely for the teacher, while the learner is obliged to adopt the role of low-status, inactive recipient of that which is distributed by the teacher (6). The point is not invalidated by pointing towards the various instances of "progressive" practice that are to be found in a number of contemporary schools. Whether the personal relationship that exists between teacher and taught is formal or not, and whether the learner is given his data neat or is obliged to "discover" it in a hidey-hole engineered by the teacher, it remains the case that the outcome of learning – formulated in terms of what it is that the learner must come to grasp – is largely determined by the teacher and in advance of the actual enterprise of teaching. In this activity – the delineation of what is problematic about the encounter of teacher and taught, and the evolution of strategies for meeting the problems identified – the learner plays no part, and the practical outcome of this is that, in general, the learner functions as the "object" of the teaching act; as something to be manipulated by the teacher, either overtly (in an "authoritarian" situation) or covertly (in a "progressive" one). It is in this sense that our educational practice conforms with Friere's model of a "Banking" system. Such an observation does not necessarily imply criticism. It may be the case that it is the job of teachers precisely *to* "manipulate" the learners with whom they work, and a greater or lesser degree of pre-determination by the teacher, is doubtless always necessary to the effective organisation of pedagogy. But if one is to follow through, in teaching, the practical requirements of design process, then the severe subordinacy of learner to teacher must be compromised to such a degree that the character of the teaching situation is recognisably transformed. Obviously, then, the nature of the relationships which hold between the various members of a design team has to be identified and held alongside the tendency of teacher and taught to relate to each other in ways that are imposed upon them by the network of systematised practice in which they operate. If there is conflict between these two types of requirements, then we have another basis from which to formulate an account of what is problematic about the implementation of design processes within the school.

The last two points can be taken together. We have already identified one persistent feature of the tradition of "liberal education" in identifying the tendency to dichotomise physical and mental activities. A corollary of this tendency is the commitment to a perspective on education which sees the "worthwhileness" of what gets "passed on" in learning as something altogether divorced from any consideration of immediate and practical value. If education is about "cultivating the mind", "building character", and so on, then questions about its worth and value are not likely to be answered in terms of mere practical utility. More: a concern with what *is* practical and useful is likely to be seen as conflicting with the requirements of the liberal model, and is thus liable to be met with over hostility and contempt (7). This is not to say, of course, that the schooling system presents us with a spectacle of rampant asceticism – obviously it doesn't. But while the thread of pragmatism that is woven into our educational tradition does much to mitigate the effects of the liberal ideal, it has not yet superceded it, and the idea of education as the cultivation and perfection of an "inner" sensibility remains a powerful one. Consequently, there is some resistance to attempts to relate the content of learning to its contexts; attempts to build-in to learning a sense of the continuity between what goes on inside the learner's head as an "idea" and what goes on outside it as a concrete and manipulable existence. Since such a continuity – between idea and existence – is absolutely crucial to design

activity (design, we might say, *is*, precisely, a conscious organisation of the idea being dialectic), then the tendency of the system to resist it must obviously figure as part of our analysis.

This gives, in very general terms, and subject to the qualifications indicated at the outset, a very general summary of those features of the schooling system that impinge upon the implementation of design activities in the classroom. We now need to consider what it is that constitutes "design activity", as a preliminary to our comparison of design as a process with schooling as a system of learning and instruction.

ii

At this stage the account must become somewhat contentious, for the analysis has to move into areas where there is no obvious consensus of outlook or argument. The analysis will take its starting point from a fairly "safe" basis, and will move from there into a consideration of less certain areas.

The "safe" starting point is the contention that design activity is, at centre, a problem solving activity. While this much is so obvious as to appear trivial, it is not easy to see very far beyond it. Each part of this apparently innocuous formulation generates, in fact, fairly serious difficulties of definition. For it is not clear, first of all, just what is to count as an appropriate "problem" for the designer, and nor is it clear what kinds of activity constitute the elements of a process of "solution-seeking". These are not gratuitously fostered difficulties but are, rather, central to the theory of design. It will therefore be necessary to devote some attention to them here.

