RE - GENERATE: A CASE STUDY OF A COLLABORATIVE DESIGN RESEARCH -LED NEW PRODUCT DEVELOPMENT

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Introduction

This paper highlights the collaborative nature of design and through case studies we will provide an insight into the increasing trend for multidisciplinary alliances. The paper will reflect on the traditional role of the practising designer and suggest how design research within the academy may provide new models and methodologies for working. Key to this approach is the collaborative and multi-disciplinary nature of the research the authors have undertaken. Prof. Rachel Cooper, Editorial Chair of the internationally refereed Design Journal, recently referred to a paper based on a case study of their work. (Chamberlain, Roddis 2003). She says, ‘If we are to consider the future of design methodology, this is a good example of the trend of design leading research in collaboration with social and scientific disciplines’.

The Art & design Research Centre at Sheffield Hallam University (SHU) has played a significant role through collaborations with local industry to take help regenerate, redefine and reinforce industry within the region. The authors of this paper are design researchers who through fundamental and then applied research programmes are making a considerable contribution to industrial product development. Through case studies we will highlight the role of the designer as the ‘mobiliser’ of new solutions.

Multi-disciplinary research activity is generally easily embraced by designers, as Design, unlike many disciplines, is not governed or restricted by context. It provides ways of thinking and skills that can deliver physical objects as tools for creating new scenarios in the world we live in. Designers can create 'contexts' for other disciplines to experience and explore. Design is not an insular activity and has to by its very nature engage with other disciplines. A challenge to this approach to research is establishing communication methods that provide a clear understanding between the potentially diverse stakeholders in the research.

The paper will discuss the key role of designers and ‘the physical prototype’, in new product development, outline the diverse current research that has emerged from the projects and draw out the theoretical and practical implications.

Traditional designer - client model

There is increasing literature on new product development (NPD) processes which aims to provide models of practice and identify factors that account for success.

A shortcoming of most of this literature is that it assumes design to be a functional resource directed by management strategically to enhance the NPD process. Much of this literature is produced to educate business managers, it is hardly surprising that it conceptualises NPD as a corporate-driven process which employs the services of design.

Design is often seen as a resource to embellish products towards the end of the research and development process. Once the science has been established and the engineering proven, designers are brought in to add visual value to a product. A traditional view of the industrial design profession is that it tends to be preoccupied with *visual* appearance, at the expense of other factors. In the USA, the first industrial designers were known as "stylists", since their chief concern was the cosmetic appearance of products (Margolin 1997, Rothstein 2000)

Adrian Stokes a well respected and experienced industrial designer and Principal of ASA designers provides an insight into collaboration between the traditional client designer relationship (Stokes 2002). He refers to a quote from Dr Rolf Fehlbaum at Vitra, 'It is my experience that good results can only be achieved in a long term and intense designer client relationship'. There are good examples to support this view, witness Jonathan Ive with Apple, Ken Grange with Kenwood and Dieter Rams with Braun. Stokes describes two strands of communication within a design practice. - between designer and designers and designers and clients. He suggests the best relationships remind him of, 'a benign game of ping pong'.....'what do you think'...'what do I think? Erm well if we'.....'yes but have you considered'.....'oh god no I haven't.....'that's ok just have a look'....
Gradually making okay, good, and good, great and anything after that a bonus and source of regret it wasn't thought of before the product was signed off'.

However, Jevnaker does provide different models of 'design alliances', one of which - entrepreneurial mobilisation - considers the role of the designer as a "dialectical, knowledge-intensive, source of innovation" who can take on an entrepreneurial role in the process (Jevnaker, 1998). Despite high profile examples of design as 'entrepreneurial mobilisation', such as Sir Terence Conran or James Dyson, there are few analytical case studies available.

Designer – user

"User-centred" design methods have been widely discussed, within product design discourse, and also in the disciplines of human computer interaction (HCI), human factors engineering and ergonomics. McDonagh-Philp introduces us to the following definition of user-centred design:

"User-centred design is a design methodology that utilises the target product users as a designing resource to increase the understanding of the design practitioner." [McDonagh 1998]

Many business models will assume an understanding can be established through marketing techniques and questionnaires. However there has to be a clear understanding of users needs and wants. If Henry Ford had asked his public what they wanted they probably would have asked for faster horses. Questionnaires can confirm past prejudices and breed mediocrity and dullness. Would the Wright brothers have invented the aeroplane based on a questionnaire? or Edison the light bulb?

