ARE GUITARS SO DIFFERENT? THE CASE FOR INTEGRATED PRODUCT DESIGN DEGREE PROGRAMMES

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ABSTRACT

Innovation in acoustic guitar design requires a range of knowledge, skills and values that are not embodied in any current mono-discipline. People are educated to be luthiers, musicians, physicists and materials scientists, manufacturing, mechanical and structural engineers, industrial designers and as business experts, all potentially useful, but separately insufficient. The most advocated approach to attempting innovation in such product areas is that of ‘inter-, cross- or multi-‘ or ‘X-‘disciplinary teams. Whatever their success elsewhere, the limited innovation in acoustic guitar design since C F Martin in the 1930s is a reality. Loughborough’s polymer guitar project has demonstrated one of the possibilities for successful innovation and it might therefore be reasonably expected to have been more widespread. The guitar market is conservative, dominated by a belief in the primacy of tonewoods, and the Far East’s effect on manufacturing costs could also explain the stagnation in design, but, in the author’s view, neither are sufficient. There remains a gap between analysis and action, designing and making, that inhibits creativity and innovation.

Building on this position, through the presentation of wider evidence, this paper challenges the presumed primacy of mono-disciplines on degree programmes and X-disciplinarity as the route to resolving subsequent issues. A less commonly supported alternative for developing innovation capability is provided by integrated design degree programmes based around particular product categories. This paper presents evidence supporting the strategies such programmes embody.

Keywords: mono-disciplines, innovation, guitars, integrated design programmes

1 INTRODUCTION

The predominant model of University degree programmes throughout the world is currently that of mono-disciplines. In order to graduate, students must demonstrate mastery of particular areas of knowledge, skills and values that define a programme boundary. Much recent debate concerning the development of design degree programmes has focussed on the issues surrounding creativity and innovation, e.g. the Cox Report in the UK [1]. One of the major recommendations of this report was the establishment of centres of excellence combining creativity, technology and business teaching, essentially related to education at masters level. The thinking behind this recommendation clearly stemmed from the very successful postgraduate link course in Industrial Design (Engineering) run by the Royal College of Art (RCA) and the Imperial College of Science and Technology (ICST), which has its origins in the 1980s.

Cox also mentioned the undergraduate link course in Product Design Engineering run by the Glasgow School of Art and Glasgow University, however, there was no discussion of the integrated undergraduate courses, which have been long-established (also since at least the 1980s) in order to tackle parallel agendas. The apparent perspective of the Cox Report is that crossing subject boundaries is a postgraduate activity: a perspective centred on the concept of a 'jack of all trades and master of one' perhaps, as it is sometimes expressed. The associated description of an integrated design programme would presumably be education as a 'jack of all trades and master of none'.

Design courses seeking to merge the arts and the sciences began in earnest in UK higher education in the 1980s. These courses became generically known as 'Industrial Design Engineering' (IDE), and hence inevitably became closely associated, and perhaps thought to be conceptually derived from the RCA/ICST postgraduate programme. Reports on their development were completed by Ewing [2] and Carter [3] for the UK's Design Council and Myerson [4] reported on the integration of technology into such programmes. The ideas culture in the UK in this period was characterised by a recognition that Snow's 'two cultures' model of human knowledge was inadequate for the development of design education, as eloquently argued by Archer and his colleagues in the 1970s at the RCA's Design Education Unit [5]. The 1980s was also the decade in which undergraduate programmes combining engineering and industrial design emerged at Brunel University, Loughborough University and Napier University.

Elsewhere in Europe, such courses began even earlier. For example the IDE programme at TUDelft started in the early 1960s from its origins in a school of architecture. So, by the 1990s there was increasing evidence of such new perspectives on design education gaining momentum, but they have clearly not yet gained any ascendancy, as evidenced by the Cox Report. For example, Archer wrote as follows in the mid-1990s.

> *In 1989, there were fewer than ten university courses on engineering product design, By 1994, there were more than 200, some of them producing graduates with aesthetic sensibilities and communication skills comparable with those seen in graduates of schools in art and design.* [6]

The apparent insignificance placed on the importance and track records of these programmes is both surprising, and disturbing, given the importance of successful innovation for economic, environmental and social sustainability. This discussion paper is both exploring and presenting the case for such programmes: firstly, through a particular case study, the polymer acoustic guitar; and secondly, through some of the wider evidence available. The benefits from the contribution that integrated design programmes can make will not be fully realised without appropriate recognition and support of the alternative strategy that they represent.

