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Working the line

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“Working the line” - applying a multidisciplinary approach within design education

John Humpherson and John Law

School of Advanced Manufacturing Technology and School of Industrial Design, University of Central England in Birmingham

Abstract

The dividing line between industrial and engineering design has become increasingly diffuse, both in education and in practice. This presentation examines the rationale and content of the University's BSc Honours course in Engineering Product Design, a new course which crosses the two disciplines. As a parallel, case studies from personal experience are presented which illustrate successful approaches to cross-disciplinary design in both fields. An accompanying poster presentation of work from the first year of the course and other appropriate material provides visual support

1. Introduction

The dividing line between industrial and engineering design has become increasingly diffuse, both in education and in practice. Case studies from personal experience are presented which illustrate successful approaches to cross-disciplinary design in both fields, with a view to affirming the need for the education of designers who can successfully work across (or along) the line of division.

The background to the design of the University's BSc Honours course in Engineering Product Design, a new course which crosses the two disciplines, is discussed in the light of this experience.

2. Design Practice

Adopting a multidisciplinary view in the management and execution of design projects can hardly be seen as breaking new ground, since this technique is well established within the commercial and industrial sector. The benefits of using teams of individuals with the specialist skills necessary to achieve effective results in design projects is widely recognised in professional practice.

What is perhaps less well understood is how this approach translates across to design education. Below surface level there are a number of apparent anomalies between a genuine multidisciplinary approach and the type of experience that many educational institutes (including ours!) can offer under the “Multidisciplinary” banner.

Consider the real life situation where two members of academic staff from the University of Central England were commissioned as consultants to design a folding lighting column for a company in the West Midlands. The ingredients for this multidisciplinary approach comprised the following:

- The two staff involved brought their own specialist skills to the project, their respective backgrounds being in industrial design and mechanical engineering.
- The staff had sufficient exposure and experience of each other's field to ensure that technical language and communication was not a problem during the development of ideas. This was important to the success of the project, but in addition it became clear that the two designers moved easily across the normally accepted boundaries of the two disciplines, and both addressed mechanical and industrial design issues during ideas development.
- Other members of the multidisciplinary team included key staff from the company's marketing and manufacturing departments, providing the infrastructure for the design brief and a valuable knowledge base throughout the project.
- The project was managed and directed by the consultants, with the team given free access to the company's facilities and expertise in other areas.

Once this pattern of working had established itself, subsequent design commissions were approached in the same way, with a relatively “seamless” integration of the different disciplines.

3. Cross-disciplinary student project experiences

Compare the above with the experience most undergraduates are exposed to while working in team situations. Many projects are structured in a manner which dictates that students tend to work in teams together with other students from a similar background or specialism.

At UCE, attempts in the past at running interschool collaborative projects within the Department of

Three Dimensional Design has meant that students were always working with other design students, constraining their exposure to people already sympathetic to their working methods and thinking patterns.

Attempts at linking with other departments within the University, such as joint projects with Mechanical Engineering students, or even with other institutions such as the University of Birmingham could have encouraged the students to interact with the terminology, technology and approach of a different discipline.

However, the true benefits of the multidisciplinary model were rarely realised at this level, due to the relative inexperience of the players involved, particularly in managing and directing their efforts to encompass other necessary specialist information, such as from marketing for example.

Too often students in such situations work in isolation from their team members instead of in a spirit of co-operation, and stick solely to the areas in which they are confident in working. The opportunities for arriving at an innovative and integrated design solution diminish rapidly in such adverse conditions, with at best the students gaining only a surface appreciation of an alternative working culture and at worst taking up the negative and stereotypical roles of the engineers "looking after the nuts and bolts" while the designers "stick the stripes on".

In attempt to break this mould and provide the basis for a more realistic multidisciplinary approach, staff at UCE recently arranged a collaborative project across three schools within the Department of 3DD and with Thorn Lighting Ltd. The schools involved were Industrial Design, Ceramics with Glass and Interior Design, with the aim of the five week project being to provide an opportunity for students to work in teams with not only other designers but with key personnel from Thorn Lighting.

The project was carefully structured to encourage a culture where there was genuine interaction between the parties. This was achieved through consultation with Thorn during the conception of the design brief, which set as the task the design of hotel bedroom lighting. The students worked in teams of three, one from each design specialisation and in close liaison with key staff from Thorn. Each team of students visited the Copthorne Hotel in Birmingham, which acted as the client.

