Andy McDonald

BeastiesLAB: A Case Study on the Co-Creation of Digitally Printed Textile Products

Introduction

The ongoing financial crisis has not only revealed the weaknesses of the banking system but also undermined public confidence in the capitalist ideology. At the same time, public awareness of climate change is exposing the damage caused by the cycle of mass production and mass consumption that fuels free market capitalism. Disillusioned with appropriation of material culture by celebrity endorsed brands, people are striving for greater authenticity in their lives (Boyle 2004; Gilmore & Pine 2007). This combination of economic and environmental factors presents craft with a tremendous opportunity to lead society towards a more sustainable future however, in order to embrace this future, the craft movement must resolve to engage with technology - the computer cannot be viewed as a threat to creativity in the same way the machine was (Sennett 2008).

This paper presents a case study of the BeastiesLAB project - a collaboration between Timorous Beasties [TB] (a surface design partnership creating high-end printed products for the interiors market) and the Centre for Advanced Textiles [CAT] at the Glasgow School of Art (a research centre specialising in digital textile printing). The project was funded by the UK Technology Strategy Board through the 'Creative Industries: Exploiting Digital Technology' scheme. As an experiment in co-creation, the purpose of this feasibility study was to investigate the commercial implications and creative opportunities enabled by digital technologies through the development of a dynamic and flexible production model based on the principles of craft rather than those of fashion. Using innovative production methods being pioneered at CAT, the project involved the development of an interactive retail environment that engages customers with the design process through the use of rich interface / interaction technologies - we termed this 'the kinetic design experience'.

Methods & Approach

Prior to submitting the funding proposal, the first task for the CAT research team was to evaluate the existing production model used by TB through a series of conversations with Paul Simmons and Ali McCauley, the designers and owners. The potential benefits of co-creation as an alternative strategy where then introduced. Although the flexibility of an on-demand approach brings the promise of more efficient production, it was the creative freedom that ultimately drove discussions. This dialogue yielded a number of key insights that shaped the funding proposal. In particular, we recognised that the core value of the TB 'brand' lies in a distinctive aesthetic that juxtaposes contemporary (often controversial) imagery with a traditional style of illustration.

With funding in place, the initial phase of the project involved visual observation and analysis. In order to understand how designs progress from concept to product, Paul & Ali were asked to guide researchers through their typical design process. Examples of their finished work were then studied to determine how the static imagery might be translated into dynamic content. From this a number of simple concepts were developed by researchers to demonstrate various levels of interactivity and provide a stimulus for the iterative cycle of prototyping, testing, discussion and refinement of ideas that ensued. A functional version of the system was then piloted with a small number of people before being demonstrated at an preview event held at the Glasgow showroom.

This preliminary feedback is currently being used to further enhance the system ahead of more comprehensive user testing with customers in order to gauge their attitudes towards co-creation. Given the exploratory nature of the research, it is felt that assessing the potential of co-creation from the perspective of the designer will actually be of greater significance. This will be done by comparing conversations recorded throughout the project in order to see how Paul & Ali's opinions might have changed as a result of their participation in the project.

The Existing Production Model

For the most part, design and manufacturing takes place at their Glasgow studio with retail being split between showrooms in Glasgow and London (as well as a selection of stockists worldwide). The company also has a website but cannot take orders online. Like many practitioners, TB pursue a dual approach that combines retail activities (i.e. products) with bespoke commissions (i.e. services). From the outset, the intention of this project was to establish a hybrid model that mixes elements of both strategies.

Paul & Ali typically create their imagery by first tracing objects from photographs; progressively adding layers of detail to the original silhouette (as necessary). Using a scanner, these individual drawings are then converted into digital format and saved on the computer. The designers maintain a bank of graphic assets by using a specific folder structure to organise the image files into thematic collections (e.g. people, plants, buildings, etc). Adobe Photoshop is used to combine these basic elements and arrange them into more complex groupings that are themselves saved and re-combined to form the overall print design. Once the final composition has been agreed, screens are prepared for each colour within the design.

The screen-printing process is done along a thirty metre table within the studio and follows a very precise procedure that requires careful calibration of the screen position relative to the substrate. Whilst wallpapers and fabrics can be packaged on-site, products requiring assembly are sent to a local company to be sewn in batches.

The retail showrooms (Glasgow and London) are usually staffed by one person and stock a limited selection of TB products (a larger stock is held at the studio). With limited space, the shops are not able to maintain an inventory of every combination of product, print and colourway therefore swatch books are used to indicate what other options are available. By providing customers with the opportunity to actually touch the product, they can appreciate how it feels and also get an accurate sense of the colours and the scale of the print - qualities that are very difficult to express through the website.

