Chance would be a fine thing: Digitally Driven Practice-based Research at Huddersfield
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Introduction

Emerging software based processes are challenging the role of the maker as author as well as introducing new areas of practice. Recent developments in digital art and design at the School of Design Technology, University of Huddersfield have included two areas covering the application of digital techniques to the process of making in very different contexts: Product Design and manufacture; and Visual Arts. Much of this work represents a convergence of art and science, of aesthetics and technology, of process and production.

These developments have emerged from two programmes of practice-based research at the University and at the Digital Research Unit at The Media Centre, Huddersfield. The first of these is the Designer in Residence programme based in the Design Department, which aims to employ professional designers in order to embed practice-based research activity into the department's delivery of 3D design pathways. In the second of these, the Department of Architecture has been working with the Digital Research Unit to deliver a dynamic and challenging range of work from artists at the forefront of digital media practice, bringing new ideas and working practices to the fore. Together, these programmes bridge academia, commercial R&D and the cultural and creative industries.

Though they utilise very different approaches, the projects are connected in the ways in which they explore the role of chance, of unforeseen elements in the production of the 'finished' work. In a research context, the accidental, the random and even the unaware as contributory constituents are considered as aspects which have considerable impact on the definitions, roles and expectations of the author, the mediating technology and the consumer within the creative process. Aspects of 'control' over the results of creative endeavour which are normally taken as a given are here questioned and ownership of the process debated. As high level pieces of original practice-based research such uncertainty is understandably problematic.

Through the presentation of two case studies, this paper will explore the implications of these approaches to making. The first of these case studies is the 'Future Factories' project by the designer Lionel Theodore Dean, which explores the creation, selection and digital manufacture of randomly generated computer models to produce finished physical artefacts via rapid prototyping technologies. The second case study is the 'QQQ' commission by the artist and programmer Tom Betts, which is an interactive installation constructed from the code of the graphics engine for the computer game 'Quake', modified using generative programming techniques. The two case studies will then be analysed through the perspective of the writings of Alfred Jarry, with particular respect to his notion of 'Pataphysics' and the writings on chance and play of Paul Virilio, in order to highlight how both projects utilise real-time networked technologies in their final manifestation. The case studies also contextualise the shifting relationships between the maker, software techniques and the participation of the audience or consumer in playful and game-like processes in the production of the finished environment or artefact.

'Future Factories'

Lionel Theodore Dean is a designer and engineer working in the fields of transport and product design, and worked for Pininfarina in Italy before setting up as a design consultant in the UK in 1990. His product work has mainly been in the area of domestic interior products, exploring in particular the boundaries between art and design. His work has won a number of international design awards, and a number of his designs are in commercial production.

During 2002, Dean was employed as a designer in residence in the Design Department of the School of Design Technology at the University of Huddersfield. Departmental research monies were set aside to fund two positions to enhance the environment in which undergraduates were working, and to develop the research culture in practice-based areas of study – one of these was a designer in residence to work alongside students on the Product Design and Transport Design courses, and the other was an artist in residence to work alongside Fine Art students. The aim was for the residencies to provide an example of professionals working in creative industries on a real-time basis – students would see the pace of the project work being carried out, the amount of work

produced, the planning involved and approach to problem anticipation and solving undertaken by a professional practitioner. Their work would be disseminated in an informal way, through day to day exposure and observation, and on a more formal basis by regular seminars and presentations to disseminate the work and provoke discussion.

For the design residency, Dean proposed working on an embryonic project to design and produce finished artefacts through direct digital manufacture, with an element of random variance in the designs being introduced by the computer applying a mathematical algorithm to a 3D solid model.

