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RAPID PRODUCT DESIGN IN THE CURRICULUM - FROM CONCEPT TO INTERACTIVE MODEL IN 24 HOURS

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1. The 24-hour design challenge

The trigger for our 24-hour design challenge was inspired by a student exhibit at an exhibition of university projects at New Designers, an annual exhibition of the very best talent in British Design is held annually at the Business Design Centre, London. New Designers is the best showcase for British design talent and enables employers and retailers to discover the next generation of top designers prior to them becoming household names.

Graduates of the Product Design programmes at the Nottingham Trent University and the University of Wales Institute, Cardiff (UWIC) have established strong reputations for their departments as being among the top providers of Product Design education in Britain. The nature of some of the exhibits was intriguing. There is always the new twist on an old theme – the redesign of a humble household electrical device, somebody's answer to underwater propulsion, or some revolutionary application of solar powered energy.

It was alarming how little was actually achieved over three months despite access to the Internet and its infinite resources of competitor products, market data and imagery; intelligent databases that can reward you with a data sheet of the preferred manufacturing material and process by simply typing in a few basic parameters; state of the art photo-realistic software that spewed out reproductions of a design whilst the designer lies asleep!

The project that most intrigued me was an attempt to redesign the humble peg. What was unusual about this exhibit was that he was not displaying a facsimile model like his peers; he had collaborated with an industrial partner who had commissioned an injection mould tool to produce his design. This really was Pugh's product design process in the flesh.

Despite the shallowness of the project, he had achieved something, which is the Holy Grail of most product design students: a fully manufactured product that had been accepted by one of Britain leading retailers.

But three months to produce a peg! It was at this point, the idea that it should be possible to create and develop a new product in less than 24 hours was spawned.

The essence of the idea is simple: gather together a select group of experienced innovators, designers, engineers, researchers and users; place them in a conducive environment, feed them, water them, provide access to information, allow the creative process to flow, no criticism is allowed, ensure state of the art equipment such as CADCAM and rapid prototyping is available, employ time compression techniques during the development process and you have the ingredients to take an idea from concept to final design specification.

Managing the process in such a restricted amount of time became a challenge in itself. Organising people, rooms, equipment and other resources had to be done in the greatest detail. The day had to be choreographed minute-by-minute, hour-by-hour.
Individuals were invited whose strengths are being able to think blue skies, to diverge, whilst others in the group can manage this cauldron of creativity and identify strong, feasible concepts with tangible benefits and commercial viability.
Undergraduates from each of the Product Design programmes were invited to mix with staff and industrialists to transform functional, verbal descriptors and product attributes into a three-dimensional product aesthetic that we could all understand and evaluate.
Staff and students from Nottingham Trent University worked with PDD, one of the UK's most prestigious product and brand design consultancies, and staff and students from UWIC worked with design engineers from Alloy Limited, one of Britain's leading product design consultancies. Both were invited to bring their wealth of experience and knowledge in product creation, engineering excellence and commercial aspects to the activity.
The National Centre for Product Design, Development and Research (PDR), the commercial arm of the University provided design and technical support during the creative and development stages as well as creating the product in the virtual environment using state of the art CADCAM software. Similarly, the Centre for Design Innovation (CDI) at NTU provided support during the design and development stages at PDD.
PDR's rapid prototyping technique, stereo lithography (SLA) would then used to produce a three dimensional facsimile reproduction of the proposed concept. A range of rapid modelling techniques were employed at PDD.
Risk management had to be considered carefully. We identified a number of areas that could present a risk of failure for the activity including:
Product Related - Whilst we felt that we had to acknowledge that there was a very small risk of the activity failing to produce an output, this risk was acceptable as the assembled teams had a broad knowledge in the conception and development of new products and in the area defined in the brief.
One of the key outputs of this process are the facsimile models. The greatest risk comes from the failure of SLA files, either in their conversion from CADCAM software or from failure of the SLA machines. CADCAM operators from PDD, NTU and PDR, experienced in the design, conversion and operation of SLA prototypes were selected to minimise this risk.
A contingency to build a CNC machined replica was organised. This gave the design teams the opportunity to develop a functioning prototype that would embrace a PowerPoint presentation of the user interface linked to functioning buttons on the model.
Whilst the 24-hour activity now had two teams, we were keen not to turn the event into a competition but to compare and contrast the different techniques employed by the teams in producing their solutions. We were excited by the potential for diverse product solutions from the same brief.

