

Materials in Art and Design Education

Institute of Materials, Minerals and Mining, London, 25 April 2008

A one day conference organised by InnovationRCA at the Royal College of Art for Materials and Design Exchange (MADE¹). Chaired by Professor Clare Johnston, MADE Board Member and Head of Textiles, Royal College of Art

Report by Jonathan Ward



How can universities and colleges best equip students with the skills and enthusiasm needed to develop innovative uses for materials? Fifty of the UK's top design and materials educators met to debate this question at the Institute of Materials, Minerals and Mining, 25 April 2008.

Dr Bernie Rickinson, Chief Executive of the Institute of Materials, Minerals and Mining, set the context for the debate by describing the work of the Materials Knowledge Transfer Network (KTN) and MADE in connecting the materials industry, the academic institutions that drive research into new materials and the consumers who will ultimately benefit from their use. Describing the flow of knowledge as a chemical process, Rickinson suggested that the valve between materials academia and industry was, thanks to the efforts of the KTN, 'three quarters open'. The link between the materials community and consumers was, however, not so free-flowing. "Designers have a vital role to play here, in helping to bring those innovations to consumers," he suggested, before encouraging all present to play their own part in helping the design community to make better and more innovative use of materials. "Don't just sit on the sidelines," he said. "It is a contact sport."

Innovation by contact

The first speaker of the day, Dr Mark Miodownik, Head of the Materials Research Group at King's College, London, has more experience than most at helping new audiences to access and understand interesting and unusual materials. Miodownik started his presentation by showing a photograph of a typical London street scene. By annotating the slide with many of the materials in use there he pointed out the sheer number and diversity of materials in everyday use today. "Our streets are exotic jungles of materials," he said.

Critically, said Miodownik, people understand these materials in very different ways, depending on their background and objectives. As a demonstration, he compared the periodic table of elements, favoured by chemists, with the perspectives of his own profession – materials science – which is primarily concerned



Dr Bernie Rickinson



Dr Mark Miodownik



Jane and Patrick Gottelier



Dr Eddie Norman

with the structure of materials at different scales. The characteristics of materials “cascade up and down” through these scales, he explained, pointing out that innovation at the nano-scale in alloy design was responsible for the construction of materials that could operate reliably in the harsh conditions of a jet engine for thousands of hours. This, in turn, delivered the low cost air travel that we enjoy today.

Other user groups think of materials in still different ways, however, continued Miodownik. Tables of material properties, so beloved of engineers, are an extremely powerful tool for the integration of materials into new designs. Even these tables, however, fail to capture many properties that have a huge effect on our use and enjoyment of products. Characteristics such as smell and feel are almost impossible to capture in simple numbers, he noted, and many modern products show evidence of the fact that these properties were ignored during their design.

The only way that people can gain an understanding of these other material properties, suggested Miodownik, was by experiencing the materials directly – touching them, manipulating and interacting with them in different ways. “Touching a material changes your way of thinking about it,” he said.

Miodownik went on to describe two projects in which members of the public had been brought into contact with materials in unusual ways. In the first, a number of different materials, including large quantities of Silly Putty,

were left close to exhibits in the Tate Modern. Gallery visitors were encouraged to interact with the materials in response to the art around them.

In the second project, the human body exhibition at the Wellcome Trust was augmented with opportunities to touch and interact with flesh in different ways: a butcher allowed people to handle freshly cut pig organs, and there were opportunities to practice surgical suturing techniques and to feel the strength and elasticity of tendons. All these opportunities to play with materials were enhanced, said Miodownik, by the presence of experts who could instruct and guide visitors, and answer their questions.

Innovation by limitation

Jane and Patrick Gottelier, who today run two fashion courses at University College Falmouth, described the role that innovative use of materials had played in their earlier career as owners of a specialist knitwear firm, Artwork, as well as in their current role as academics.

The couple first collaborated during their time at the Royal College of Art, when they used welding technology to produce inflatable PVC clothing. When they went into business they found that being a small company limited their access to high quality materials from large yarn producers. In order to compete, they were forced to innovate in the way materials were combined, constructed and finished. This innovation started with the introduction of beads and sequins – knitted directly into garments to add a luxury feel to otherwise everyday materials. The

¹MADE is part of the Materials Knowledge Transfer Network (KTN) funded by the UK Government, forging a link between designers and other sectors of the KTN concerned with metals, plastics, textiles and the full range of modern materials. The core partners of MADE are the Institute of Materials, Minerals and Mining (IOM3), the Royal College of Art (RCA), the Design Council, the Institution of Engineering Designers (IED) and the Engineering Employers Federation (EEF South).
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couple went on to pioneer the printing of knitted garments and the use of unusual fibre blends, including early use of Lycra to improve the stretch of garments and cotton-wool blends to make garments friendlier for use in warmer climates.

