CASE STUDIES IN THE USE OF DESIGN PRACTICE BY PHD RESEARCHERS

DPR case studies

INDUSTRIAL DESIGNERS' ATTENTION TO MATERIALS AND MANUFACTURING PROCESSES: ANALYSES AT MACROSCOPIC AND MICROSCOPIC LEVELS

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INSTITUTION: Loughborough University, UK

DATE OF AWARD: 1999

SUPERVISOR(S): Professor Eddie Norman
Professor Phil Roberts

EXAMINER(S): Professor Martin Woolley
Dr Ian Wright

CREATIVE DISCIPLINE: Industrial design

RESEARCH METHODS:
- Literature review
- Interview
- Diary
- Content analysis

NUMBER OF DESIGN CASE STUDIES UNDERTAKEN BY THE RESEARCHER: 1

LENGTH OF THESIS: 129000 words

EXAMINATION FORMAT: Thesis and oral examination

DURATION OF STUDY: 4 years full-time

EXPERIENCE OF DESIGN PRACTICE BEFORE START OF PHD:
- BSc in Industrial Design and Technology
- Two industrially-sponsored major undergraduate design projects: strap-on MIDI keyboard (with E-Mu Systems Ltd) and equestrian saddle strap hole-making machine (with Thorowgood Saddlers Ltd)
- Summer placements at a building surveyors undertaking survey, design and drafting activities.

PERSONAL MOTIVATION FOR UNDERTAKING PRACTICE DURING PHD:
- To develop and apply hard-won design skills, thereby extending my product design portfolio for future employment possibilities
- To retrospectively deconstruct own design activity and make comparisons with other people's work
- To be intensively involved in musical instrument innovation, design and development

AIM OF THE RESEARCH:
Prior to commencing the research, little had been published on ways in which industrial designers consider materials and manufacturing within their projects. Investigations were required into two aspects of materials and design decision-making: pragmatic and epistemological. Revelations in these areas would be useful not only to design educators, to improve teaching and learning, but also to information providers to better fit their offerings to the needs of industrial designers. The aim of the PhD was to characterise the tripartite relationship of materials, manufacturing processes and industrial design, by exposing and theorizing on current practices.

RESEARCH QUESTIONS:
- What role and significance do materials and processes have in industrial designers' decision-making?
- Can industrial designers' 'distinct way' of expressing and generating materials and processes knowledge and values be identified and described?
- What implications do the above questions have for industrial design educators and information providers?

OBJECTIVES:
- Construct a framework for analysing industrial designers' attention to materials and manufacturing processes through a critical review and synthesis of literature
- Design and test an effective data collection method suitable for capturing own design activity over long periods (months, years)
- Establish the extent to which industrial designers are involved in materials and manufacturing decisions, through literature review, interviews and a longitudinal study of own design practice
- Build theory towards a general model of how industrial designers' materials and manufacturing decisions are influenced by internal and external drivers
- Build theory towards a general model of the ways in which industrial designers know about materials and their use of information sources

Perspective view of 'P1' prototype showing combination of foamed PC soundboard and GFRP back/sides

Rear view of 'P1' prototype showing moulded GFRP back and sides with integral Armstrong logo

Detail of foamed PC soundboard material and logo on 'P1' prototype

Undesirable distortion of soundboard under string tension

SUMMARY:
At the time of commencing the PhD (mid 1990s), there existed confusions about the nature of expertise, responsibility and perspective that industrial designers had with regard to materials and manufacturing processes. Part of the problem was that materials selection was heavily engineering-dominated. Very few designers or design researchers, with Ezio Manzini being a prominent exception, had broached the topic and contributed to a materials and industrial design knowledge base. The PhD research sought to help redress the situation. Two substantive sources of data were generated, alongside prior art reviews. The first was interviews with professional designers in consultancies and manufacturing firms to gauge a broad overview of contemporary practices linking industrial design and materials. The second was a diary method to document the researcher's own design practice, thereby creating a meticulous account of materials and design decision-making throughout the lifespan of a project, from brief to working prototypes. In analysing the data, it became clear that various practical and epistemological facets of practice contribute to an 'industrial design perspective' on materials and product design. Subsequent to the PhD, the embedded design practice – the design of a polymer acoustic guitar – grew into the guitar innovation venture 'Cool Acoustics.'