Commercial / Creative Limitations

From a commercial perspective, the limitations of this design-make-sell approach stem from the build-to-stock nature of their production model. Since products are manufactured before they are sold, production takes place on a speculative basis. As such, this supply must be matched with the demand they anticipate. Consider the selection of colourways. Whilst the task of choosing appropriate colour combinations is clearly a design decision, determining what volumes / percentages to manufacture of each colourway is perhaps moving into the realm of merchandising.

To illustrate the impact of any forecasting errors, imagine a scenario where three colourways have been created for a given design: red, blue and green. Of the one hundred cushions to be manufactured, let us assume sixty were red, thirty were blue and just ten were green. Now suppose the green cushions happen to be the most popular, selling out within the first week. Although less desirable, some customers who actually would have preferred green end up settling for the red; eventually selling out within 6 weeks. The blue however, is not popular at all - even after being marked-down, just ten are sold in twelve weeks.

This simple scenario highlights a number of problems that arise when supply and demand are not balanced. On the surface, the company is left with blue cushions that must be discounted. Once out-of-stock, sales of green cushions may have been lost whilst some owners of red cushions were not fully satisfied.

Viewed in terms of cash-flow however, the problems go much deeper. Let us imagine that each cushion costs £20 to make and is sold for £50. Before any cushions can be sold, the company has already spent £2,000 - a debt that will not be recouped until forty cushions have been purchased. From our example, the company does not break even until around week six and makes a return of less than £300 after twelve weeks (once the mark-down on blue cushions is taken into account).

With cash-flow regularly being cited amongst the top reasons why any small business fails, manufacturers and retailers are particularly susceptible to these risks due to the costs involved in producing stock. Indeed, our simplistic example only deals with a few variables. What if another colourway is added? Do cushions come in different sizes? Might there be other products? What about other designs? How do you split the stock between multiple locations? Predicting demand becomes even more difficult as the complexity of the product range grows; further compounding these risks.

So far, the discussion has focused primarily on the economic limitations of the build-to-stock production model, unfortunately this reflects the reality of current market conditions - regardless of how talented a designer might be, unless they are highly skilled at merchandising, marketing and accounting, their business is not likely to survive. The problem for TB (and many other practitioners) is that despite their size, they are still subject to the economics of scarcity on which the mass production paradigm is founded. Next, we shall examine the same issues from a creative perspective.

Returning to the example discussed in the previous section, the logistical limitations involved in managing complexity ultimately impact on creativity. Essentially, there is an incentive to reduce variation (another defining feature of mass production) that manifests in decisions that are based not on design thinking but economic reasoning.

Whilst this pressure is certainly evident, over time TB have become adept at mitigating these risks by learning to balance the relationship between supply and demand - this is probably due to the fact that manufacturing is largely under their own control.

What cannot be avoided are the limitations imposed by the process of screen-printing insofar as, once screens have been prepared, the design is fixed (a feature of casting / forming techniques across many craft disciplines). In the section that summarised the existing production model, the workflow used to design the artwork was described. Although somewhat haphazard at times, this modular approach offers the potential for a multitude of compositions to be explored through the grouping, nesting, scaling and arrangement of motifs. Unfortunately, the costs associated with exposing photo-emulsion screens (in terms of both materials and labour) are prohibitively expensive thereby limiting the number of compositions that can actually make it to print. From the customers point of view, this means that all instances of a given design are identical (again, a characteristic of mass production).

In assessing the overall production model, all of these restrictions are a function of analog technology - a situation where the choice of manufacturing methods dictates the use of a build-to-stock approach that inherently resists complexity and creativity. Above all, the existing model is both rigid and static in spite of (not because of) the incredible talent and imagination of its designers.

The Research Brief

Having described many of the weaknesses of the current model, the primary objective of the research would be to develop an alternative production model that is flexible and dynamic. In doing so, the project brief was not to address the problems caused by analog technologies but rather, to exploit the opportunities enabled by digital technologies. The research team understood this to mean a rejection of the industrial principles of mass production in favour of a return to the values of craft whereby each product was the result of a creative exchange between designers and customers.

In response to the status quo, two fundamental changes would be made. Firstly, screen-printing would be replaced by digital (textile) printing as the manufacturing method used. With no setup required, digital printing represents an on-demand process whereby the impact of variation is eliminated. From a financial perspective, it costs no more or less to print one hundred metres of the same design or of one hundred different designs. It is also much faster and typically requires less manual labour and less space. Whilst the difference in cost is dependent on volume / variation; the environmental benefits are very clear with digital printing using less water and electricity as well as resulting in less wasted fabric and ink.

Once again, the economic and environmental benefits are certainly welcome however, the true potential of digital printing can only been seen by considering the creative possibilities. The most obvious difference lies in the use of colour; designs can incorporate millions of colours (allowing for gradients and photographic effects) rather than being limited to a few solid shades. More generally, since every design can be different, designers are free to print multiple compositions of a given design, in multiple colourways, across multiple products - this reflects the way Paul & Ali already design. Essentially, the extreme flexibility of digital print encourages creativity by enabling decisions to be made on the basis of design considerations rather than manufacturing concerns.