Exclusive access to a special indigo-dyed yarn originally developed as a trim for denim products gave the company a unique selling point for several years, and it was able to augment its use of quite new materials with machine-made lace produced on some rather old equipment: 19th Century lace making machinery that was still in use during the 1970s and 1980s.

Today, the Gotteliers are bringing their industrial experience to bear in two new courses at the University College Falmouth in Cornwall. Designed to reflect the region's popularity for outdoor leisure activities, the Fashion Design Course is complemented by one focussing on Performance Sportswear Design. They have been able to use contacts with textile manufacturers in the Far East to give students access to a range of new materials, while industrial links have also given access to some advanced manufacturing machinery including a laser cutter, an ultrasonic welder and seam taping equipment. The high degree of crossover on the course, noted Jane, means that "Fashion design students get as much use out of this equipment as the Sportswear students."

Being able to design in such a technically rich environment is inspiring to the Falmouth College students, but Patrick raised a note of caution about offering unlimited resources to students. "Our experience has been based on necessary improvisation, rather than being handed ready made solutions by industry."

Innovation by experience

Dr Eddie Norman, Senior Lecturer in Design and Technology at Loughborough University, described some of his own teaching and research work into how designers operate. Of particular relevance to the materials community were a number of projects on the construction of guitars from polymer materials. The design of guitars, Norman explained, was a powerful example of the contrast between tacit and articulated knowledge in design. The skill used by a luthier in the selection of materials and the sizing and positioning of components comes from their experience and can't be modelled or analysed, he suggested.

In the polymer guitar design work at Loughborough, for example, material selection was made by an experimental process rather than by formal analysis, and key design decisions were made "in a matter of minutes with a pencil

Delegate wish lists
These were compiled at the conference

To engage students with new materials:

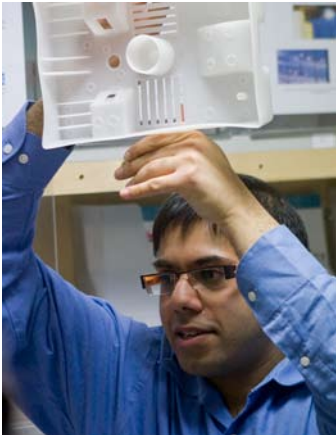
1. The time, space and opportunity to play
2. More access to more materials of more types, both new and recycled
3. Clever networks for information exchange
4. Opportunities for interdisciplinary working
5. A skilled, sympathetic and supportive technician resource
6. Better industrial links with academia and industrial support for students
7. Materials on the curriculum, starting at school level
8. Better understanding of the language of materials to aid selection and specification

For the next MADE Materials in Art and Design Education event:

1. Hot issues in material selection: ecological footprint, fair trade issues, sustainability, recyclability etc.
2. The development of materials networks
3. Engaging with materials manufacturers
4. The notion of Play as a discovery and learning tool
5. Influencing students, schools and teachers
6. Materials experimentation and the Research Assessment Exercise (RAE)

and paper," by a skilled and experienced guitar maker.

The success of the polymer guitars, however, was a demonstration of another key challenge in design education. By breaking the guitar industry's 'fixation' with wood, it was possible to explore other options in materials selection. Doing so requires designers to recognise their own bias in decision-making processes and decide whether those decisions are really made on the basis of



From left to right: Dr Sumeet Bellara, Signy Svalastoga and Lee Grandjean

know-how or simply through a reluctance to think more broadly about a problem.

Innovation in architecture

Signy Svalastoga, Subject Director of Architecture in the School of Architecture and Visual Arts at the University of East London, described their approach of introducing students to new materials and construction techniques.

The UEL architecture programmes emphasise hands-on experience of materials. Students are encouraged to build as well as design products, and to use the construction process to influence the evolution of their designs.

The first example of this hands-on approach was the construction of a cast concrete wall using fabric formwork instead of conventional rigid materials. The students designed and built the wall in workshop sessions and modified their design during the construction process – introducing a window at a late stage.

As well having a pleasing organic form derived from the bulging fabric formwork when the concrete was cast, the use of fabric formwork provided other advantages. Water could escape quickly through the fabric after construction, improving the structural strength of the material and the lightweight, compact fabric formwork could offer benefits for construction in remote sites.