There are, broadly, two ways of viewing the designer's task. From one point of view, the designer is a technician and nothing more. He is given a brief and he responds to it. He has no special stake in, or commitment for, his brief; no special concern for consequences that are not directly specified within the terms of his assignment. He does not formulate problems spontaneously or autonomously, but only reacts to whatever problems are put to him, ready formulated, by the "client". He may, for example, put all of his professional ingenuity and skill into the production of advertising media for a particular brand of cigarette, and then be equally assiduous in his subsequent execution of anti-smoking propaganda. There is no reason why such contradictions should be a source of worry, providing the designer is seen simply *as* a technician. Similarly, the fact that a designer may be, and often is, called upon to organise human resources in the pursuit of the ludicrous, the trivial, the banal and the plain stupid, provides no cause for concern for as long as he is seen as the neutral instrument of the client's "needs". From this point of view, questions concerning the integrity of the design process or the quality of its outcome are unaffected by observations about the nature of the problem to which the designer addresses himself. The evaluation of the outcomes of design activity thus turns upon categories, such as "aesthetic unity" or "functional aptitude" or "exploitation of materials", which, while they have an undoubted critical value, are neutral in respect of the general character of the problem tackled. This, then, is one kind of perspective — perhaps the predominant kind — on what it means to engage in the business of design; design as an ethically-neutral, politically-neutral, economically-neutral, technical enterprise.

But there is another perspective which runs counter to the one just indicated: the "radical" perspective elaborated by designer/theorists such as Fuller and Papanek. According to this view, the integrity of the design process *is* inextricably bound up with the character of the problem encountered. Broadly, "problems" are here given a basis in people's "needs", and the critical distinction is drawn between needs that, while they may be urgently pressed, are really spurious,

and needs which are "authentic". Positive and negative species of design activity are thus identified; needs generate problems which are met through design; pseudo-needs generate pseudo-problems which are met through pseudo-design (8). This type of argument is not, of course, specific to design theory, and it has attaching to it quite severe problems of conceptualisation (9). It is not the purpose of this article, however, to trace out the critical pre-suppositions attaching to the kind of "radical" stance identified here. All that need be noted is that a commitment to such a stance generates consequences for the way in which design is seen, and therefore for the way in which the central features of design process are identified and incorporated into an "educative" programme.

Whichever of these two lines is taken, one point is clear enough; design takes its impetus from some ("perceived" or "received") practical human need. Consequently, what goes on "inside" the design process is closely conditioned by what takes place "outside" it. Content and Context stand, in the end, in a relation of reciprocal determinacy; the design process being modified by a context which is itself, in part, a product of design activity. The first general point to be made concerning the character of the design process is, therefore, that it takes its starting point and direction of movement from a context of practical need. We are thus confronted with the implied pedagogical requirement that a programme of design education will be concerned, at some stage, to sensitise its participants to the nature of human wants. (And there is a secondary implication lurking behind this one; the implication that, if design is necessary at all, then it is because existing strategies for meeting people's requirements are inadequate – design *must*, then, have incorporated into it procedures for recognising and articulating such inadequacies, and hence design is, in a real sense, a *critical* activity).

We will postpone until later the discussion of how the stages of problem-solving activity may be schematised so as to allow for the evolution of appropriate strategies for the organisation of learning. Two general points may, however, be made at this stage; one concerning the *formal* scope of the problem-solving process (that is, the general kinds of activity it encompasses), and one concerning the range of "content" which may be incorporated into the process at any level.

Both of these aspects point towards the same sort of consideration. In the case of the "formal" aspect, the main relevant observation to be made is that there are no *a priori* constraints upon the kinds of activity that may be engaged in by the designer. The assimilation of data relevant to the brief is, to be sure, a part of the process of design (and this pre-supposes that the designer is literate in the language – mathematical, technical, economic or whatever – in which the data is formulated) but it is only a part. The stage beyond data-gathering is constituted of activities which can only be predicted, catalogued and characterised in the broadest sort of way; activities which centre upon the exercise of imagination, sympathy, diplomacy, wit, humour, insight and all of the other amorphous facets of creative behaviour. And there are, manifestly, other levels still which are dependent, not simply upon the abstract manipulation of "ideas", but also upon the concrete manipulation of materials – in particular, the organisational and technical dimensions of production. Here, other sorts of competence come into play; motor skills, facility in technical procedures, understanding the properties and possibilities of materials, a grasp of the economic, ergonomic and psychological features of production processes and an understanding of the ways in which resources may be exploited so as to yield an optimum balance between requirements in these various areas, and so on. Since all of these – and here, obviously, the selection is as cursory as it is random – are dimensions of the design process, then a pro-

gramme of design education will be concerned to explore both their inherent characteristics and their interaction within a context of enquiry. The implication is that no general constraints can be placed, in advance, upon the formal character of design process (and this counteracts for instance, the tendency to reduce design to something as restricted as the "creative idea", or whatever).

