

4D Dynamics:

An international interdisciplinary conference on design and research methodologies for dynamic form

4D Design Futures: Some Concepts and Complexities.

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Abstract

A new design frontier is emerging where the added value and usefulness of many new products centre upon the design of complex dynamic form - 4 Dimensional Design.

This paper outlines a view of 4D Design with some implications for design practice and research. It is proposed that 4D Design is a useful notion for a new kind of professional design activity, not only related to information technology, but also to industries in the service sector of the economy, when culture is integrated into commerce, and where dynamic form and the interactive behaviour of people with each other and artifacts requires designing. Dynamic form, both functional and kinaesthetic has a wide range of application, from Virtual Reality computer game-play to 'customer care' systems.

The paper outlines how 4D Design helps the classification and discussion of certain types of designs, and it gives some new creative activities a 'home' within the design business, profession and design education.

Introduction

The rapid technological development today together with changing priorities within society, such as the increasing importance of environmental issues is resulting in a review of traditional design practices. Design is at the leading edge of changes as can be seen in new forms of consumer products, such as 'smart' video cameras which respond to instructions from people and to their operating environment. (1)(2).

These changes are happening at the same time as the design profession is taking stock of its own development over the past few decades, as seen at the international DESIGN RENAISSANCE CONGRESS in September 1993 at Glasgow, Scotland. (2) Also, despite efforts to promote the value of 'design' in business over many years there is still a question over whether commerce and industry sufficiently understands the potential of *design* as a resource. There is also a question over whether the identities of design specialisations are clear enough, or indeed appropriate for the future. The plethora of design organisations and specialisations

together with some rather ambiguous terms used both in design practice and in design education could be a significant contributory cause to the general lack of understanding of 'design' beyond the design professions.

Design as a discipline needs useful classifications and terms to describe and communicate its essence and the underlying nature of its specialisations. Historically, the terms two-dimensional (2D) design and three-dimensional (3D) design have been used to group certain kinds of design activity. They refer to the dimensions of space - the x, y and z axes of geometry. The objects of graphic design and illustration are for example included within 2D Design; those of furniture design and ceramics under 3D Design. However, the terms 3D design, product design and industrial design are often used loosely, especially in design education, and many new kinds of useful artifacts, which designers can contribute to such as computer software do not seem fit easily within the 2D and 3D design classification. It might be argued that design involves unique intellectual processes and 'designs' incorporate an infinite number of characteristics and therefore the 2D and 3D classifications are inappropriate, or at least too limiting. However they have proved to be useful and it is proposed they should be built upon to communicate a principal characteristic of broad types of 'designs'.

4D Design

The term 4D Design is an appropriate addition to the nomenclature of 'design' classification. Although the notion of the fourth dimension in quantum mechanics is complex, (4) it is however useful to view it simply as concerning 'time' within design.(1) It is a helpful term to contrast dynamic form with the normally static form of 2D designs and 3D designs. The word 'animation' is of course often added when reference to movement of 2D and 3D forms is made. However, 'animation' is no longer an 'add on' feature but fundamental to many new products, where complex dynamic form can be independent of the exact nature of the 3D form. There is little point forcing the definition of 3D Design into contorted inclusion of complex dynamic form. There is a need for a *paradigm shift* in design (5). It is also important not to use terms which confuse, are ambiguous, or just plain unattractive. 4D Design as a classification has an elegance which could give conceptual authority to the design of complex dynamic forms.

A definition of 4D Design:

"the dynamic form resulting from the design of the behaviour of artifacts and people in relation to each other and their environment."

An assumption is made that 'design' can draw from knowledge of 'art' at one extreme of its spectrum and science at the other. Designers are in a unique position to synthesise such knowledge and externalise it in the form of artifacts. 2D and 3D design include aspects of static art and therefore it follows that since 4D Design focuses on dynamic form it can incorporate knowledge of 'kinetic art', and particularly the performing arts at one extreme and dynamics within engineering science at the other.

In addition, there are many activities involving time-based design which are currently on the fringes of professional design. As information becomes more of a commodity and the value

of the service industry increases, the way such information and service products are designed and delivered is increasingly important.

The classification of design activities under 2D, 3D and 4D design does not necessarily affect professional names such as industrial design, although it might be beneficial to use the terms more and highlight the obvious characteristic and therefore identity of various professional design activities.

The origins of Industrial Design are in 3D design but it can be considered 4D Design where there is both complex functional and kinaesthetic movements and interactions involved. However, the notion of a 4D product design extends far beyond the contemporary conceptual basis of established design professions, which have focused upon the design of material form for 'manufacture'. 4D Design involves much more.