Other projects carried out by students included constructions using willow to construct living grid-shell roof designs and rammed earth for sustainable wall construction. The East London students have the benefit of a large space for hands on work, something that other delegates noted with some jealousy.

Innovation in sculpture

Lee Grandjean, Senior Tutor in the Royal College of Art Sculpture School, described his own and his students' use of conventional and unusual materials in their work. The process of sculpture, he suggested, is a two-way link

between the material world and the mind. The sculptor attempts to use material in order to express the internal and the intangible, but the process of sculpting has its own effects on the sculptor's ideas and thought processes.

For Grandjean, who is a practicing sculptor, and for many of his students, reclaimed and recycled materials play an important role in their work. Grandjean himself works extensively using plastic milk containers, which are melted with a blow torch before being plunged into water. The resulting bone-like forms are assembled into larger structures, sometimes incorporating other found and reclaimed objects, before being finished with a variety of surface coatings.

Materials in Art and Design Education was attended by course leaders, tutors and librarians from the following institutions:

- Brunel University
- Cardiff School of Art & Design
- Central Saint Martins College of Art and Design
- Chelsea College of Art and Design
- Coventry University
- Goldsmiths College
- Hull College
- Kings College, London
- Kingston University
- London College of Fashion, University of the Arts
- London Metropolitan University
- London South Bank University
- Loughborough University
- Manchester Metropolitan University
- Nottingham Trent University
- Queen Mary University of London
- Royal College of Art
- Southampton Solent University
- University of Brighton
- University College Falmouth
- University of East London
- University of Hertfordshire
- University of Leeds
- University of Liverpool
- University of Ulster
- West Herts College



Professor Clare Johnston (right)

“Touching a material changes your way of thinking about it,”

Dr Mark Miodownik

“Overcoming limitations is what really helps you to innovate, we need to be careful that students face some of the same challenges.”

Patrick Gottelier

“Designers must recognise their own bias in decision making, are they applying know-how, or just fixated on a solution they know will work?”

Dr Eddie Norman

“Students learn more when they have the opportunity to do things with their own hands.”

Signy Svalastoga

“Processing material is a way of thinking about the world.”

Lee Grandjean

An essential part of the creative process for sculptors, said Lee, is the freedom to experiment without fear of failure. To assist this, RCA students are given 14 square metres of private studio space, and £200 to purchase materials. They also have access to a pick-up truck to help them obtain and transport reclaimed materials.

This freedom to experiment is important, says Lee as “insights come from the processing of material that may alter your intentions.” For an artist, processing of material is, he said, “a way of thinking about the world.”

Rules of engagement

Over an extended working lunch in the middle of the conference delegates had the opportunity to visit the MADE materials resource centre in the basement of the Institute of Materials. Managed by Dr Sumeet Ballara, the resource centre currently has more than 1,000 samples and is developing into a unique and powerful resource for students, designers and industry. The core of the working lunch was an opportunity for intensive discussion among the delegates. Divided into three facilitated groups, the participants were encouraged to debate mechanisms to help in engaging students with materials and to come up with a ‘wish list’ for better resources to help students. Discussion was enthusiastic and there was a good degree of agreement about the priorities and challenges.

Play

The vital role of “play” in learning about materials was a key theme for many. Innovations and deep insights, they suggested, arose when students had the opportunity to work with materials with no specific end-goal in mind. The opportunity to ‘waste’ material, just to see what could and could not be done with it, was the essence of this play, but an increasingly rare luxury for students operating in an environment with limited access either to appropriate materials or to the time to experiment with them.

Space

It is hard to play without a playground. In order to encourage free experimentation, students should have access to workshop space in which to experiment. Some participants also emphasised the importance of private, individual space where students could fail without fear of embarrassment, and where they could surround themselves with the materials that inspire and provoke them. As space comes under increasing pressure in academic institutions, many delegates worried that it was becoming hard to justify the allocation of such spaces.



Time

Along with space, the time to play without concerns about delivering an end product was also considered to be very important, and under threat by increasingly compressed and complex curricula.

Craft skills

The importance of craft skills was emphasised by numerous participants. Deep knowledge of materials comes from experience in handling and processing them. The recent explosion of interest in digital and virtual design techniques may have shifted the emphasis away from time spent gaining hands-on experience, and many participants felt that there was a need to redress the balance in many art and design courses.

Process

Many delegates spoke about the way introducing students to materials using a hands-on, craft-based approach led to a way of thinking about materials in terms of the processes that were applicable for working with them. This process-led approach, they suggested, was fundamentally different to other materials selection techniques, which concentrate more on the characteristics of the finished product than on the journey used to produce it.

