Learning and Teaching Investment Fund 2011

Final Project Report

Submission date: 17 February 2012

Title of project: Development and the delivery of a cross-disciplinary course, integrating applied architecture, textile design and Mechatronics; The design and digital fabrication of working prototypes.

Strategic objective(s) addressed:
- to be global in reach and impact;
- to be urban in innovation and impact;

Project leader: Dr. Flora Salim, Spatial Information Architecture Laboratory, School of Architecture and Design.

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Project team members:
- A/Prof Jane Burry, Spatial Information Architecture Laboratory, School of Architecture and Design.
- Dr. Juliette Peers, Spatial Information Architecture Laboratory, School of Architecture and Design.
- Dr. Jenny Underwood, School of Fashion and Textiles.
- Dr. Milan Simic, School of Aerospace, Mechanical & Manufacturing Engineering.
- Prof. Mark Burry, Spatial Information Architecture Laboratory, School of Architecture and Design; Design Research Institute.
- Prof. John Mo, School of Aerospace, Mechanical & Manufacturing Engineering.
1. Executive summary (up to half a page)

- Provide a summary that describes the project and what was achieved.

*This will appear on the RMIT website and the full final report will be linked to the summary.*

The project, delivered in an 8-week intensive studio – namely ‘Augmented Spatiality’, addressed the interaction between people sharing public space, the interaction of those people with the wider community and the expression of and possible interaction with concealed activities such as ambient and artificial flows and events within the city. It posed the question of how recent technological advances in computing, communication, sensing and actuation could be retrofitted to the visionary city of the immediate past to foster concurrent interaction in physical and virtual public space.

The studio targeted the design and development of prototypes which are innovative, functional, interactive, and responsive, in order to address a specific urban problem, analyse environmental data, and interact with the city. The pilot run of this studio involved the participation of 35 students from six different design disciplines - architecture, landscape architecture, interior design, industrial design, textile design, and public arts - and a team of teaching staff and tutors with backgrounds in architecture, computer science, arts, textile design, and mechatronics. Students learned to design and construct architectural models using digitally fabricated models and woven, knitted, or printed textiles, embedded with smart materials. Integrated with sensors and actuators connected to embedded microelectronics, these architectural models were to respond to or interact with the changing environment or users.

Students learned to communicate better across cultural and technical barriers and improve their analytical and critical skills for effective participation in cross-disciplinary teams in the workplace. Students also learned to solve real world urban problems using design-led approaches and techniques previously isolated in other disciplines. The impact was global in reach as such integrated teaching of technical and design skills with access to high performance digital fabrication, textile machines, and robotic platforms was potentially a world-first. The outcomes include eight different life scale responsive and interactive models that were installed at various sites on Swanston St for a few days in September for public viewing and interaction and were exhibited in a major art gallery in November 2011.

2. A list of outcomes

- Provide a brief overview of the project’s outcomes and impact.

*List any scholarly output in the form of conference presentations or journal papers. This will appear on the RMIT website.*

Full scale prototype manufacturing and one-to-one scale designing gave a very concrete demonstration of what was achievable (as well as what was too ambitious) on student skill-bases and with a very diverse set of people, which suggests that advanced concepts can be communicated to a range of students, not only to the obvious elite of high achievers. The two days of installations on Swanston Street brought the presence of RMIT as an internationally innovative university of design and technology directly into everyday Melbourne street life. There were very positive interactions from the general public - as well as meeting our internal goal of transforming a very boring piece of streetscape. One of the installations was invited to be exhibited in the prominent Melbourne Fringe Festival. All of the installations were exhibited again in the Yarra Sculpture Gallery.

Scholarly Output:


Creative Output:

3. Project outcomes and impacts

- List and discuss the outcomes the project was designed to achieve and the outcomes the project has achieved, including any literature review and evidence of the impact the project has had on students.
- Describe briefly any issues that may have prevented you achieving all the original outcomes stated in the application.
- Describe any disciplinary and interdisciplinary linkages that have emerged as a result of the project.

The novel integrated teaching of this combination of technical and design skills, with access to high performance digital fabrication, textile machines, and microelectronic platforms, were delivered in just eight intensive weeks during the semester. Related works include a past architecture elective in RMIT, run by Flora Salim and Jane Burry, which used the “Input-Process-Output” approach borrowed from Computer Science in teaching architecture students to design responsive architecture (Davis et al, 2011) and the RoboStudio conducted in University of British Columbia that applied robotics, mechatronics, and kinetics to architectural design (Meyboom et al, 2010). However, this project builds to a higher level of complexity and sophistication than the precedents, with a higher number of disciplines involved and goals to produce new kinds of interactions in public spaces. In this studio, students were allocated to eight different groups, each having 4-5 students from different design disciplines.