A similar consideration applies to content. Again, there are no *a priori* constraints upon what might come to be seen as a "problem". The critical perspective already indicated does not provide grounds for the *a priori* formulation of appropriate "problem contents", but only a means of assessing the value of stated contents against a shifting background of practical need. The range of the design problematic is therefore, in principle, limitless. While the point is an obvious one, it needs to be made if we are to avoid the simplistic identification of design with welfare cosmetics (the paint-a-pensioner's front-door syndrome). Disadvantaged groups within the community may, indeed, supply the content for a design problem but, the point is, design is not to be totally equated with the life problems of low-status or impoverished social groupings – it can legitimately concern itself with other things as well. And just as it is impossible to determine, in advance of the practical implementation of a design programme, just what may or may not count as a problem, so too it is not possible to place general constraints, in advance, upon what is to count as an appropriate data source, or upon precisely what behaviours are likely to yield useable ideas for solutions, or upon what processes are to be utilised in translating idea into artefact. In all of these areas the content is determined by the immediate requirements of a continuing process and cannot be predicted or limited in advance through the formation of general principles. With content as with form, then, the scope of design process, while it always has limits in actual fact, is in princple limitless. Design is thus an "open-ended" research procedure.

Three very simple points have been made here. First, design process has its origins in, and develops in accordance with, a context of practical need. Second, there are no *a priori* constraints upon the formal character of the activities which constitute design process (it is not exclusively a "thinking" process, for example). Thirdly, there are no *a priori* constraints upon what might function as content for the design process at any of its levels. The concluding part of this article will trace out some of the implications of the juxtaposition of design process, thus characterised, and the features of the schooling system indicated earlier.

iii

Theories diverge on the question of what takes place when someone "solves a problem", but they tend to come together in their identification of the broad features of problem-solving activity and the kind of sequence that they tend to conform to. The "typical" sequence follows the general pattern: Problem recognition / data review / hypothesis formation / testing / solution. Although the ways in which these stages are characterised and the sub-divisions that are made within each of them may vary somewhat, this general sequence holds good for quite a few accounts of problem solving. Since design is a problem solving activity, then it too will conform to this general pattern, and by elaborating on these basic categories it is possible to formulate a schematic model of the design process as a problem-solving activity (10). All that I want to do here is to suggest one such model, and to compare it with an alternative derived from the schooling context.

For our present purpose, the problem-solving process can be broken down into ten distinct stages. It matters little whether any of these stages may be extended or conflated, since the aim is simply to draw attention, through them, to the range of activities and

skills constitutive of the total design process. This "ideal" model will be called, here, the Research Model:

STAGE	REPRESENTATIVE ACTIVITIES	REPRESENTATIVE SKILLS
(1) Familiarisation with problem area.	Observation; Discussion; Interview; Questionnaire, etc. . . .	Sociability, tact, humour, pertinency, watchfulness, tenacity, etc. . . . .
(2) Identification of particular problem (derivation of brief)	Discussion, analysis and collation of data . . .	Capacity to perceive relevant issues, to focus upon what is significant, to formulate clearly and precisely areas of difficulty . . .
(3) Preliminary review of data	All search and review procedures; collation of relevant data from any field (History, Maths, Economics, the Natural Sciences, Politics, etc. . . .)	Ability to understand the language (e.g.: mathematical, technical) in which data is presented. Selectivity. A grasp of what is significant. Ability to set up connections between apparently diverse sets of data . . .
(4) Hypothesis-formation.	Dreaming, arguing, doodling, playing games, reviewing possibilities, making unlikely suggestions . . .	Imagination, wit, inventiveness, humour, freedom of association, receptiveness . . .
(5) Preliminary indication of possible solution (or solutions)	Talking, drawing, demonstrating, constructing rough models and otherwise representing ideas.	Facility in communicating ideas through a range of media (ability to formulate ideas, to translate ideas into representations, to present these in an intelligible form, etc.)
(6) Criticism & refinement of preliminary proposals.	Discussion, drawing, model-building, game-playing . . .	Ability to identify sites of possible error; willingness to consider alternatives; flexibility; readiness to admit error, to relinquish non-productive strategies, etc. . . .