2. The project

The 24 hours was mapped out to provide a tight framework for each activity. Driving the schedule was the decision to employ rapid prototyping techniques for the facsimile model making. Discussions with the teams established that at least six hours needed to be allocated for the production of the actual SLA components. In addition, one hour was allocated for the preparation of SLA machine files from the CADCAM software and five hours of post-production, model finishing, painting and application of graphics. A schedule was drawn up as follows:

08.00 a.m. - Design Brief handover from The Audi Foundation
08.10 a.m. - Creative Problem Solving technique (CPS); De Bono's Six Hats idea evaluation session
08.20 a.m. - Research / interviews with target user group
09.30 a.m. – review of creative processes
10.00 a.m. - Production of concept models in blue foam
10.20 a.m. – group discussion/idea clustering/concept sketches
10.40 a.m. - Review Panel selects preferred idea for development

11.00 a.m. – CAD Design development of selected design
12.00 p.m. – User interface design development commences
16.00 p.m. – Fully modelled version of design available
17.00 p.m. – Preparation starts of SLA machine files
18.00 p.m. – SLA component production commences
22.00 p.m. – Alias presentation boards available
01.00 a.m. – SLA components available for finishing
05.00 a.m. – Completion of product design specification (PDS).
06.00 a.m. – All models complete and user interface tested
08.00 a.m. – Presentation to user target group

With the planned start time of 8.00 a.m. approaching and the creative and development team assembled, an Audi Foundation representative arrived and delivered a sealed envelope containing the design brief.

3. The design brief

'Design a communications device for use by design-aware18 - 25 year olds who are interested in extreme outdoor pursuits including mountain biking and orienteering. Your solution, which will be launched in 2010, should consider their needs, aspirations and advances in materials and technology. Your design should also consider the implications of sustainability, life-cycle engineering and design for disassembly. The product should have a suggested retail-selling price of less than £500.00. The unit may make use of LCD screen technology and membrane keypads. It may also suggest touch screen, voice activated, and touch-sensitive polymers'.

At 08.10 a.m., the development process started with a frenzy of activity. The core teams were split into two groups of seven, one employing the Creative Problem Solving technique for creative brainstorming and idea generation using written descriptors only, whilst the second team embraced De Bono's Six Hats technique to evaluate a range of existing products and perceptions about the proposed product, the target user and the environment.

4. The design process

Ninety minutes had been allocated to complete the Creative Problem Solving session. CPS encapsulates the creative process in 5 steps:

- Preparation
- Question formulation and reformulation
- Idea generation
- Idea Clustering
- Action Planning

Figure 1. CPS word association

Simultaneously, teams were evaluating competitor products and generating a series of related concepts and themes employing De Bono's Six Hats evaluation technique (figure 2) which forces teams to move outside their habitual thinking style to gain a more rounded view of a situation.

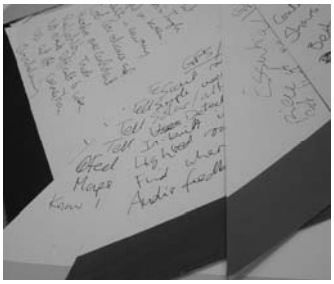

Figure 2. Six hats

After fifty minutes, the initial brief had been reformulated by the CPS team into a new statement which more clearly defined the device. We were now asking the teams to:
'Produce a device that could provide feedback and communication via a core unit with detachable input and output peripherals. Integrated into a sustainable system via an upgradeable, customizable service package, facilitating a virtual community of sports enthusiasts, mentors, coaches and competitors'.
The essence of the concept had been drawn from a number of indicators:
We believed that an opportunity exists to create an intelligent, upgradeable, innovative product for the 'PlayStation Generation' – our target market of extreme sports enthusiasts with 'tribal' instincts seeking risk and fear through physical and mental challenges.
That the device would harness the power of the internet to enable like minded enthusiasts to share experiences.
The target group could access the knowledge of others in order to test their own physical and mental abilities – a communications device that encourages risk taking activity by using technology to minimise potential danger. The device would have the ability to demonstrate the skill level of others by 'ghosting' an image of their experience on top of your real time experience. Single Player mode would capture your time, speed and body functions such as heart rate as you descend and this could be used as a competitive comparison on subsequent descents. Multi Player mode enables downloads of the experience of somebody who has descended this route in the past from a virtual league on the Internet and compare your experience with theirs in real time and then register your experience in a downloadable format on the Internet for in-depth analysis and interaction others to access.
The scope for the concept generation phase was now determined. In less than twenty minutes, a series of ten aesthetic solutions (figures 3 and 4) had been created for the Review Panels to consider. With an 11.00a.m. deadline for final concept selection fast approaching, we selected an aesthetic that we felt embodied the key attributes identified during the brainstorming sessions.