If the aim is to improve the usability of products, it is essential that designers acquire knowledge of product use that is derived from first hand experience. In some cases, such as when designing familiar consumer products, designers can draw on their own "real-life" experience of using these products. It is therefore necessary for designers to build close collaborative relationships with product users and, where possible, to take part in user activities themselves.

Quoting from Dreyfuss (1955):

"I have washed clothes, cooked, driven a tractor, run a diesel locomotive, spread manure, vacuumed rugs, and ridden in an armoured tank. I have operated a sewing machine, a telephone switchboard, a corn picker, a lift truck, a turret late, and a linotype machine…. We ride in submarines and jet planes. All this in the name of research." [Dreyfuss 1955]
However, it becomes more difficult when designing products that are used in unfamiliar contexts (e.g. in Hospitals), or for people whose age and/or capabilities lie outside of the designer's own experience.

Designer – other stakeholders

Human-centred design is a broader concept; a holistic approach that explores the relationships between the designer, the end-user(s), and the other 'stakeholders' within the system of production and consumption. This may include those who manufacture, transport, sell, carry out maintenance, or dispose of the product or system at the end of its useful working life. The role of the designer becomes that of 'advocate', within a system of production and consumption that is socially and ethically responsible (Papanek, 1971).

The authors of this paper are working within a region whose industry has been decimated since the later end of the last decade. South Yorkshire which has a world wide tradition in the heavy industries of steel and coal has witnessed its workforce in these industries since the late eighties decline by over 70%. There are now no deep mines in the South Yorkshire Region. The following case studies demonstrate how the design researchers have 'joined forces', establishing collaborative alliances between designers, clients/manufacturers, users, and 'other stakeholders', and provide examples of the designer as the 'mobiliser' of new solutions. Core to these studies is the crucial role of 'physical prototypes' in communication and understanding.

Case studies

Rompa –are one of the leading suppliers of products and equipment for special needs teaching and sensory environments. Through collaborative initiatives with clinicians, musicians, and technologists, design led research projects resulted in product outcomes that were subsequently adopted by the company and have since achieved major design awards (Design Council). The relationship with the company has led to the establishment of a sensory research centre within the University

The research agenda has been concerned with the design and development of sensory equipment for people with profound sensory disability and its therapeutic, educational and recreational benefits. An early development from this research was a versatile vibro-acoustic modular system that tries to convey the emotions of music and meaningful sounds to people who cannot hear in the usual way. The portable units can be used individually as stools or in combinations to create beds and floors. The product now named as the tac-tile *sounds* system$_{TM}$, (Rompa) is a system that delivers sound to a series of resonating surfaces where they are converted into mechanical vibrations which can be felt by people who cannot here sounds in the usual way. The system has a wide range of uses in clinical, rehabilitation, educational and domestic settings. The system can be used to assist users with impaired hearing become aware of some of the characteristics of speech, music, rhythm and domestic or other environmental sounds in order to help them explore and adjust to a world of complex meaningful sounds. The system allows the users to experience

different frequencies, amplitudes, rhythms and intensities of sound and intersperse these with silence.

Establishing a common language between 'partners' is essential for the understanding and communication of information. A designer must understand the technical and commercial 'jargon' of the client and end user to both develop the question/s and then appreciate and understand what the answer/s mean.

Early stages of research and development involved a process of collaboration and communication between the design team, a team of clinical and educational specialists and the end-users, which in the main were deaf children and in some cases, deaf-blind. In short, the problem was that the design team was faced with the challenges of understanding highly specialised fields of clinical and educational practice, and the end-users literally could not hear what the designers and the clinicians were trying to achieve. Somehow the designers had to develop methods of communication that went beyond words. It was through quite literally 'feelings and vibrations' that prototypes provided that the research team gained the knowledge necessary to develop the product.