The project 'Future Factories' (FF) is an exploration of the possibilities for flexibility in the manufacture of artefacts inherent in digitally driven production techniques. To date, the focus has been on the layer additive manufacturing techniques referred to as Rapid Prototyping (RP). Basically, this project proposes a move beyond that of mass customisation, towards a system of individualised production – in which a number of random values of variance are introduced by the computer to elements of the design within parameter envelopes defined by the designer. Each unique artefact physically produced will be a one-off variant of an organic design that has been defined by the designer and maintained in a constant state of metamorphosis by computer software.
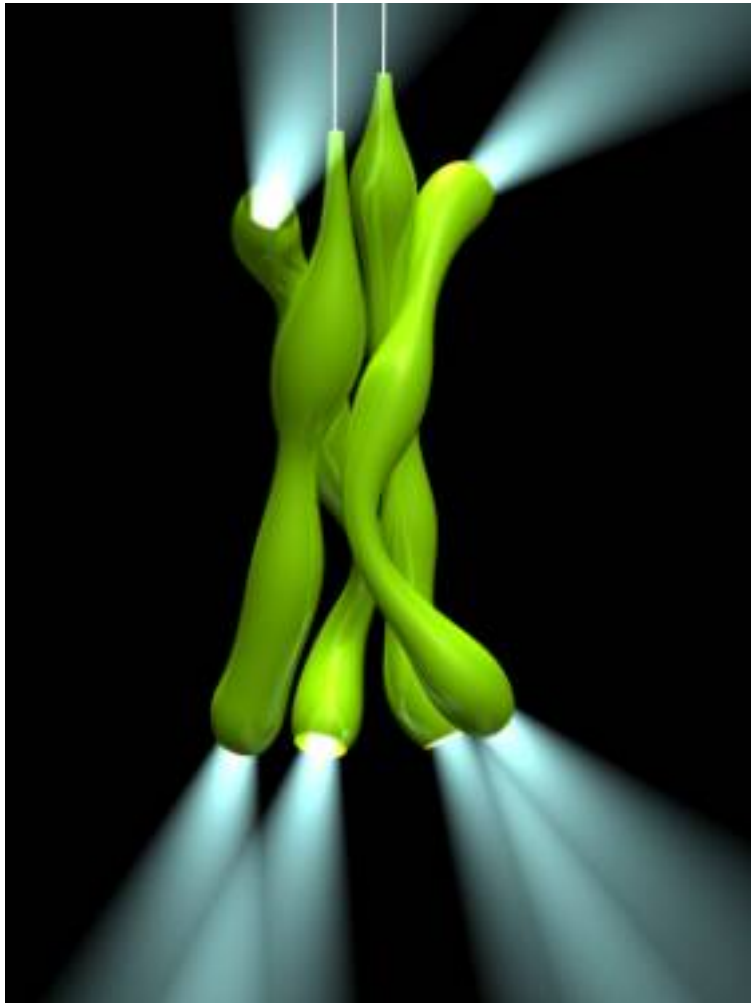
Fig 1: 'Tuber' luminaire – CTRL + click to play movie

The variance may be over a number of different aspects including, for example, the relative positioning of features, relative scale of features, proportions, surface texture, pattern, colour, and materials and so on. These variable factors may be multiple and interrelated. The intention is to achieve subtle differences in aesthetics based on a central theme rather than the mere differentiation of the kind achieved by mass customisation. This random variance is intended to parallel the lack of uniformity in craft production techniques where the craftsperson is led by a design intent rather than tightly controlled specification. By doing so, FF overcomes the split between technology and art, and between individual creativity and repetitive machine reproduction.