2 A CASE STUDY OF INNOVATION IN ACOUSTIC GUITAR DESIGN

It is not that there has been no innovation in acoustic guitar design since the 1930s. There have been significant efforts and some successes, notably Maccaferri in the 1950s, who developed successful polymer ukeleles, and rather less successful guitars and violins, and in the 1970s, Gibson's Mark Series project [7]. More recently the Ovation and Rainsong guitars have achieved some success. The evolution of the guitar as a product species was discussed by Norman [8], and further explored as a case study demonstrating the human need and capacity to strive for change at product boundaries [9]. Part of the explanation for these developments lies in a characteristic human behaviour, perhaps best described as Doyle's concept of 'technicity'[10] … 'the creative capacity to: a) deconstruct and reconstruct nature, and b) communicate by drawing'. It appears that some evidence from the field of evolutionary psychology suggests that technicity, rather than language, can be seen as the driving force underpinning the evolutionary success of humans. So the seeking out and exploration of new possibilities is at least partly 'simply what humans do'. However, any brief visit to a guitar show or retailer would demonstrate that the acoustic guitar market is dominated by wooden, flat-top guitars as developed by C F Martin in the 1930s. The following is a brief discussion of some of the issues surrounding this agenda, particularly in relation to the potential contributions of mono-disciplines.

2.1 Recognising possibilities

It is well-known that acoustic guitar construction has a long history, but less well appreciated that wood was not so much 'selected' for the construction of guitars, but adopted as the only credible option. Clearly, the better woods were identified e.g. spruce or cedar for the soundboards, and the apparently obvious conclusion was reached that the grain would need to lie parallel to the strings in order for the wood to withstand the forces on it, but that is a long way from defining this as an 'optimal' choice. With a soundboard expanding 6-7mm transverse to the grain with differences in humidity, and, perhaps 0.15mm in the direction parallel to the grain[1], there are major construction problems to overcome. The rigid neck joint imposes great strain on the soundboard in the region close to it and transverse braces need to be fitted to keep it from splitting. Instruments constructed from wood in the traditional manner are masterpieces of structural engineering, designed to withstand these forces whilst using the minimum possible material in order to ensure good acoustic response to the small energy inputs. Luthiers need years of training and experience in order to master the required craft techniques, and, although this means that they have an excellent understanding of the solutions to the inherent problems of constructing wooden instruments, it is not an ideal background from which to recognise alternative possibilities.

2.2 Applying science

The science of the acoustic guitar is also not sufficiently advanced for either physicists or material scientists to engage in innovation with any confidence. Bernard Richardson, of Cardiff University, is a foremost authority on guitar physics and a guitar maker. This quotation indicates the difficulties associated with current levels of understanding.

> *Because no two pieces of wood are alike, even … from the same tree, the maker has to fashion each piece of wood in an individual way to exploit its maximum advantage … there is no substitute for the sensibilities of the skilled craftsman who has learned through long experience how to extract the required vibrations from carefully chosen and carefully fashioned pieces of wood. It is these makers who are the key to the future prosperity of the instrument* [11]

Again, it is not that no progress has been made in understanding guitar physics, but that the non-homogenous structure of woods makes analysis difficult and prediction impossible, given that the material properties will effectively be unknowns.

And then there is the human sound perception problem. Even if humans' ears receive identical sound waves, the way those sound waves are interpreted is a function of the way the resulting signals are interpreted by people's brain. Frequencies can be filtered out (e.g. the hissing of old transistor radios) or added in from memory (e.g. the bass

[1] Information from Alan Marshall, luthier at Northworthy guitars, Derbyshire, UK

lines of recordings when played through small speakers). So, it is not possible to conduct reliable listening tests, as the results will be culturally determined and as much a sociological outcome as a scientific measure of an instrument's performance. For the engineer, the major difficulty is in having a goal, that is difficult if not impossible to define. There is no 'ideal voiceprint' for a guitar. Most customers buying guitars do not realise that each example of a particular model sounds different even when geometrically identical, because often they only hear the one, and their ears are not trained to hear the differences.

2.3 A branded market

The modern guitar market is controlled by the major guitar brands. They sign-up promising musicians, and images of 'guitar heroes' are published in the media. If you are purchasing your first guitar, then clearly you will not be able to play the instrument to test its quality, and will have no experience on which to base a judgment, even if someone else plays it. Most initial purchasers will wish to play safe, particularly in the eyes of their peers, and choosing the guitar being played by the current 'guitar hero' is a reliable option. If the reality that most current wooden acoustic guitars are made in the Far East at low cost and to a high quality is added in to this equation, then it becomes even clearer why there is currently stagnation. Changing production technology would be a major undertaking for any of the brands and what would be their incentive?