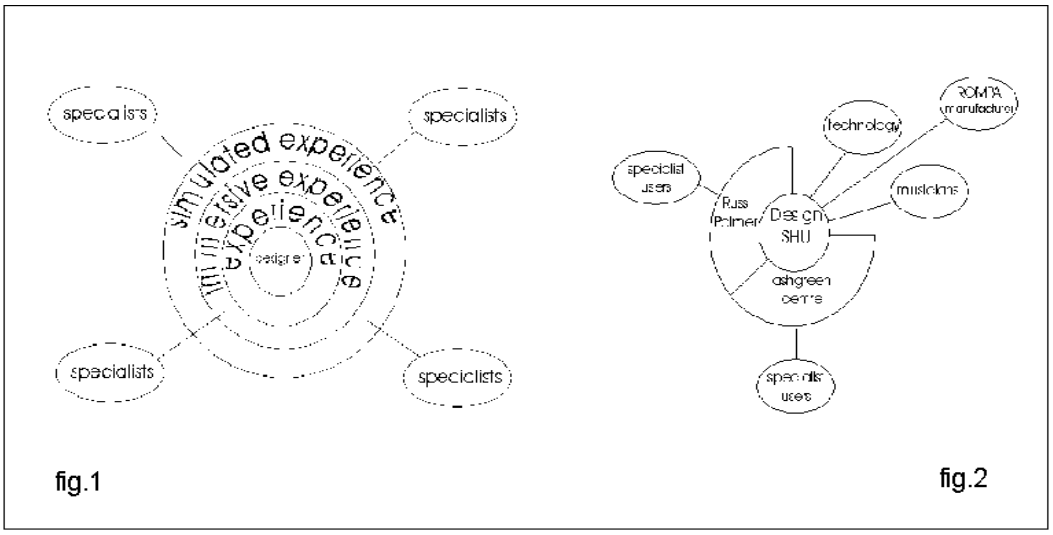
B.Braun. – The Art & Design research centre at Sheffield is currently leading a research project with this major international medical device company to minimise medical misconnection errors.

The increasing complexity of medical interventions and the associated medical devices means that users are required to connect a multiplicity of external tubes to various types of diagnostic and therapeutic devices. A typical patient in a coronary care unit may have as many as 40 connectors. It is not surprising then that errors arise and a recent incident involving the death of a patient who received drugs intrathecally (via the spine) that should have been delivered intravenously (into the vein) has raised concern about the application of a single connector design to a number of incompatible applications. Our research brings together a multidisciplinary team to design and test a new system of medical connectors. There is now significant pressure for research and development into a system of medical connectors that will distinguish between the different routes of delivery, so that misconnection of this kind become physically impossible. The design of a non-interchangeable connector system will eliminate the possibility of misconnection, which has the potential for catastrophic results. Currently more people die through medical errors than in motor related accidents. An easily identifiable system should eliminate the common practice of customised labelling and reduce the time for clinical checking procedures. Clinical practice will benefit in terms of a safer, time saving system and should contribute to a less stressful working environment. The project will lead to a new range of innovative devices and could provide valuable new knowledge that will inform their future product development

The research brings together expertise in general and regional anaesthesia, critical care medicine (Bradford Royal Infirmary), Psychology and human factors (Leeds University) and industrial design (Sheffield Hallam University) to develop an engineered design solution supported by a *novel* means of enhancing the discriminability of a new system of connectors through visual and tactile (haptic) cues. B.Braun a major international manufacturer and supplier to the health industry provides technical expertise and will support the route to market.

Models for collaboration

Designers often reflect on their own experiences to inform their work and can provide sufficient skills and expertise to manage and deliver a project. Design collaborations in the traditional sense is largely focused on the designer and manufacturer as discussed by Stokes. However there are many instances where the designer has to venture outside their own experience and will require external specialist knowledge. Designers, like Dreyfuss, sometimes have to create opportunities through collaborations to immerse themselves in unfamiliar 'real life' experiences. Occasionally this is not possible as we witnessed in the extreme case of the 'deaf blind users' or specialist clinical tasks. Sometimes there are opportunities to 'simulate' these experiences but this often requires the designer to establish collaboration with specialists and be creative in their techniques. (fig. 1)



Design research may demand different collaborative initiatives at different stages of a project e.g. Research and analysis, development and evaluation, realisation and route to market. 'Sub-partners' may provide a specific and defined role within the research. Partners that may have a more fundamental role and vested interest in the research can establish a more significant collaboration as a 'joint force' in the research as a 'key partner'.