The FF approach is not the same thing as 'Mass Customization', which can be defined as a 'process through which mass-market goods and services are individualised to satisfy a very specific

customer need at an affordable price. Based on the public's growing desire for product personalisation, it serves as the ultimate combination of "custom made" and "mass produced"' (Fu 2002: 44). The term 'Mass Customization was coined by Stan Davies in his book Future Perfect (Davies 1987). The term is deliberately paradoxical. There are many different models for mass customization suiting different products and market sectors. They are however, all consumer driven, and the key to mass customization remains modularisation and configuration. 'Products are "decomposed" into modular components or subsystems that can be recombined to more nearly satisfy consumer needs.' (Crayton 2001: 78). This may be through a combination of options as in cosmetic customization, in which the consumer selects from a potentially extensive but finite range of colours and finishes. Alternatively the consumers may provide data on personal preferences or accurate measurements of body parts to enable the production of a 'tailor made' product. Consequently, examples of mass customized products range from genuine medical 'needs' such as perfectly fitting hearing aids (Fu 2002) to desired product differentiation in a kitchen stove or better-fitting bespoke jeans (Marsh 1997).

In contrast, the FF model derives no input from the consumer. Where mass customization consists of consumer selection and specification, FF allows the consumer only to select the moment at which the process of form generation is arrested. Each artefact produced is therefore a one-off realization of the designer's formula. It is the automated one-off production of an ever changing organic design.

The creation of computer generated form is obviously not physically constrained (http://www.artworks.co.uk). The adaptation of these forms into functional products, though, requires stricter control in order to ensure functionality. Advances in computer aided design have brought a shift to parametric solutions as a methodology for the definition of three-dimensional computer models. In parametric design, relationships between the degrees of freedom of a model, instead of the degrees of freedom themselves, are specified. Using parametric design software, designs can be quickly manipulated and alternate solutions considered, simply by changing the variables or parameters that define the product.

The FF designs are defined by 3D parametric models. In these models, ranges are set for certain parameters within which values are assigned at random by the computer. These range limits, along with further interdependent parametric relationships are imposed by the designer to maintain functionality and the desired aesthetic. This leaves an organic model which is free to mutate within a series of interrelated parameter envelopes. Each organic design is defined by a production formula, which can yield an infinite range of equally valid outcomes. Humans are able to categorise objects in nature by the recognition of certain common patterns and proportional relationships in spite of significant variance. FF aims to achieve this same balance between order and chaos, between manufactured uniformity and individual sensibilities. It aims to develop a system for the automated production of one-off outcomes that are at once distinctly individual and at the same time of a recognizable design.

Two fundamental approaches to the concept of product variance in the FF model have been identified in the work to date; manipulation of the core 3D form and the application to the core 3D form of a variable feature.

As an example of the first approach, a three-legged candlestick was designed, (fig 2) having a series of functional requirements – to stand upright and support three candlesticks of a fixed size. The candlestick's footprint is fixed, the legs being evenly spaced and at a fixed separation, for stability. The tops of the legs are also constrained but not fully. Each top is required to remain in the same radial plane as a foot, again for stability. The height of each leg may vary, separately, between a maximum and a minimum value. A relationship is applied to ensure an even spread of heights between the legs. This relationship prevents an outcome with two legs close to maximum height and one close to the minimum, or the reverse scenario. The only constraints on the form of the legs between top and bottom are the degree of interference required for a joint to be made, and that the legs spiral in the same sense and in a smooth curve.

Fig 2: 'Twist' candlestick – CTRL + [click to play movie](#)

As an example of the second approach, a light fitting was designed which took the existing form of a light bulb, but with a solid metal body. Instead, the light source is a series of high intensity white Light Emitting Diodes (LED's) mounted in the ends of 'tentacles' which appear to grow at random from the bulb form. The end of each 'tentacle' is dimensionally constrained to accept an LED and the direction in which the LED points is restricted to certain angles from the vertical (to avoid glare). Three distinct characters of 'tentacle' have been designed;

'Drops' form like stalactites on the lower half of the bulb tapering as they 'grow' downwards as if under gravity.

'Tentacles' form like drops from the lower half of the bulb, these however are able to resist gravity to an extent, they have a tendency to curl and coil.

'Risers' form like stalagmites rising from the upper half of the bulb. As they rise they lean out from the bulb body and begin to curl under gravity.