STAKE	REPRESENTATIVE ACTIVITIES	REPRESENTATIVE SKILLS
(7) Selection of final solution on the basis of Stage (6)	As Stage (6)	Ability to review and summarise the results of all earlier strategies; to extract a single general line of attack from the total complexity of previous experience.
(8) Production A. (Prototype)	All construction activities; the organisation of production units; technical processes for the manipulation of materials, etc. . . .	Manual skills, dexterity, hand/eye co-ordination, appreciation of the properties of materials, understanding of the effects of organising production in various ways, etc. . . .
(9) Testing.	Using the artefact, discussing its use with the client, etc. . . .	Ability to formulate pertinent questions; to assimilate criticism; to modify existing ideas . . .
(10) Production B. (Final Result)	As Stage (8)	As Stage (8)

What this model is intended to provide is, primarily, some indication of the scope and complexity of the design process. The activities engaged in range from highly specialised and controlled enterprises (for instance, production techniques) to activities that are "open-ended" and have a fairly amorphous character (for instance, the preliminary, tentative moves towards framing the elements of a solution). Skills, similarly, range from the highly specifiable, such as those involved in construction work, to skills, such as that of "sociability", which are only open to the loosest sort of definition. Some activities depend upon the individual working in temporary isolation from other members of the project team, while others are group activities which depend upon co-operation and inter-action between a number of people. And there are other dimensions to the process of problem solving than those that have already been cursorily indicated here. The highly differentiated character of the process carries implications for, for example, the way in which contact between teacher and taught comes to be organised. A whole range of possibilities become accessible, from large group sessions to individual tutorials, and from "formal" teaching to "informal" methods, for organising the confrontation between tutor and learner. All that matters here, however, is that some indication should be given of the highly complex and differentiated character of the problem-solving process — a complexity and a degree of differentiation that has to be recognised and assimilated to teaching practice if that practice is to be at all adequate.

A wholly different sort of picture emerges if we move in the opposite direction — if we move, not from a consideration of design requirements to a model of education, but from a consideration of schooling requirements to a model of design activity. The immediately striking thing about the movement in this direction is that it results in a

vitiated and cramped realisation of design process. The operation of systems constraints has, in general, an ennervating effect upon process; paring down the richness and complexity of the problem-solving enterprise to the routinised and banal enactment of production techniques. It is not difficult to see why this should be so. The dichotomy between "physical" and "mental" activities destroys the continuity that exists, in our "ideal" process, between research and inventiveness on the one hand, and productive activities on the other. Thus, the "production of objects" within the "system" (i.e. in the school workshop) tends to be seen as the outcome, not of "thought-proper", but simply of physical action. Consequently, the skills and techniques attaching to production are limited to the technical aspects of manipulating materials. The design process is restricted, in the first place, to simple physical production (and I therefore call the alternative, systems, model a "Production" model).

Other restrictive consequences are not difficult to identify. The insulation of subject from subject strengthens the concentration upon production as the enactment of a technical process. And this insulation results not only in a failure to realise the continuity between productive techniques and "thought activity", but also in a failure to grasp the connectedness between the outcomes of production techniques (i.e. the artefact) and a specific and "external" context of need. In many cases, indeed, there *is* no "external" need; the initiating "needs" are the "internal" ones that an injunction be followed or that a technique be illustrated — the artefact has, otherwise, a quite arbitrary and gratuitous existence. Lastly, the participants mode of activity is generally limited to that of giver or receiver of information — the teacher stipulates the course of action that he wants followed, and the pupils act accordingly. This too, obviously, falls a good deal short of the diversity or activity and experience which is associated with our "ideal" model. To summarise then: the "production" model interprets the manufacture of artefacts in basically technical terms, allows little scope for any interplay between "technical" and "other" activities, and tends to be associated with a predominantly didactic style of teaching. The problem of bringing about change in design education is, in the end, the problem of making the transition from a "production" to a "research" situation — the preceding remarks have been intended to give some indication of what this switch in emphasis involves.