It is interesting to note that 'key partners' in the sensory research were initially clinicians, Derbyshire Health Authority's Ashgreen Centre, a residential and special day care centre and Russ Palmer a Music therapist who himself was deaf/blind. These key partners provided access to other important specialists and users to input useful information to the project. The Design team liased with technical specialists to inform the project and the Music Department at the University of Sheffield to composers to create customised 'low frequency' music for the system. Rompa the manufacturer were a 'sub partner' who only engaged in the research at the latter stages of realisation when the work had been trialed and tested. (fig. 2)

As our research has progressed Rompa have become a 'key partner' and have now formally 'joined forces' with the Art & Design Research Centre at Sheffield Hallam University. Continuing our close collaboration with clinicians and users as well as technology specialists we have access routes to other specialist resources within health and social care, electronic technology and software developers. (fig. 3)

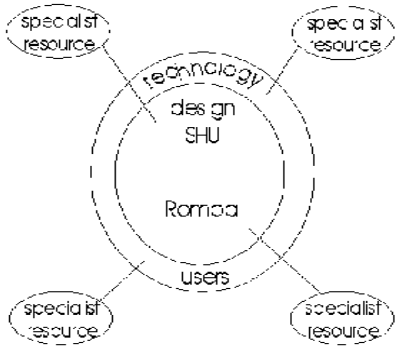


fig.3

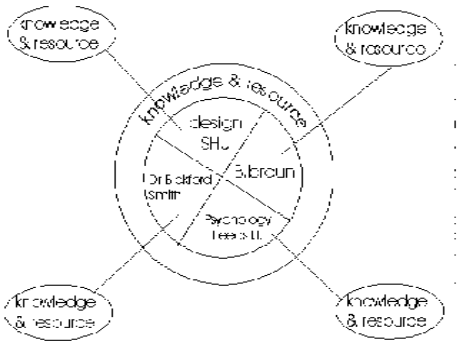


fig.4

Multi disciplinary collaboration can provide essential expertise and knowledge but it also brings a new perspective and way of thinking to a project. This hybrid of practice, theory and methods can provide real opportunities for cross-pollination. However collaboration of this nature must acknowledge the cultural and language difficulties between 'partners'. Our medical connector project sees the 'joining of forces' of Design, Psychology (University of Leeds), Medicine (Dr Bickford Smith, Bradford Royal infirmary) and industry (B.Braun Medical). Each 'key partner' brings their own specialist knowledge and resource that the research 'team'can share in. The Design team is co-ordinating activities and will provide the physical tools for research, provide technical understanding and apply the theoretical findings in a tangible solution. Psychology (human factors) provides an important fundamental theoretical underpinning and quantitative analysis. As a 'key partner' Dr Bickford Smith provides experience as a 'user' as well a conduit to other stakeholders, patients, nurses, stores, purchasing and the CEN committee. B.Braun provide manufacturing expertise and potential route to market. (fig. 4)

Notably in both of these case studies the 'object' whether it be a soft model or pre-production prototype has been the catalyst for communication and understanding across contributing disciplines. The 'object' has negated the semantic subject boundaries where misunderstandings occur. Even in the world where interactive design software has revolutionised the way we design things the physicality of an object allows engagement and critical appraisal utilising more than one sense.

These case studies provide useful models that have been successfully implemented that may help define collaborative multi-disciplinary design research as opposed to the traditional and more established activity of commercial design practice. Much traditional design research is based on the commercial designer / client relationship and a model where a theoretical study sometimes leads to a tangible product output. The authors of this paper based at the Art & Design Research Centre at SHU provide exemplar how 'the product' underpinned with intelligent theory can then enable further research within a broad multi-disciplinary context.

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