These 'Tentacle' types appear in varying proportion and random positions over the bulb form. Each can then vary in form based on its type.

In FF, a production system is envisaged in which the consumer is presented with a 3D digital model of the artefact via a website. The consumer may access the website directly or through a sales outlet, at a gallery or in a department store for example. The web site, the 'Future Factory' itself, would have a series of 'production lines' corresponding to different products. When a particular production line is selected the user is presented with a computer generated animation showing that particular product design in metamorphosis within a parameter envelope specified by the designer. At any given point the consumer may freeze the animation creating a one-off design on screen. Should the consumer wish they might then proceed with an order, in which case the relevant digital production files (stl etc.) would be generated automatically and sent to the relevant RP production facility. The artefact, a one-off piece of design, will then be manufactured using layer additive manufacturing (rapid prototyping) techniques. This may be achieved directly, via laser sintering in a suitable material for example, or indirectly via the production of a single use tool or pattern. It should be pointed out that the intention is not for the consumer to use the animation to adjust design features to their liking. The animation is changing in real time and is outside their control (this would hopefully be part of the allure). A variant can be 'designed' for them but not by them, and they can choose to order it or not.

To add to this allure of one-off products, there are a number of ways in which the 'value' of the artefacts produced might be increased. An element of exclusivity can be introduced for customers such as corporate buyers, for whom specific commissions could be undertaken and unique design formulas produced. They could then order as many of the objects (such as light fittings for a particular chain of restaurants) as they required, secure in the knowledge that each product would be unique in itself as well as the design formula being unique to them.

Alternatively, the production of designs can automatically be 'capped' to a specified quantity as is the case, for example, with limited edition screen prints, with a numbered system being used to show how many have been produced, and how many opportunities to own a one-off variant of a particular design are left. Another option is not to cap the quantity, but to limit the amount of time for which any particular product will be produced.

Perhaps the most interesting possibility for increasing value is to employ the model of a single line of 'evolutionary' development in which a design is created, adapted and finished over a specified time span. Imagine a simple design being created for production for a period of, say, six months. Over that period, the design might become more and more complex, more organic, or more convoluted in form until it reached the end of its 'growth' pattern when it would no longer be able to be turned into a real object. At any point during that period, customers could view how the object started out and how it has developed since its inception. They could have the option of purchasing the object at that point (but not be able to purchase any of the forms from a previous time), or anticipate, like gamblers playing a game of chance, how the design might look in a month, when they might return and purchase it. They might plan to purchase a range of objects from a number of different points in its existence, or vectors along the animated production line. It is possible that 'early' incarnations of the design could become more valuable than later ones (as with limited edition screenprints having lower imprint numbers). The possible combinations of ways in which the process could be employed are potentially huge and are currently forming the basis of a funded attempt to commercialise the technology developed.

QQQ

Tom Betts is an artist, programmer, designer, composer, musician and performer practising in the field of digital and interactive media. His more recent activities include an electronic score for contemporary dance, audio to visual interfaces and tools using generative programming techniques, a seven track EP of his generative electronic music, and a publishing deal with EMI for his pop band, Weevil.

During 2002, Betts was commissioned by The Design Research

Unit (DRU) based at The Media Centre in Huddersfield and under the curatorial direction of Tom Holley, Creative Director of The Media Centre. The DRU has been developed through key partnerships with Yorkshire Arts, The Arts Council of England, European Regional Development Funds and the University of Huddersfield. The ambitious creative programme consists of three core strands; DRU Commissions, DRU Research Programme and DRU Residency Programme. Through these, the DRU aims to initiate, support and disseminate creative research and production activities in digital, interactive, and network media across Yorkshire and beyond, linking artists, researchers, academics, creative networks and commercial enterprises. The DRU delivers a dynamic and challenging range of work from artists at the forefront of digital media practice.