An example to illustrate the point being made can be seen within the traditional Japanese Tea Ceremony. Contemporary 3D Design focuses on the design of the teapot - its spatial construction, materials, and its manufacture etc. 4D Design would focus upon on the tea ceremony. The paradigm shift here is from 3D design for the 'user' to 4D Design with the 'participant'. Japanese culture provides several useful concepts from the Japanese 'do' training for some arts, sports, and ritual social activity together with 'kuchikomi' - customer care and 'fuka-kachi' - added value. The tea ceremony is perhaps the most famous Japanese 'do' , called 'Chado' - where the 'performance' of the 'participant' and their relationship to the teapot, the room, and other people are important.

Virtual and Real Design.

There is increasing recognition of designs which do not have material form,(6) where words such as 'incorporeal', 'intangible', 'humanware' and 'softtechnica' are used. Another new term being used for non-material designs, is 'virtual', which is used within the computing disciplines for software and its visual display. 'Virtual' 4D Design is interactive and dynamic in, what William Gibson called 'cyberspace' (7).

Virtual 4D designs include:

- interactive information points,
- computer games,
- on-line shopping.
- interactive television programmes,
- computer flight simulations,
- metamorphic internet site design.

Computer based designs and models do not necessarily involve 4D design. For example 3D computer models are just that - 'virtual' 3D, and if they move they are 'virtual' 3D animations. Even when there is some 4D design it is often poor. For example 4D design is often conspicuously lacking in computer games, as many superb 2D graphics and 3D modelled characters are not supported by imaginative and careful 4D 'game play design'. Likewise many multimedia applications often have attractive 2D screen designs on well designed 3D personal computers but the 'navigation' and level of 'interactivity' are poor due to naive 4D design .

Real 4D products have 'dynamic' form in real or actual space and can be events:

- at one extreme, the 'have a nice day' etiquette of employees in supermarkets,
- and the way food is served in restaurants eg. McDonalds vs The Ritz.
- through to 'customer care' systems in hotels, eg. a motel vs a Hilton
- to the exotic mind products of New-Age enthusiasts ; or
- from the dynamic lighting designs in a discotheque or office using computer control technology
- to the 'staging' of Rave concerts;
- from the Fire Alarm that shouts "FIRE on the first floor"
- to the TV Knight-Rider car and 'talking' lift with 'personality',
- from the 'smart' focusing of a domestic video camera
- and automatic doors that open as you approach.
- to solar heat collectors that create imaginative visual effects on buildings as they follow the path of the sun across the sky using robotics technology.

If the teapot of the Japanese tea ceremony 'Chado' 'performed' along with the tea maker using animatronics technology then it too would involve 'real' 4D Design. Where there is a high cultural content of dynamic artistic expression based upon performing arts knowledge this kind of 'kinetic' design might be referred to as '*product opera*' - opera signifying the integration of the time-based arts within a 4D product design, in contrast to the functional perspective taken to tasks in product design incorporating human factors/ergonomics data.

A comprehensive *corporate identity design* - the personality of a company and its interactive behaviour with people is a 'real' 4D design. Companies depend much on the success of how the organisation and its people behave to their customers.

An emphasis on real 2D and 3D design is placed in the design journals. Within architecture and interior design it is rare to see people in the glossy pages illustrating 3D geometrical spatial designs. The buildings are decanted of people. Perhaps this is due to the use of static print medium. Likewise, in Museums covering design the 'object in a glass box' is still dominant, rarely do you see a 'working' exhibit. This neglect of 4D design runs deeper and would not be too obvious if some visualisation of use was outlined with a diagram showing interesting traffic flow of people within the spaces.

Real 4D design stresses the relationships of people to the material forms, and to each other within the spaces, whether these are pre-mediated by the professional designer or spontaneously designed by the users of the spaces. The skill of the 4D designer is to help create functional and kinaesthetic 'actions' with 'actors'.- both with people and artifacts.

What disciplines are involved in 4D product design and development?

The answers to this question will depend on the exact nature of the problem. However one might expect a design team to include for example a mechatronics engineer, an industrial designer and a dance choreographer, or, a multimedia software engineer, a graphic designer and musician and drama expert, or, an architect, kinetic artist and a building services engineer, together with a representative sample of the 'participants' who may be involved with a 4D design. Other combinations of disciplines will be necessary for 'service design' in retailing and leisure industries. The interaction of such disciplines presents exciting challenges for design.