Interdisciplinary engagement

“One discipline’s everyday materials deliver the ‘wow’ factor for another,” said one participant. There was agreement that courses, departments and disciplines gain powerful insights by interacting with others from different backgrounds. Mechanisms to encourage this could be formal or informal networks within and between academic institutions, cross-functional projects and workshops.

Industry

The relationship between the academic art and design

community and the materials industry was the subject of some particularly lively debate. Many participants agreed that today’s relationships are not effective, although there was also agreement that the failings come from both sides. Some participants felt that industry was insufficiently willing to make materials, particularly new materials, available to students for experimentation. Budgetary concerns may be part of the reason for this, but other participants also felt that worries about control of intellectual property also limited industry’s willingness to hand over its assets.

Other participants pointed out there was a lack of understanding by industry of the academic community’s desire to experiment with materials. Used to supplying materials to meet specific criteria, industrial companies find it difficult to offer materials to students who either don’t know their materials requirement or who wish to explore possible applications far outside the material designers’ original intentions.

Where relationships with industry do exist, some participants felt that they could be made richer, “Rather than just giving us material, we’d like these companies to come in and participate in an interactive workshop with our students, and to let them into their own factories to see the production and processing of materials on an industrial scale,” said one participant.

There was a need for academia to make steps across the divide too, however. Some participants emphasised the importance of equipping students with the language and knowledge to interact effectively with materials producers and specify materials in terms that they would understand.

Access

Getting hold of increasingly costly materials in the context of limited financial resources was a concern to many. Access, emphasised many participants, should not be



limited to the ability to handle material samples, although this was important. Students needed the opportunity to “test materials to destruction” in order to discover more about their properties. Industrial sponsorship was seen as an important route here, but many other participants also emphasised the importance of recycled and reclaimed materials in many contexts. While many courses encourage their students to access re-used materials on an ad-hoc basis, some participants felt that there were opportunities for more formal mechanisms to operate. Access to municipal recycling streams was one suggestion, while others pointed out the wider use of re-use schemes with industrial links, such as the successful Hackney scrap project, could be extremely useful.

Technicians

Hands-on experimentation with materials requires a unique kind of support. The freedom to experiment as freely as possible within obvious health and safety limits, but also to access knowledge and experience where required is only possible in workshop environments staffed by highly skilled and enthusiastic technicians. Several participants expressed concerns that the vital role of technicians in many academic institutions was insufficiently recognised, with the result that numbers and skill levels were in decline.

Information

While experimentation is a powerful learning mechanism, the ability to build on the experience of others is equally useful. Many participants discussed ways that information could be more freely exchanged between academic institutions and with industry. There was much interest in approaches that take advantage of modern internet-based communication technologies to facilitate two-way exchanges of information.

A Wikipedia-style materials information exchange was

one suggestion, where students and researchers could access information and describe their own experiences of working with different materials. The use of on-line video sharing technology such as YouTube was also suggested as an effective mechanism to communicate live content, such as lectures or demonstration of material properties.

Another participant suggested that the internet could be used as an “archive experience” showing work of previous generations of students together with contact details for alumni who had gained additional experience in their later careers, and who would be willing to share this with today’s students.

The internet can also be useful in aiding access to re-used materials. Several participants reported success in using sites like Freecycle to access unwanted materials at little or no cost.

Materials libraries

Materials libraries were considered by many participants to be an extremely powerful resource for students. Delegates from institutions without materials libraries all wished for one, or at least for access to such a facility. The feasibility of a mobile materials library was discussed as one possible solution to this need.

Those delegates with access to their own materials libraries emphasised the importance of introducing such facilities in an effective way, by giving students projects that required them to learn how to make use of the library resources.

The role of art and design research in materials innovation

To end the day, the delegates reconvened as a single group to share the outcomes of their discussions and to debate the best next steps for MADE and for the art and design education community. The largest opportunity, many delegates felt, was for constructive steps to create and

sustain an active two-way relationship between art and design academia and industry. One delegate pointed out that, as the art and design community is coming to the end of the Research Assessment Exercise (RAE), it has a unique opportunity to “redefine the role of research in art and design,” before the next exercise.

A big area of potential here, it was suggested, was a re-examination of the role of art and design research in helping industry to develop and adopt truly innovative

uses for materials, overcoming its “fixation” with established solutions. It was quite possible, the delegate pointed out, that the art and design community’s unique approach to “learning by doing” might offer to industry exactly the stimulus it needs to make truly radical innovative steps.

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Photography: David Ramkalawon