All this creative freedom inevitably leads to a problem: increased complexity. As we have seen, being able to design and manufacture dozens of combinations of print / product is one thing; being able to predict exactly what combinations customers will actually purchase, and in what quantities is quite another. In order to resolve the dilemma of supply & demand, the second fundamental change is to switch from a build-to-stock approach to a build-to-order one.

By only manufacturing products once they have been purchased, the sequence of design-make-sell becomes design-sell-make. The effect of this can be seen by returning once more to our simple example involving the cushions. With every cushion being made on demand, the company does not need to commit to any particular mix of colours in advance, every customer who wants a green cushion can have one. Likewise, if no-one wants to buy a blue cushion then no blue cushions will be made. Responding to demand instead of trying to predict it immediately saves the company £2,000 in up-front manufacturing costs. As a relatively new technology, digital textile printing does tend to be slightly more expensive than screen-printing (depending on volumes) therefore let us assume that each cushion now costs £25 to make but is still sold for £50. After the first cushion is sold, the company is £25 in profit as opposed to £1,970 in debt. What is important about this scenario is not the actual numbers used, but the general structure of the formulas:

Build-to-Stock:	total profit = (units sold x unit price) - (units made x unit cost)
Build-to-Order:	total profit = units sold x (unit price - unit cost)

Given that the profit margin (i.e. unit price - unit cost) is likely to be greater with products that are made on-demand, there will always be a point at which the build-to-stock approach yields more profit however, this will always come after the initial outlay has been recouped. In other words, build-to-stock favours high-volume / low-variation whereas build-to-order is the opposite - which do you think is more suitable for a small business such as TB?

So far, I have made the case that digital printing has the potential to enable greater creativity, but that with this freedom comes increased complexity. In order to minimise the impact of this added complexity, it makes sense for making and selling to swap places within the supply chain. The key word is potential. In order for these changes to be effective, it is vital that this creative potential be maximised. This was to form the central theme for the new production model that was developed.

Before we move on to examine the supply chain that has been developed through this research project, let us firstly consider the following question: What is the nature of retail within an on-demand production model? Until now, the underlying assumption has been that whilst the physical product may not exist, the product specification does. In this sense, retail would involve customers selecting products (by whatever means) from a catalogue of discrete product designs waiting to be manufactured. More flexible, yes... more creative, not really. By bringing designers and customers together, can retail be about more than just selling?

The Development Process

In maximising the creative potential of TB, the brief would be to develop an interactive retail experience that invites customers to engage with TB designs to create their own products through a rich media interface. A design workflow and manufacturing system would also be developed to support this retail experience as part of the overall production model.

To recap, the early stages of the research project entailed observation and analysis whereby I (in my role as developer) set about deconstructing a selection of existing TB imagery in order to determine how best to translate static artwork into dynamic scenes. This exploratory phase involved the use of numerous techniques borrowed from the new media disciplines (e.g. web design, video production, games development) and was about answering the question: how could the visuals be brought to life? For example, a ‘green-screen’ video shoot was set up to capture the movements of human actors to be used as characters within the dynamic scene (a software programme was written to extract the silhouette from the footage). In the future, this capability could be integrated into the retail environment (as opposed to the design workflow) thereby allowing customers to actually become part of the content.

Whilst some graphic elements would be based on pre-existing motifs, it made more sense for other elements to be generated dynamically by code. The advantage is that behaviors are not based on the use of pre-defined animations and therefore, produce different results every time. Deciding what techniques should be applied to which elements is a constant issue when creating interactive content - most actually use a combination of manual and generative techniques.

As the group honed in on a particular concept, that comprised elements of TB’s well-known Toile and Decouper designs, a number of interactive prototypes (coded in the ActionScript 3.0 language using Adobe Flash CS4) were developed to demonstrate behaviors such as plants growing or blood dripping. The discussions triggered by these mock-ups centred around how content-specific interactions could be used to enhance the narrative behind each scene; drawing the customer into the designer’s particular vision or message. Paul & Ali particularly liked the idea of the dynamic scenes incorporating the storytelling devices of films and games.

As the development cycle continued, attention turned towards the customer’s participation. Until this point, the dynamic behavior of the prototypes was ‘hard-coded’ into the software with nothing much in the way of user interaction. Press a button and the script would generate a scene based on a pseudo-random set of variables. Press it again and a different scene is generated according to the same variables but different values. From the beginning, one of the main criteria for the retail interface was that the customer did not feel they were using a computer. It was important ensure the experience was significantly more immersive and compelling than anything that could be achieved through a web browser therefore, the research team was keen to extend the interaction beyond the screen into the physical dimension. In doing so, the next challenge was how to combine the software-driven behaviors

with hardware-driven gestures to further enhance the customer experience. Rather than standard keyboard and mouse, we experimented with a variety of alternative input devices that could be used to navigate/control the scene. As well as making use of the built-in microphone and webcam, these hardware peripherals ranged from off-the-shelf tools including a graphics tablet and Nintendo Wiimote controller, to custom devices built from electronic components such as touch sensors and RFID readers. Throughout this phase of development, it became clear that our ability to drive content-specific behaviors using an expanded set of gesture-based input methods greatly amplified the scope for creativity, both for designers and customers.