Figure 1 shows how basic ideas inter-relate to give 4D design. TABLE 1 shows how a new classification of design might look. 4D Design focuses upon interactive dynamic form and includes knowledge from industrial and graphic design, aspects of engineering, the performing arts and culture, as well as human factors/ergonomics.

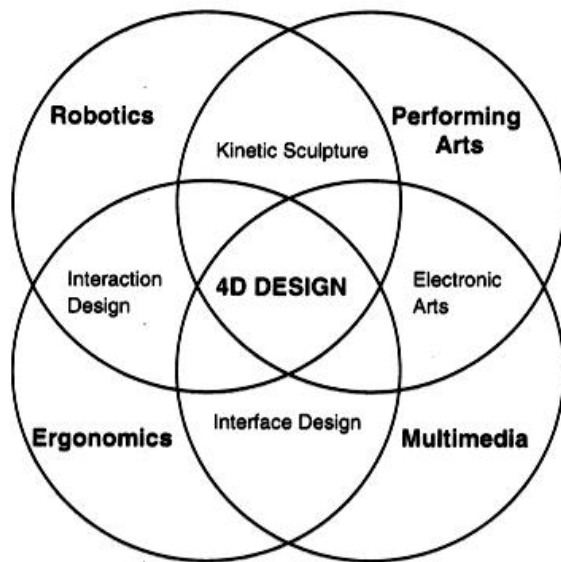


Figure 1: 4D Concept Diagram.

2D DESIGN	3D DESIGN	4D DESIGN
Graphic Design	Metalsmith design	Interaction Design
Illustration	Furniture Design	Multimedia Design
Printmaking	Structured Textiles	Animatronics
Film	Fashion Design	Service Design
Video	Jewellery design	Corporate Identity Design
TV	Industrial Design (3D)	Industrial Design (4D)
Textile Prints	Packaging Design	Cultural Engineering
	Ceramics	Information Design
	Glass	Event Design
	Architecture (3D)	Architecture (4D)
	Interior Design (3D)	Interior Design (4D)
		Product Opera

Table 1: Classification of Design.

Challenges for Professional Design.

The aim of professional design services is to provide industry, commerce and society with well thought out solutions. Designing takes place often without professional design services. 4D designs are all around us but as the importance of dynamic form in the human constructed world is acknowledged, professional 4D design services will be increasingly required.

It has been suggested here that 4D Design is a useful notion for a new kind of professional design activity, not only related to information technology, but also to industries in the service sector of the economy, when culture is integrated into commerce, and where dynamic form and the behaviour of people with each other and artifacts requires designing. 4D Design helps to us to classify and to discuss certain types of designs, and it gives some new creative activities a 'home' within the design business, profession and design education.

The 21st century will introduce products undreamed of today just as in the 19th century the everyday products we take for granted were beyond the imagination of the best minds of the period. 4D design will be central to new products, which will be based upon well designed dynamic form.

Today there is a need to review design classifications and vocabulary in a changing world. This is particularly important for assisting commerce and industry to grasp the potential provided by professional design. This is general requirement but it is especially important for questions posed for design and industry by products that are fundamentally 'non-material' because their design processes are not well understood. For the design professions, this is becoming as important as the issues relating to material products for manufacture. One of the

challenges for design practice, research and education is to bridge the conceptual barriers of several usually separate disciplines involved with dynamic form.

Design Responsibility.

On a final note 4D Design could challenge the ethics of design and its management. Responsive and adaptable behaviour in the natural world, such as is found in the botanical systems from our gardens to the planets rain forests, ensures efficient use of energy and resources. New control technologies can also make material artifacts more efficient too, but imagine millions of animatronic consumer products made possible by low cost mechatronic and microchip technologies. Such 'real' 4D designs would increase humankind's use of energy because movement of physical components is central their dynamic form. This may well significantly increase the probability of global warming and be a devastating blow to the natural environment, and ultimately threaten our own survival. It is difficult to see how the development of consumer products will not take this route.

However many 4D designs could be beneficial for the natural environment. An international economy increasingly built upon the consumption of well designed non-material products, where the technologies include 'people' as well as software and cultural ideas, has obvious environmental and material resource benefits.

This position paper is a tentative step to more rigorous consideration of the ideas, concepts and terms used. It asserts that 4D Design will help to create the much needed new opportunities for wealth generation and a way forward to enrich the quality of life being sought . It presents challenges for design research, design practice and design education. Time will tell whether the notion of 4D Design as outlined here, will bring a breath of fresh air into the academic debate within design, professional practice , design research and design education.

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