RATIONALE FOR THE INCLUSION OF DESIGN PRACTICE UNDERTAKEN BY THE RESEARCHER:
Design practice was included for the primary purpose of gathering documentary evidence of how materials and manufacturing considerations are integrated into industrial design decision-making. The role of design practice was therefore as a 'vehicle' for investigating certain aspects of design activity. It needed to be longitudinal, in order to track design activity in detail as it happened across many months of work. In this way, the design practice would reveal in detail the trail of material considerations and decisions made when designing a new product. Any genuine industrial design brief could have been set, e.g. design of a vacuum cleaner, mobile telephone, cutlery, sanitary ware, power tools etc. However, the chosen project (an acoustic guitar made from plastics as an alternative to wood) was chosen because materials selection would be an inevitable challenge during the project, rather than a simple matter of selection from amongst commonly used alternatives. From this perspective, the guitar project was viewed as a source of 'good data' for an examination of materials and design decision-making: there was pursuit of innovation from the outset, not routine design or redesign.

HOW THE PHD DESIGN PRACTICE DIFFERED FROM THAT OF COMMERCIAL PRACTICE:
The design practice embedded in the PhD was essentially a tool for generating academic research data. Therefore, the mind-set of the researcher was necessarily complex. On the one hand, there was necessity to carry out a design project with the level of creativity, competence and outcomes comparable to commercial practice. On the other hand, there was a need to spend considerable time away from the design practice, to focus on the many other academic activities necessary for the PhD. Furthermore, the design practice (guitar project) was the only case study conducted during the research: such concentration on a single project would be very unusual in commercial practice. The design practice can be further characterised as different from commercial practice in the following ways.

- The designing occurred over an extended period of time (years) because it was interspersed with academic activities necessary for the conduct of the PhD
- The design brief was conceived as 'technology-push' rather than 'market-pull.' For the musical instrument industry, it was a design brief that would probably not have been supported commercially, because of the large effort and high risks involved
- No commercial partner or client was attached to the project. Instead, it was carried out in collaboration with a professional guitar maker, who would later make use of the developed technology in his own work
- The design practice was essentially a solo effort rather than a team effort, notwithstanding the collaboration with the professional guitar maker and the PhD candidate's supervisory team

THESIS AVAILABLE AT: https://dspace.lboro.ac.uk/2134/7155

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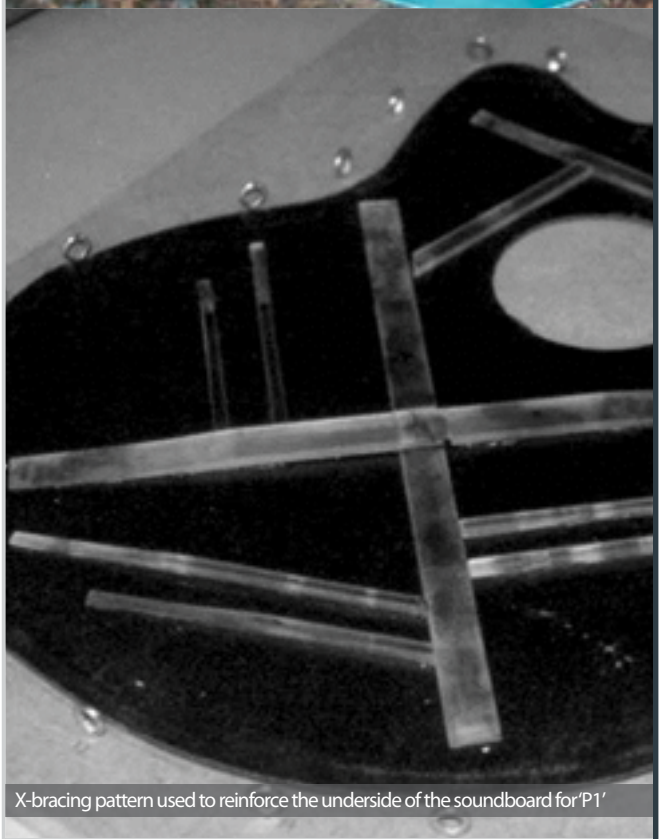
Creation of the single component back and sides for the 'P1' prototype from GFRP involved CAD modelling, CNC machining and hand preparation of plugs, moulds and parts



X-bracing pattern used to reinforce the underside of the soundboard for 'P1'