For the DRU Commission Betts created an interactive installation, 'QQQ', which was launched in October 2002 at the Evolution Festival in Leeds, and by its nature is a continuing work in progress. The project is based on the expanding cultural practice of game modification, in which the software applications that gamers use are modified in order to warp the users' experience in innovative and unexpected ways. By modifying the code of the graphics engine the work subverts the function of the application.

In the work, the digital arenas of the game 'Quake' are manipulated using generative programming techniques to produce abstract architectural forms; players paint afterimage trails and motion smears. Real-time gaming sessions are re-presented in a different cultural context, while remote online gamers act as invisible 'performers'. Contextually shifted, their actions and interactions are transformed into a participatory live art performance.

'QQQ' is an ambitious project, working with cutting edge technology and contemporary gaming culture. The work has developed from a series of game modifications that span the history of computer game development itself. Ever since the first home computers played host to primitive games there has been a culture of modification. In many cases the aim of this manipulation is cheating (the infamous POKE commands of the 8bit era), but for some people the ability to modify or hack a game meant the opportunity to expand it's horizons, to allow greater and more abstract possibilities into the code.

The history of hacking and modification is a dual one, attracting both glamour and derision. However the recent growth of open source projects and the success of Linux and other open systems has led software manufactures to rethink their approach to modifications. In fact, many games manufacturers now openly encourage modifications, providing free tools and incorporating successful alterations into the next generation of their software. Observing the development of games and game modifications reveals not only the technical but also the social progress of games and gaming culture. A prior series of hacks by the artist, titled 'Q' and 'QQ' demonstrate the movement from low-res solo player games to visually complex multiplayer experiences:

Q and QQ use a combination of code rewrites and resource edits, to enable the user of a game to become its programmer, rebuilding the game in their own image. With the current obsession of VJ culture it is surprising that little game-engine software is used outside of the sphere of PC gaming. Similarly much of contemporary design practice draws from video game culture and hack/glitch aesthetics. Q explored the demo mode which would re-work a predetermined sequence, constantly replaying this score live and generated in real-time.

'QQQ' exploits these aesthetic trends, and infuses them with an autonomous, generative aspect. The modified engine creates a continuous stream of glitched images and abstracted video sequences. The constant modulation of the digital landscape, coupled with the 24/7 interaction of online players creates an environment in flux, with no end or beginning (both projects can be viewed at http://www.nullpointer.co.uk).

Fig 3: QQQ Installation – CTRL + click to play movie

As an installation, a 1960's cinema, unused and semi-derelict since 1980, provides a unique venue for QQQ - a blacked out environment where the abstracted death matches hover in the space where the old screen once was. The endless audio crunch of gunshots and footsteps echoes around the empty space. Users can interact with a modified keyboard, stripped of all function except the ability to direct the action.

Analysis
Interaction in both FF and QQQ is interaction with a process of generative production dependent on chance operations. Through the network, participants (a single consumer in FF and multiple players or combatants in QQQ) become actively engaged in the production of the work. In QQQ this is used as an aspect of the generative system where the chance operations of unwitting participants playing an otherwise 'normal' fragfest in a Quake team arena scenario provide an unpredictable element to the otherwise procedural code. In FF a direct connection is made between playful desires and the will to take risks through predictive forecasting, as well as connecting with dominant modes of capitalist production via the technologies, if not the processes, of mass production. FF is not mass customisation, the mode of production is craft placed momentarily in the hands of the

consumer, temporarily liberating them by engaging them in a culture of chance, variability, selection and playfulness.

In this section of the paper we will compare chance operations with reference to 'Pataphysics' and discuss game modification and generative systems as the production of solutions to imaginary problems. The posing of imaginary problems as a strategy for developing infinite solutions is proposed here as an aspect of game modification in QQQ and intervention in generative structures in FF- as an extension of game play – and (surrealist) games of chance as a means of developing a conceptual framework for such inter-authorship.

