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Rise & Design - The Power of Collaboration: Paxman Scalp Cooling Research

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Rise & Design - The Power of Collaboration: Paxman Scalp Cooling Research
Presentation at Design Network North Symposium

3M Buckley Centre, Huddersfield, 20 Jan 2017

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Introduction to Scalp Cooling

Scalp Cooling is a method used to reduce chemotherapy induced hair loss in cancer patients.

Scalp Cooling can result in a high level of retention or complete hair preservation which improves the patients self-confidence and positivity to their treatment and recovery.

Scalp cooling (the cold cap) can be used with all solid tumour cancers that are treated with chemotherapy drugs such as taxanes, alkylating agents and anthracyclines/DNA intercalating agents. These drugs target rapidly dividing cells and the matrix keratinocytes, which results in hair loss.
Scalp cooling works by inducing vasoconstriction of the blood vessels leading to the scalp, this reduces the blood flow to the hair follicles in the period of peak plasma concentration of the relevant chemotherapy agents.

The University of Huddersfield's Biology department along with Paxman’s previous Knowledge transfer partnership (KTP) associate discovered that scalp temperature plays an important role in cytotoxic protection.
Benefits of Scalp Cooling

The benefits of scalp cooling include:

- Greatly reduced risk of hair loss,
- Preserves self image,
- Allows continued social activities,
- Maintains scalp at a constant temperature,
- Comfortable and pain free,
- High level of patient/clinical tolerance and acceptability.

“Nobody knew I was having chemotherapy unless I chose to tell them.” - Becky

“8% of patients choose not to have chemo because of fear of hair loss.”
Design and Development of Paxman’s Generation 2 Cap
Using available literature and database collected including data bases such as SizeChina and the CAESAR project, the team were able to identify the average head size needed for scanning.

Before designing the tooling concepts the 3D scan was converted into NURB data to give a more accurate head shape to use for the design process.

Several concepts were designed including a 3D printed cap, however the technology to print a cap in one go was not readily available.
Application of Rapid Tooling

Complex channels, grooves and curves were specifically designed for the manufacturing technique silicone sheet forming.

Both Polyamide (Nylon) and Alumide (Aluminium infused nylon) were printed to test the capabilities of the tooling during production.

3D printing allowed the design and development of a complex tool for a much lower cost than traditional tooling, it also decreased the time of receiving the tool dramatically.
Iterations One and Two

**Iteration One**

This used a polyamide tool.
Cost – £2500
This was used to create a prototype, check the fit, size, flow rates and pressure

Problem – Low flow rates, pressure sensitive

**Iteration Two**

This used an alumide tool.
Cost - £2000
Issues identified during manufacture, hot silicone was flowing into the channels creating flow rate issues
Iterations Three and Four

**Iteration Three**

This used an alumide tool.
Cost - £1200
Requested design changes to increase manufacturability,

Currently being tested in Japan

**Iteration Four**

This used an alumide tool.
Cost - £1000
Some manufacturing issues have been identified, so changes have been made for more manufacturing
Benefits of Rapid Tooling

Up to now 10 sets of tools have been printed

Initial two tools were printed in Polyamide, a week to production and delivery time.

All other tools were printed in Alumide costing £1000 - £1500 and taking a week to print.

Traditional tooling would have cost up to £25’000 per set of tools and would have taken 3 – 6 months to arrive.
Limitations of Rapid Tooling

The main challenges the team identified include:

- If print orientation is not specified the print will not warp in the right direction and the tool will not join correctly.

- Limitations in some materials, heat transfer, warping, strength (after heating).

- Bed size limitations, this limits where the tools get printed and how the parts are oriented.

- Bed size limitations, this limits where the tools get printed and how the parts are oriented.
The generation 2 cap shown is the cap developed by Paxman, the University of Huddersfield’s design team and silicone manufacturer Primasil Silicones.

The collaboration between Paxman and the university of Huddersfield has allowed Paxman to gain knowledge in design software and or emerging technologies not commonly available to SME’s.

This has allowed Paxman to adapt and make design changes quickly and for a low cost allowing a quicker route to market.
Benefits of Collaboration

Current Achievements Include –

A successful KTP graded excellent,
A second KTP currently underway,
Two worldwide patents and two UK Patents
Winner of Medtec Ireland Exhibitor Innovations Accolade
Winner of West Midland Medilink Innovation Award
Winner of Yorkshire and Humber Healthcare Partnership with Academia Award
Insider's 2016 Made in Yorkshire Awards
Journal Papers
Conference Papers

And More!
Product Design, Supporting Research, Academic work, and other activities:

115 Academic staff, Including 12 Professors; 4 Readers
50 Admin, Technical and Support staff
Strong partnerships with a wide range of external stakeholders and organisations
Local, Regional, National, International
Over 2500 students
BA/BSc Product Design at Huddersfield:

CHANGE YOUR MINDSET
THINK ABOUT CREATING IP NOT PROJECT MARKS
AWARD-WINNING, RESEARCH ACTIVE AND ENTERPRISING COURSE TEAM

OUR STUDENT SUCCESS’

New Designers Mars Award for Design Thinking WINNER 2015
Electrolux Design Lab WINNER 2015
Autocar ‘Next Generation’ Design Prize FINALIST 2013, 2015
D&AD Awards FINALIST 2013
RSA Design Award FINALISTS
Design Innovation in Plastics FINALISTS (2 of 6)
DEVELOP YOUR SKETCHING SKILLS
LEARN OUR UNIQUE CREATIVE THINKING METHOD - GENERATE 100s OF IDEAS TO ONE PROBLEM
PITCH YOUR CREATIVE IDEAS TO DIRECTORS & DESIGN PROFESSIONALS
DEVELOP YOUR VISUALISATION SKILLS
BECOME AN EXPERT IN 3D CAD & 3D PRINTING
BECOME ONE OF OUR SUCCESS STORIES


“We only recruit the most talented graduates and benefit from their high level of design
Marcus Hartley graduated from the Product Design with 3D Animation BA(Hons) in 2004. After graduating he attended the New Designers exhibition in London and managed to win the 2004 James Dyson Foundation award with his final year project (the hammer). After an extensive interview process he was offered a job with Dyson. In late 2004 Marcus started on the Dyson Airblade project (hand dryer), successfully designing, manufacturing, testing and launching this product in late 2006. He was responsible for both setting up the new production facility in the Far East and delivering this project to market. Once AB01 was out of the way he then moved on to AB03 which was successfully launched in early 2008. To the current day he continues to work on new and exciting products!
A MATURE COURSE, COMMERCIAL APPROACH, EMPLOYABILITY PROSPECTS, GOOD INDUSTRY LINKS, NO EXAMS, A VISIBLE, ACCESSIBLE COURSE TEAM AND VERY SATISIFIED STUDENTS
SAMPLE PROJECTS:
Enterprise activities

Kinetic Energy Storage Device, ESP ltd

3D Scanning: Mackinnon & Saunders

Wheelie Bin Lock: JA Innovation

Portable Potty: Simple Little Creations Ltd

Blister pack opener:

Bob the Builder Tractor: Mackinnon & Saunders

Visits & Training: Uludag University of Turkey, Ural State Academy of Architecture & Arts, Russia

Paxman Cap

Royal Coat of Arms, 3M Buckley

CNC Learning Software: Kirklees College
Interdisciplinary & International Impact

Rupert Till-Heritage, Music

Jill Townsley, Art

Business L’Oreal

Engineering

Costume

Digital Doubles

International
Future Factories (2003-2010)

Future Factories focuses on 3D printing,

- Iconic designs ranging from gallery pieces to retail products,
- Work acquired the Museum for Modern Art in New York and DHUB, Design Museum Barcelona
Automake (2006)
Low Cost Tooling for Product Design (2012-2015)

Experimental Investigation of Sheet Metal Forming Using a Recyclable Low Melting Point Alloy Tool, Injection Moulding using Low melting alloy inserts, Carbon Fibre using 3D printed mould.
Prototyping using 3D printing:

The tool was produced using an EOS 3D laser sintering machine and PA2200 material (Fine Polyamide PA 2200 for EOSINT P). Normally the tool would CNC manufactured in Aluminium at a much higher cost. We also used Alumide.
3D Printing/ Rapid Prototyping Resources:

We operate three rapid prototyping machines which can quickly and accurately produce parts from CAD files. The file format required is STL and Solidworks software produces the best results although 3D Max files saved as STL format can work with some fixing. VRML files from Archicad can also be printed. Students are charged for parts produced at cost price.

ADA 3D Print Lab - QSB03:

- **3D Systems Projet 5500x** [3D Systems.com](http://3DSystems.com)
  3D Systems Projet 5500x uses MultiJet Printing (MJP) technology to build very high quality, accurate and tough multi-material parts. Maximum build size = 533(x) x 381(y) x 300(z)

- **Projet CJP 650** [www.3DS.com](http://www.3DS.com)
  The Projet 650 is a powder based machine which prints a binding fluid on to each successive 100 micron layer of powder laid down to build up a 3D representation of the part which has been designed. Maximum build size = 250(x) x 380(y) x 200(z)mm

- **Stratasys FDM360mc** [FDM print process](http://FDMprintprocess)
  This machine uses Fused Deposition Modelling technology to produce parts which are very strong and useable as functional prototypes generally ABS. Maximum build size = 360(x) x 250(y) x 400(z)mm

3M Business Innovation Centre:
EOS FORMIGA P 110 Laser Sintering Machine cost around £200k, Similar Machines for metal sintering cost over £500k
Paxman Project: Visual Summary
Any Questions?