This enabled them to make an evaluation of the space and analyse the lighting requirements.

Lighting plans were drawn up and discussed before designing any of the hardware and particular attention was paid to adopting a holistic view of the lighting requirements within this environment.

The project was directed by the Marketing Director of Thorn, who was able to advise on marketing issues. Technical guidance was provided by two mechanical engineers from Thorn, who attended regularly scheduled tutorials with the students in their studio at UCE.

Initial reluctance to talk to experts soon gave way to an atmosphere of mutual co-operation and positive inquiry, resulting in the development of a number of innovative lighting applications. The project was split into three phases; generation of initial concepts, selection and development of final concepts and prototyping of selected designs, for which Thorn supplied the components and luminaries.

Thorn personnel from commercial, marketing and technical departments joined UCE staff at the conclusion of each phase to review the work and make recommendations to each team. A visit to the Thorn Technical Centre at Spennymoor was arranged to familiarise the students with the manufacturing facilities available and to encourage students to take advantage of advice in designing for high speed production and assembly. At the conclusion of the project, the teams were invited to present their design work to a panel of Senior representatives from Thorn, giving them valuable experience of making presentations at board level.

The project agreement allowed the students to retain proprietary rights on their designs, while Thorn awarded prize money totalling £1000 to two of the teams in recognition of outstanding work.

This proactive approach by UCE and Thorn Lighting resulted in the students receiving a considerably more realistic experience of the opportunities afforded by a multidisciplinary approach. In addition to the beneficial publicity received by both organisations, Thorn were able to introduce and promote lighting design as a topic, thus increasing the awareness of this subject amongst the students and hopefully attracting potential lighting designers of the future.

4. Background to Course Provision in Engineering Product Design

The expansion in courses offering a multidisciplinary education in design is a recent phenomenon, although some such as the

postgraduate course in Industrial Design Engineering at the Royal College of Art and Imperial College, and the undergraduate course at the University of Greenwich (formerly South Bank Polytechnic) in Engineering Product Design have run for a longer period.

Traditional provision in Engineering Design has been through specialist courses, mainly at higher technician level and through the design routes of study within engineering degrees. The former have in the past provided a large proportion of design office-based engineering designers, but the number of courses has fallen substantially due to a general move towards the manufacturing engineering area in content.

Engineering degree courses, however continue to provide the supply of engineers working in analysis-based or functional design across the spectrum of industrial activities. Industrial Design has generally continued to be based within Art & Design education, but courses have moved towards increasing involvement with technology. The CNAA Report "Technological change and industrial design education"¹ provides a valuable review of changing practice relevant to both industrial design and the newer engineering-based product design courses.

5. Influences for change

A recognition of the need for a new type of course became apparent through the late 1980's. During the design of the BSc Engineering Product Design course various sources of information were used to determine the need for the course, and some of these are discussed below:

National education and training needs

It has been estimated (Farrer²) that industry requires approximately 3000 engineering designers per year simply to keep engineering design alive. This was more than the total output of all the engineering design courses in the country at the time (1991), and the supply gap still appears to be considerable.

Recommendations of professional bodies

The reports of a number of these (appendix 1) were reviewed. There were general recommendations for the type of course envisaged and for an increase in the design content of engineering courses. It was also possible to distil from the reports a number of desirable student experiences:

- Integrative and cross-disciplinary projects
- Design-and-make projects

- Exhibition of project work
- Economic awareness
- Management, communication and social skills
- Legal aspects of design
- Contribution to teaching from outside organisations
- Attachment of staff from industry as project tutors
- Senior industrialists act as "customers" on proposals and projects.

The majority of these were incorporated into the Course Objectives of the course at UCE. The ideas themselves are not new, of course but it was valuable to have this kind of focus on them.

At that stage the number of learned reports on the subject exceeded the number of engineering product design courses in the country, although the ratio has now improved somewhat.

Specific industry needs

Monitoring job advertisements in the general area of product design and development during the early stages of course design showed a clear requirement for the type of skills identified above, together with positively stated requirements for creative skills (engineering advertisements) and technological skills (industrial design advertisements).

Influence of schools curriculum

In the past Design & Technology has suffered from its perception by universities as a "lightweight" A level. The graduate courses in Engineering Product Design now running (currently about 15 in the country) offer a logical progression from A level design studies. The popularity of the courses with students majoring in an A level design subject appears established, if PCAS applications are a good guide.