"Pataphysics is the science of that which is superinduced upon metaphysics, whether within or beyond the latter's limitation.... Pataphysics will examine the laws governing exceptions and will explain the universe supplementary to this one; or, less ambitiously, will describe a universe that can be—and perhaps should be—envisaged in the place of the traditional one.... Pataphysics is the science of imaginary solutions, which symbolically attributes the properties of objects, described by their virtuality, to their lineaments." (Shattuck & Tayler 1965: 192-93).

The written instructions or code that is used by Betts as he modifies the Quake universe to present QQQ and the generative algorithms of FF can be described in Pataphysical terms as a "…universe that can be - and perhaps should be - envisaged in place of the traditional one, since the laws of physics that are supposed to have been discovered in the traditional universe are also correlations of exceptions, albeit more frequent ones, but in any case accidental data which, reduced to the status of unexceptional exceptions, possess no longer even the virtue of originality" (Taylor 1996)
Alfred Jarry is the founder of Pataphysics and is associated with the development of the Theatre of the Absurd. Jarry links the 19th and 20th century avant-garde, particularly decadence and surrealism.
Pataphysical practice has links with the surrealist preoccupation with games and chance operations, including objective chance or the certainty hazard and Exquisite Corpse - a game-based process of inter-authorship.

"The Exquisite Corpse game … can be both initiatory and

exploratory, both inspiring and clarifying, both relaxing and stimulating. And when one adds to this mixture the notion of the observer, the functions multiply geometrically…[It is a] game of folded paper which consists of having several people compose a phrase or drawing collectively, none of the participants having any idea of the nature of the preceding contribution or contributions. The now classical example, which gave its name to the game, is the first sentence obtained in this manner: The exquisite—corpse—shall drink—the young—wine." (Breton and Eluard, 1938)

The consumer in FF is participant in the development of the FF 'exquisite corpse' of objects which in this case consist not of folded paper but folded surfaces composed by Dean and arranged by the generative algorithm. Both FF and QQQ involve players in games.

"I believe that alongside those addicted to chance, to roulette, to cards, to any game, a new kind of addict is being born: the addict of the virtual…Those who are addicted to card games or the roulette table always end up playing Russian roulette. Games and death, games and accidents are related. When you play at chance, you are compelled to play and thus no longer free to play; a physical and mental death occurs. Now video games, or the more sophisticated games of tomorrow's virtual reality, will induce this same desire for death. A desire to cross the boundary…" (Virilio, 1998)

For Betts, as with Virilio, the image is a weapon, the war zone of the quake arena is turned into a game "…with the same image repeated over and over; a weapon hitting its target. That image is still very present." (Virilio, 1998). In QQQ that smudge is the opponent's body fat on the surface of the screen, that smear is your blood on the camera.

Betts, like Jarry, is fascinated by the possibilities of spectacle and relatively uninterested in narrative, dialogue or character development…QQQ as an installation takes the 'narrative' of Quake (demons will kill you - kill anything that moves or be fragged) as an essentially monitor-based experience in the 'first person' to a spectacular scale of expanded cinematic proportion. In QQQ the narrative in the game is "…the visual rather than descriptive simulation of a voyage (along tracks, through a labyrinth, through a tunnel) that moves you. Thus the simulation becomes the new novel, the virtual journey replaces the poetic

quality of the story… the new player is also a traveller …but now the travellers are travelled; dreamers are dreamed. They are no longer free to move about, they are travelled by the programme. They are no longer free to dream, they are dreamed by the programme." (Virilio, 1998)

In FF the simulation is a narrative of production, thus the simulation becomes the real, and the virtual process succeeds the poetic of materialist production and its accepted norms of designer- manufacturer- consumer relations. Both FF and QQQ as situations are Pataphysical games opening up the metaphysics of game play and opening up the physics of the game engine or the generative score onto the world.