The evidence of the impact the project has had on students were captured in our questionnaires, students’ individual reports, and Course Experience Survey (CES) results. In order to evaluate the pilot studio and this new transdisciplinary method, we conducted two questionnaires, at the first and the last studio meeting. The questionnaires sought to capture the capacities that the students carried into the studio around the cluster of ideas and techniques under investigation in the studio and to see how students’ concepts had evolved during the studio. Whilst the questionnaires document that the students found working with colleagues with a variety of backgrounds complicated and ambitious speculation was rapidly reconfigured to the possible, a number of students recorded that they emerged from the end of the studio with an expanded range of professional capacities. From students’ reflections at the end of the studio, the difficulty in uptake of new programs appeared to be both mediated and complicated by the fact that whilst students had been tutored in digital techniques, they used different programs in their home disciplines. No-one was equally capable in all the programs being deployed in the studio, which added a burden of difficulty to planning and development of the prototypes. However projects went ahead either with digital work being done by those with the most relevant competence or weaker students gaining confidence from those with greater facility. Intense tuition in key programs also expanded students’ abilities. Many of the final reports and questionnaires testify to the fact that students emerged from the studio with an improved theoretical and practical knowledge of deploying digital design techniques. Thomas Black, a participating student noted that “using programs such as Arduino, Grasshopper, Firefly and Rhino have opened my eyes to seeing how it is possible to truly integrate the digital in reality” (Group 3, 2011). Communication and the understanding of how other disciplines worked enabled both the digital and physical to be managed. Not only did students bring in discipline-specific expertise such as the detailed knowledge or product and capacities offered by the textile students, there were a wide range of pre-existing performance and making skills. Masters in Public Art students who were experienced sculptors/artists and installation specialists particularly enhanced the studio. Answers to the questionnaires and other on-paper submissions made tangible something of the social role that speculative and forward-looking architectural models has now acquired in the wake of accessible digital technologies, a generation of technology “natives” and also new play- and communication-driven ways of experiencing both recreation and the urban.

Unfortunately, given the tight timeframe from notification of the LTIF award (June 2011) and the actual start of the course (mid July 2011) and the significantly reduced funding from the requested amount in the proposal, we could not use the Advanced Manufacturing Precinct (AMP) facility for prototyping.
smart and composite materials and it was not possible to get any mechatronic students to be enrolled in the course given the process for advertising a new course in SAMME is not as flexible as in the School of Architecture and Design, or Fashion and Textiles, or School of Arts. Mechatronics involvement was limited to employing two technical tutors from SAMME to help groups in embedding microelectronics in their installations. The cost to build the installation was up to $2000 per project using conventional and easily accessible materials. Due to the limited funding, we could not subsidise any of students’ experiments and prototyping requirements.

References:

4. Dissemination strategies and outputs
- List materials or outcomes that will be made available to the university or groups of stakeholders within the university or sector and provide information about where any project material is available
- Describe the ways in which the project’s outcomes have been or will be shared across the university, the sector and/or nationally and internationally. For guidance refer to the ALTC Dissemination Framework (url: http://www.altc.edu.au/print/resource%2Ddissemination%2Dframework%2Daltc%2D2008)

- Journal article, currently under review for publication in the International Journal of Architectural Computing: http://www.multi-science.co.uk/ijac.htm
- Future conference papers and presentations, addressing different streams of outcomes from the studio: learning and teaching, environmental sustainability, cultural engagements, and social interactions.

5. Evaluation of project outcomes
- Provide evaluation outcomes including evidence of the impact of the project and the value it will bring to the university and/or the sector. For guidance refer to the ALTC Evaluation Framework (url: http://www.altc.edu.au/extras/altc-gsep/index.html)

The course was evaluated based on the CES outcomes and the two questionnaires we conducted at the first and final studio meeting. The overall satisfaction results of the ‘Augmented Spatiality’ course in CES were 80% and 90% respectively in the survey run by the School of Architecture and Design (course code: ARCH11681171135513581361) and the School of Fashion and Textiles (course code: GRAP2347). The questionnaires also revealed, in general terms, development of a more precise and targeted formulation of students’ design thinking around technology in design, interdisciplinary and group design work and sustainable urban futures during the studio. This improvement was seen equally in marginal and highly capable students.
6. **Budget report**
   - What was the amount of funds approved?
   - What was the final amount of funds acquitted? Please attach a financial statement.

   All financial claims related to your project must be processed against your internal order number before the end of 2011. Claims cannot be accepted in the New Year 2012. Unexpended funds will be retained by the university and unclaimed costs will be borne by your School/College.

   A financial statement (in PDF), signed by the team leader and relevant Finance Manager of acquittal of funds must be attached to the report. It should include a statement of income and expenditure against the budget categories specified in the approved project proposal. Please consult your Finance Manager for further information.

7. **Appendices**
   - Include any material that may support your claims of outcomes and impact.
   - Attach pictures, presentation material, website links and so on that may be important. In particular, please provide an image that can be used for publications, such as a poster.

**Submitting the Final LTIF Project Report**

   - Please follow the headings listed above.
   - Please save the report in Microsoft Word using the following formula: team leader's surname_College_LTIF2011_finreport.doc (e.g. brown_DSC_LTIF2011_finreport.doc).
   - Please include a Table of Contents.
   - Please sign the final signature page.
   - Submit the final report by close of business, Friday, 17 February 2012 to diana.cousens@rmit.edu.au

**Further information**

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