In relation to conventional school student perceptions of engineering, it was felt important to try to attract those who wanted a career in design but who would not normally consider one in engineering.

6. The BSc (Honours) in Engineering Product Design at UCE

It is hoped that an account of the thinking behind the course will be useful to those designing new courses or reviewing existing ones. The Course

Introduction, Rationale and summary of Course Content given in Appendix 2 are condensed from the Validation Document of September 1991.

7. Conclusions

The new courses in Engineering Product Design are well placed to provide the type of experience described above, together with an enhanced starting point in technical knowledge and awareness. The inference is that the multidisciplinary activities will be handled more effectively by the student, and overall value of the project enhanced.

Because of the depth of knowledge required in the majority of projects within the industry it would not be feasible for the trained multidisciplinary designer to handle all aspects of the work. Nevertheless the value of this new type of course in providing a designer who can overcome role-perceptive and communicative problems in the creation of new products appears now to be widely recognised within the product design field.

References

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APPENDIX 1

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2. Managing Design - An Initiative in Management Education, CNA/DTI/Design Council Report 1984
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10. Education and Training of Chartered Engineers for the 21st Century, A F Pollard Fellowship of Engineering 1989
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APPENDIX 2

BSc (Honours) in Engineering Product Design - Extract from Course Validation Document, Sept. 1991

1. COURSE INTRODUCTION

The primary aim of the course is to produce graduates who possess the broad range and combination of knowledge, skills and understanding necessary to work as Engineering Product Designers in design consultancy or the manufacturing industry.

The course is specifically aimed at widening access for students wishing to become professional designers in a field of proven opportunity.

The BSc Honours in Engineering Product Design is a substantially studio-based design course which imparts the skills and understanding of both industrial and engineering design, and which together with supporting studies in management will enable the student to respond as a professional engineering product designer to the challenges of innovative product design and development.

The two Faculties (Engineering & Computer Technology and Birmingham Institute of Art & Design) jointly proposing the course have had close ties through serviced teaching and industrial liaison. The course proposal contains a balance of industrial design and engineering viewpoints and methods of working.

The broad resource base of the two Faculties will be

available to support the course and teaching will take place in both Faculties to extend student experience. The industrial links established by both Faculties will be used to provide realistic situations for student design briefs and opportunities for industrial visits. The 1st and 2nd years of the course will be based around a purpose-made studio in the Faculty of Engineering & Computer Technology.

The Final Year of the course will be based in the studio accommodation of Birmingham Institute of Art & Design. It is envisaged that during this year a particular emphasis will be placed on the establishment of close contacts between the students of this course and students of the BA Honours Three Dimensional Design/Industrial Design course through joint seminars and cross-disciplinary team working.

2. Course rationale

With ever-increasing requirements for the fast development of new products for both the consumer and capital markets, there has been a broadening of the demands on engineering designers. The need has been recognised for integrating industrial and engineering design education to produce creative designers who are capable of handling the visual, functional and technological aspects of a product through all its stages of development. There is increasing evidence that design consultancies and firms having substantial involvement in product design require graduates with these skills.

The proposed course is aimed at equipping the graduate with the design, engineering, management and entrepreneurial skills necessary to be successful in the design, development and marketing of new products. This is achieved by building around the central core theme of design a structure which provides the necessary knowledge of the fundamentals of engineering science and technology. In this way graduates will be able to undertake creative design from a firm engineering knowledge base, and have a practical appreciation of the constraints of manufacture.

An option study programme from one of four themes provides breadth and allows the individual some freedom of choice of course content, whilst at the same time developing knowledge and skills within a specialism related to design practice or design management.

2.1 Perceived Job Functions of the Engineering Product Designer

As there are relatively few graduates in this specific

discipline, a view of possible job functions is valuable in focusing stated aims and objectives. These functions are best seen in relation to conventional definitions in the two contributing disciplines. The titles "Engineering Product Designer" and "Industrial Design Engineer" are both used to describe the designer working across the two disciplines.

Industrial Designer

creates new product concepts and designs products by reconciling human factors, technology, marketing and manufacture.

Engineering Designer

creates and develops components, products and systems with a view to optimising performance, function, cost and production efficiency

Engineering Product Designer

undertakes the total design of products where the brief requires inputs from both disciplines but where circumstances do not justify briefing both specialists.

leads product development programmes

spans the two specialisms where design liaison between them is required

acts as a Product Champion, having a broad understanding of, or direct involvement in the whole of the design process

3. Course structure

3.1 General Description of the Course

The BSc Honours in Engineering Product Design is a three-year full time course. The structure of the course is illustrated in Fig 1.