The observer or participant in QQQ operates at the level not of a disinterested observer but as both an unwitting participant and active participant in the production of the spectacle. It is not passivity and absence that creates QQQ as spectacle but the networked participation of players as unwitting participants in a game of chance – it is from this that the generative structure emerges rather than some computational approximation of randomness.

"If you let a coin fall and it falls, the next time it is just by an infinite coincidence that it will fall again in the same way, hundreds of coins on other hands will follow this pattern in an infinitely unimaginable fashion" (http://en2.wikipedia.org/wiki/Alfred_Jarry last accessed 23.01.04)

It is thus not only the heads or tails, off or on, decision in the throw of the coin, but the trajectory of the coins path - the players' trajectories through the virtual environment of Quake through which Betts constructs a virtual environment.

Betts' 'exquisite corpse' is not the chance development of a text or drawing, but chance operations within an algorithmic, combinatorial, or modified structure that establishes the parameters of play. It enables participants to construct and explore an exquisite corpse of graphics and sound as smudges and glitches as they roam, run, shoot, maim and kill in real-time.

For Dean the vectors of the coin's tailspin enable the consumer to engage with a plethora of possibilities through chance decisions

that ultimately capture a particular moment, through which a unique object is cast out from a virtual environment into the real world.

Conclusions

It is clear that both 'Future Factories' and QQQ are examples of emerging and converging technologies and new practices which are combining to form a new position for the maker and author as the source of the final artwork. Selected and manufactured 'Future Factories' pieces may bear only a passing resemblance to the initial concepts imagined by Dean. The random interaction of multiple parameter envelopes and the use of direct digital manufacture free the designer from the detailed specification and inspection of tools and prototype samples normally associated with the production of functional artefacts. The designer may not, in fact, even be aware of products selected and produced in his name. The QQQ virtual environment is equally fluid in its authorship. There is no fixed, recorded 'original' piece carrying Betts' approval; only a realtime interaction with a continuous phenomenon, which by its nature can never be repeated. In both cases, the combination of mathematical algorithms and autonomous production processes potentially isolate the author from the outcome, and leaves hanging questions of responsibility and ownership.

These constantly shifting relationships between the author and receiver, in particular the inclusion of the audience or the consumer in the production itself is a key element here. As a 24 hour web-based experience, the role of the viewer in QQQ is uncontrolled, as access is not restricted in time or space. Moreover, the role of the participant is not only unrestricted, but unstaged, unplanned, and carried out in complete ignorance of the fact they are being observed as art. In the 'freezing' of morphing objects in 'Future Factories' the customer selecting forms can also contribute to future developments. Analysis of data retrieved from the FF website will enable the preferences for the amount of 'deformation' from a base design to be measured. Certain design formulas may show selection curves with a flat response indicating the purchase of a wide spread of forms, in which case future parameter envelopes may be stretched further. Other design formulas may return selection curves showing marked peaks in

popularity with no activity at the extremes of deformation, in which case parameter envelopes may be more tightly focused. This fluctuation of parameter envelopes could even be added as an automated, self-reflexive response to customer interaction with the 'Future Factories' process.

Finally, the use of software processes and real-time networks as generative tools force not only the questioning of transient boundaries, but also the relevance or irrelevance of conventional definitions and the accepted nature of the roles, practices, techniques and processes involved. It is clear that the outcomes of these new models of creative production cannot be thought of as traditionally conceived pieces. They are, without doubt, art. Outside of that, definitions convey little of the reality of their production. 'Future Factories' products are not 'craft' as they are machine produced. They are not mass-produced, as they are all unique and produced to order. They are not mass-customised by consumers or designed by the designer, as their form is randomly generated by computer. Similarly, viewers of QQQ see an original piece of work, but like FF, its definition is complex. The visual imagery is produced by a customised graphics engine, and it is randomly variable, due to the unknowing participants closely involved in the production of the piece. Together, the outcomes of FF and QQQ shift boundaries as they lie in some new, as yet unspecified arena of production.

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