Some gestures were used to allow customers to directly manipulate the content, such as flicking the Wiimote like a paintbrush to splatter blood onto the scene whereas others were used as a kind of physical user interface. A good example of the latter was in the selection of colours - instead of displaying a drop down menu showing the available palette, RFID tags were sewn inside fabric swatches allowing the customer to simply swipe the desired colour over the tag reader. These had the added benefit of being calibrated samples of the actual colour / fabric - a tactile preview that would be difficult to represent accurately on-screen.

As development progressed further and a sense of the complete experience began to emerge, discussions focused on determining what limitations should be imposed on the design parameters. This highlights perhaps the most important characteristics of co-creation. Under the existing build-to-stock approach, the role of the designer is to create fixed products that customers can choose to purchase or not. Co-creation is not about giving customers more choice, it is about giving them more control. The question is how much control. In this sense, the designer is not so much creating the final product specification - this is for the customer to decide. Instead, the role of the designer is to define the ‘creative space’ that the customer can explore and play in.

Having bought into the concept from an early stage, Paul & Ali were already prepared to relinquish control over certain aspects of the final outcome. Looking at how their views changed over time is particularly revealing. For example, their initial attitude towards colour was that customers should be able to choose whatever colours they wished. Having witnessed early demonstrations however, Paul & Ali recognised this could result in combinations that do not work well together (regardless of personal taste). This realisation gets to the heart of what co-creation is about - mediating the relationship between the designer’s vision and the customer’s own preferences. To this end, the latter stages of development revolved around the active negotiating degrees of freedom / constraint. In the end, it was decided that the interface be given logic to automatically calculate completmentary colour schemes based on the selection of a single colour. This logic would be programmed to reflect the design rules Paul & Ali use to generate their existing colourways. In some instances, a monochromatic rule would calculate multiple shades of the same colour and apply them accordingly (with respect to shadows and highlights). Other designs might employ a triad rule that ensures adequate spacing and contrast between colours. It might also make sense for the colour of some elements to be fixed - blood spatters might always be red for instance.

Colour is only one of many variables contained within a given composition (or indeed, the product as a whole). I would suggest that the primary skill of a designer in this context, lies in their ability to craft these environments in a way that is sensitive to level of control the customer feels comfortable with whilst preserving the integrity of the original design intent.

The project team has now reached a point where a functional version of the retail interface (and associated production model) can begin to be tested with customers. Preliminary feedback has been very positive and continues to inform and contribute to the ongoing research and development. Of particular interest is the perception of value that co-creation instills in comparison to that which is perpetuated by an increasingly disposable consumer culture. Although pilot testing has only been conducted with a small number of people, early indications support our hypothesis that co-creation enables value to be transferred from the physicality of the object (i.e. the product) to the experience of the subject (i.e. the customer). Consider the value of a photograph; even before the digital storage of images became

ubiquitous, the value of a photograph has never been in the actual paper and ink but in the experience that it represents. My holiday snaps might well be incredibly valuable to me however, I would not expect them to trigger the same emotional connection. In this sense, value could be thought of in terms of a subjective relationship where the product is merely a memento of the experience. It therefore stands to reason that the more enjoyable and compelling the co-creation experience can be made, the stronger the emotional attachment will be.

Discussion

Thinking beyond this particular case study, the emergence of a large number of flexible and dynamic craft practitioners connected to a network of digital fabrication facilities could represent a serious challenge to the handful of large corporations (e.g. Primark, IKEA, Tesco, Zara, etc.) that control the market for clothing, jewellry, ceramics, furniture, etc. This may sound ambitious however, the same could be said of the transformations that have taken place in the media, entertainment and services industries as a result of the digital revolution - think Google, Amazon, Napster, eBay. Advances in manufacturing technology are following the same trajectory as those in computing (Gershenfeld 2005) With products being made locally, the transportation and storage overheads involved in manufacturing in low-wage countries such as China and India would be eliminated. Couple this with the fact that products are only made once they have been purchased, thereby eliminating over-production, and the aggregate environmental benefits would be significant.

Despite from the numerous economic and environmental benefits I have put forward throughout this piece, it is the ability to challenge the popular notion of ‘value for money’ on which the mass production paradigm now rests, that is by far the most sustainable feature of co-creation.

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