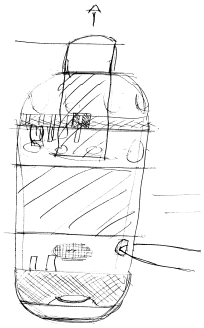

Figure 3. Selected design sketch

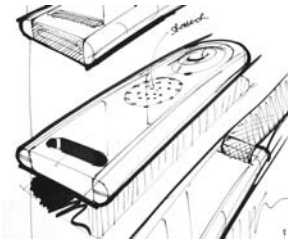

Figure 4. Selected design sketch NTU

The UWIC device needed a robust appearance with a durable, integrated user interface incorporated into a flexible polymer screen. The device would be waterproof, shockproof and accommodate features for fixing to the handlebars of the bike. A forward facing camera would provide real time feedback to the screen and a panic button and transceiver would attract rescue services if required.
The NTU device (fig 4) was based on a two parts – a hand held device and a base station that allowed users to read information left by third parties. It was seen as the equivalent to an electronic post-it note.
Using industry standard CADCAM hardware and software, the final designs (figures 5 and 6) soon took shape in the virtual environment. Designers, engineers and a CAD operator developed the product in real time, recommending appropriate manufacturing processes and design details that would ensure cost effective production and sustainability and commercial success. Anodised aluminium was selected with components exploiting a number of traditional processes including extrusion. For sustainability, it was decided that, as the main unit had longevity, the unit would embrace sustainability by enabling software upgrades rather than changes to the hardware.

Figure 5. Final Design from UWIC

Figure 6. Final Design NTU

In parallel, a team of programmers and designers started development of the graphical user interface (GUI). The Product Design department at UWIC is developing a unique method of merging the capability of Microsoft PowerPoint with facsimile models to demonstrate and evaluate concurrent development processes between the user interface and physical product design. The process uses hardwired buttons with pre-programmed functionality to be embedded into a facsimile model. Users

can evaluate the intuitive nature of the interface as well as provide feedback on the size, position and tactile qualities of the buttons.

5. Conclusion

The conclusion to the 24-hour activity was another unusual twist for the project. Staff presented to focus groups comprising second and final year undergraduates of the Product Design programmes from each institution. They provided feedback from the target user group in relation to, feasibility, acceptability, fitness for purpose and possible future commercial exploitation.

There is little doubt by all those participating in the activity that it was immensely successful and met the outcomes desired. The team of experienced innovators from industry and academia created, developed, produced and specified two new products within the 24 hour time constraint.

The activity was a tremendous example of project planning and management, of skilled individuals working as part of a coordinated team tasked with delivering specific outcomes under significant pressure; of communication between individuals and teams; and of acknowledging the impact of a decision could have on the work of other groups. The process clearly demonstrated that collaboration between academia and industry can work to the benefit of all parties, utilising the cerebral skills of academics, the commercial acumen of leading industrial designers and the state of the art production facilities enjoyed by higher education and associated commercial enterprises.

This was a fantastic illustration of developing realistic, commercial, added value proposals employing time compression techniques. The commercial value of the work undertaken will be disseminated to industry across Britain via a series of similar 24 hour activities designed to meet the needs of small businesses in the manufacturing, technology or service sectors.

The activity will also be disseminated within the Product Design programmes at each University. 24 hour projects are now being planned for student only activities. The opportunity to expand this as a competitive challenge between universities across Britain and Europe is being explored.

Acknowledgements

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