The interpretation of the problem of innovation in terms of a conflict between "system" and "process" is deliberate. The analysis of process (the character of design activity in this case) reveals a particular set of requirements, while the analysis of "system" reveals other requirements, largely inimical to the realisation of the idealised model. To some extent this must always be so; ideal and actuality seldom coincide in any case. But in the case of design education, the point is, the lack of coincidence is extensive and radical. The inference is that the implementation of a programme of design education (of a type that is faithful to the actual requirement of design activity) entails changes, and fundamental ones, being made in the character of the system which puts the programme into practice. It is the resistance of the system *to* change that constitutes the general character of what is problematic about curriculum innovation.

What underlies the argument of this paper is a conviction that curriculum innovation does not, in an important sense, depend merely upon the modification of "personal" desires and expectations. The problem of innovation is not simply to stop people thinking in one way and to encourage them to think in another — which is only another way of saying that the problem of innovation is not exclusively a problem of psychological motivation (11). It is a problem

that has to do, as well, with changing the institutional context which regulates educational practice so as to allow for the most adequate realisation of the ideas and intentions behind the "new" practice at which innovation aims. Where the discrepancy between the requirements of the "new" practice and the character of the existing system is great (as, I have argued here, is the case with design education), then the problems of innovation will be correspondingly severe, quite independently of the desires and aspirations of the individuals who administer the system. It therefore becomes necessary that we should be in possession of theoretical perspectives which are capable of articulating fully such a discrepancy and of generating strategies for the reduction of the tensions inherent in it. This paper has not been exhaustive enough to qualify as providing such a perspective, but it does, hopefully, indicate something of the extent to which the dislocation between the process requirements of design and the systems characteristics of schooling might constitute an obstacle to the realisation of curriculum change. A switch in attention, from the psychological to the structural attributes of the context of innovation, is, I would argue, necessary to a proper understanding of the scope and actual function of design education in a "schooling" context.

References

(1) See, for example, Habermas, J.: *Knowledge and Human Interests,* Beacon Press, 1971. p.301 ff.

(2) "As I see it, the central objectives of education are developments of mind. No matter what the ability of the child may be, the heart of all his development as a rational being is, I am saying, intellectual. Maybe we shall need very special methods to achieve this development in some cases. Maybe we still have to find the best methods for the majority of people. But let us never lose sight of the intellectual aim upon which so much else, nearly everything else, depends". Paul Hirst, quoted in Bantock, G.H.: "Towards a Theory of Popular Education", in *The Curriculum: Context, Design and Development* (Ed. R. Hooper), Oliver and Boyd, 1971.

(3) It should be noted that attempts are being made to re-habilitate the "affective" sensibilities of the "folk" (see Bantock, *Op.Cit*). although it may be questioned how far the "separate but equal" doctrine of conceptual types constitutes a departure from the tradition of liberalist theory.

(4) The debate over the "forms of knowledge" argument hinges upon such issues. See Hirst, P.: "Liberal Education and the Nature of Knowledge" in *The Philosophy of Education* (Ed. R.S. Peters) Oxford, 1973. And for a counter-view see Phillips, D.C.: "The Distinguishing Features of Forms of Knowledge" in *Educational Philosophy and Theory,* October, 1971.

(5) See Bernstein, B.: "On the Classification and Framing of Educational Knowledge", in *Readings in the Theory of Educational Systems* (Ed. E. Hopper) Hutchison, 1971.

(6) Freire, P.: *Pedagogy of the Oppressed,* Penguin, 1972, pp.46-7.

(7) E.g.: Boyson, R.: "The Essential Conditions for the Success of a Comprehensive School", in *Education in Great Britain and Ireland,* (Ed. Bell, Fowler & Little), Routledge, in association with the Open University Press, 1973.

(8) For a concise presentation of this "critical" line, see Papanek, V.: *Design for the Real World*, Paladin, 1974.

(9) See, for example, Marcuse, H.: *One Dimensional Man*, Abacus 1972. p. 20 ff.

(10) For an alternative model of design process, see: *Education Through Design and Craft* (Schools Council Design and Craft Education Project) Edward Arnold, 1975. p. 122.

(11) The obstacles to innovation in design education are seen as obstacles of "attitude", rather than as structural obstacles, by, for instance, Bernard Aylward in "Learning by Design", *The Times Educational Supplement,* 1st August, 1975, p. 11. The argument that there are "no real stumbling blocks" to innovation because "the aims of design education are not in conflict with present aims" (of teachers) is, on the basis of the present analysis, based on a misconception of what might count as a "stumbling block" to the implementation of change.