The course operates substantially within the framework of the Faculty of Engineering & Computer Technology's Modular Degree Programme, the main features of which are:

- 1) Each year of a full-time course is called a stage, comprising two semesters, each of 15 weeks duration.
- 2) In each semester, full-time students will normally complete 5 course units.
- 3) The honours degree programme consists of 30 units, which are normally completed over a 3

year period by full-time students.

- 4) Each unit occupies a total notional student workload of 100 hours making a total study time over 3 years of 3000 hours.

3.2 Compulsory Core

The course consists of a compulsory core of 4 units per semester and an option stream of 1 unit per semester running from Semester 2 through to the end of the course. Design studio work forms an increasing proportion of the core studies as the course progresses, while the option stream chosen allows the student to develop expertise in a specific area.

3.2.1 Stage One (Semesters 1 & 2)

The aim of this stage is to provide the student with a foundation of concepts, techniques and methodologies for subsequent application which will accommodate variations in students' educational background.

Emphasis in the core studies in this year will be on a variety of design assignments which develop creative and presentational skills, supported by taught elements which provide a "toolbox" of technology and techniques to be used in the later design assignments. In Semester 2 Design studies expand to a double unit in which both engineering and industrial design methodologies and techniques are introduced.

From Semester 2 through to Semester 4, design projects and assignments will be set which specifically cross-link modular core units to Design studies.

3.2.2 Stage Two (Semesters 3 & 4)

In this stage half the total course time is spent in the design studio and more substantial projects are undertaken. From Semester 4 design projects and assignments will be set which provide specific links with the student's option stream studies.

3.2.3 Stage Three (Semesters 5 & 6)

The Final year will be almost entirely studio-based and will consist of major design projects making use of the earlier taught elements of the course, with further ad-hoc supporting lectures. Students will conclude the year by exhibiting their design work at the Birmingham Institute of Art and Design Degree Show.

3.3 Option Studies

The Modular Degree Scheme of the Faculty of Engineering & Computer Technology allows study in a range of option streams. This gives the following opportunities:

- to study within a subject area related to the student's previous academic experience or present personal interest and aptitude. This is particularly important when considering the broad entry requirements of the course.
- To develop knowledge and skills within a specialism related to design practice or design management.
- To develop knowledge and skills specific to career aspirations and perceived employment opportunities.

The modular structure used provides for a series of recognisable subject themes. On this degree course, any chosen theme will normally be 5 units in length, which represents one sixth of total course time. This is felt to be sufficient for study in reasonable depth whilst not unbalancing the main thrust of the course. The themes chosen exist as core or option routes on existing BEng or BSc courses in the Faculty of Engineering & Computer Technology and therefore can be realistically offered as options for this course. Students will be counselled on their choice of option route during the 1st semester.

The option routes offered are illustrated in Fig 1.

3.3.1 Manufacturing Route

This route commences at Semester 3, the prerequisite units (Engineering Fundamentals I & II) having been studied within the core. An alternative Semester 2 option subject will therefore be studied to maintain a total of 5 units. Students have the opportunity to transfer to Manufacturing from other options at this stage. The route gives students interested in working as designers in a mass production environment the opportunity to extend their knowledge of production processes, to cover the technology and organisation of production appropriate to both mechanical and electronics manufacture.

3.3.2 Information Technology Route

This route allows a detailed study of the applications of information technology to design, manufacturing and business practice. In addition to developing skills in the use of a wide range of software packages, students also learn a high-level programming language and the elements of computer operating systems and hardware.

3.3.3 Business Route

This route will be of particular interest to students from a business studies or economics background and others wishing to develop a more detailed knowledge of the way in which a company is organised and how a firm makes use of cost and other information in its operations. From Semester 4 the route specialises into marketing and international marketing.

3.3.4 Language Route

This route provides an opportunity for students who wish to take advantage of labour mobility in the EEC after 1992. The chosen language of study is German, due to its importance as a language of technology and communication in both Western and Eastern Europe. The four units aim to provide a level of competence such that students can undertake social and technical contacts in spoken and written German with reasonable confidence. The route concludes with a project-based study of the historical and contemporary context of German design.

Figure 1 : BSc (Honours) ENGINEERING PRODUCT DESIGN COURSE STRUCTURE