2.4 Sustainability

From an economic perspective, it is not possible to compete with the Far East manufacture of wooden instruments. There may well be ethical concerns associated with the distribution of wealth, as such instruments would cost an importer around 20GBP, or 30€, and sell for much more, but they are providing employment in the Far East. There may well also be environmental concerns because supplies of tonewoods are declining and manufacturers are expected to run into supply problems in around 5 years. Far East manufacture is rapidly consuming the remaining stocks and, even if planted, replacement trees with narrow grains must grow slowly. Spruce for soundboards is not a renewable resource in the short term, and trade in some tropical hardwoods is banned under CITES agreements. There are also inevitably rising costs and environmental concerns from the energy requirements for transportation, as well as social concerns about lost jobs in traditional manufacturing nations.

2.5 A design perspective

Designers are trained to be goal directed and 'find a way'. Quantity manufacture in an engineering material and the consolidation of parts to reduce assembly costs would be fundamental requirements of competitive manufacture in a European economy. Knowledge to help realize such a goal could be sought from the 'know how' of luthiers and the 'know that' of scientists. New styling opportunities could be pursued and modern polymer technology exploited. With these realizations, Loughborough University's polymer guitar project was initiated in an integrated product design department. The project has demonstrated the possibilities for successful innovation in acoustic guitar design [12, 13, 14]. However the point of this paper is not to promote those possibilities, but to ask the question of whether such a project could have been started within a mono-discipline? An expert in traditional, guitar-making, physics, management or sustainability would need to see beyond the boundaries of their discipline towards the wider picture. Of course a X-disciplinary team remains a possibility, but individual designers who take an integrated approach are another, which leads to the question … Are guitars so different?

3 WIDER EVIDENCE RELATING TO INTEGRATED PRODUCT DESIGN DEGREE PROGRAMMES

Innovation in acoustic guitar design seems to be dependent on ‘integration’. However, this was also the author’s experience as a research engineer in the welding industry, where those trained as ‘welding engineers’ through a scientific route worked in partnership with ‘welders’, who had received a practical training. It was plain that each had ‘different’, but complementary kinds of knowledge. Whether it was controlling the root pass in a pipe joint or understanding how the weld penetration varies on plates where the material and welding procedures were within specification, the integration of forms of knowledge was essential. Having observed the staffing, modules and programmes of the Department of Design and Technology at Loughborough University develop since 1984, it has been apparent that they also reflect the perceived need to integrate a wide range of staff expertise and mono-disciplines. It is the author’s view that IDE at TUDelft reflects such integration to an even greater extent. Arguably the most ambitious integrated design programmes were those developed at the Bauhaus, where the integration of art and technology was perhaps first addressed. The resulting curriculum has influenced design education worldwide and the Bauhaus practice was to have two Masters, one a Form Master and one a Craft Master, for each workshop area.

4 DISCUSION AND CONCLUSION

The design spectrum proposed by the Carter Report (1977) suggested that the design of different product categories required different combinations of industrial design and engineering design as shown in Figure1 [15].

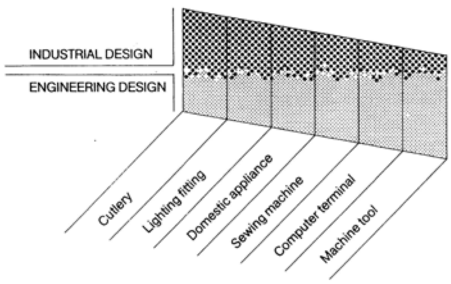

Figure 1 The design spectrum

The essential possibility is the recognition that designing in particular product areas requires associated knowledge, skills and values. For some product areas these will correspond with existing mono-disciplines, which is the reason they exist, but for others they may not. Clearly, being an expert in a mono-discipline does not make it any easier to address a task for which it is a poor match. Being able to address innovation in areas such as acoustic guitar design either requires individuals to develop the necessary ‘fit-for-purpose’ capability, for which the development of expertise in a particular mono-discipline might only be a partial starting point, or the development of special teams embodying the required expertise and relationships. There seems no reason to conclude that the latter is always the more effective approach, and the contribution that integrated design programmes that do not operate within traditional discipline boundaries can make to innovation needs to be more widely recognized. It is perhaps a post-disciplinary perspective that is really needed.

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