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Abstract: A socio-emotional approach to consider human-computer interaction (HCI) has emerged as a discipline responding to a much neglected aspect of interaction design: the social nature and emotions of users. Teaching socio-emotional design in practice can be challenging due to its newness and multidisciplinary nature. This paper reports a trial of collaborative socio-emotional design through a project shared by two faculties and three design disciplines–interface design, software design, and 3D design. Success and challenges encountered during the project are presented to share our experience of teaching and managing multidisciplinary collaboration projects.

Introduction

In the last decade, the field of human-computer interaction (HCI) has successfully embraced as design elements in interface design the social nature and emotional qualities of users such as fun, joy, and pleasure. One of the leading studies in the domain of socio-emotional design is the media equation theory by Reeves and Nass (1996)—more widely known as the CASA (Computers Are Social Actors) paradigm. The CASA paradigm has been an inspiration and guide for many social-emotional HCI studies by demonstrating that human-computer interaction is very similar to social interaction. In HCI education, a socio-emotional design approach offers a number of benefits for students by supporting conceptual development, problem-solving, lateral thinking, and reasoning skills. It encourages students to look beyond the confines of digital screen (i.e. a typical human-computer interaction), and synthesise ideas by leveraging the social and emotional context of users (Fogg, 2003; Norman, 2004; Reeves & Nass, 1996). This holistic view promotes in students a deeper understanding of users and users' experience within and outside of human-computer interactions (Caroll, 2000). Students in this model explore the entirety of a user's experience with a product in a narrative manner to gain an insight into every aspect of user experience–a beginning of user-product experience, a relationship boding between the user and the product, and a memorable ending encouraging them to revisit the product (Khaslavsky & Shedroff, 1999). In turn, students are encouraged to actively uncover potential problems and generate solutions from different perspectives.

However, the ever-changing nature of the discipline and the newness of the theme have left HCI educators struggling to teach socio-emotional design to undergraduate students. A socio-emotional approach to design HCI is not driven by a single design discipline, but instead requires a truly cross-discipline perspective that includes engineering, art, and social science–naturally, a good match for a multidisciplinary project. The multidisciplinary nature of socio-emotional HCI can be challenging and difficult to implement due to technological and cultural barriers between multidisciplinary members (Adamczyk & Twidale, 2007).

What is an effective way to implement socio-emotional projects in a curriculum? How can we cultivate user empathy in students that builds creativity beyond mundane assignments? Will a socio-emotional structure

enhance student understanding? To explore these questions, interdisciplinary student collaboration was initiated in the context of middle and upper level university courses in design and science units. This paper discusses lessons gained and outlines problems and opportunities uncovered from the trial.

Context of the project

Classroom-based projects are often insulated from reality with unrealistic requirements (Shneiderman et al., 2006). Students often find it hard to see their projects in a context of the real-world and visualise users' interaction with their projects. Projects are seen as merely assignments, which will earn them marks and grades. To motivate students in studying users and engagement with the project, a real-world project, which presented authentic user requirements and project problems, was selected for the study.

University students everywhere share the problem of locating free computer labs to work on their assignments outside of their normal class schedule. But computer labs are timetabled with many units during semesters. This project was envisaged to communicate an elegant visual representation of live lab usage in real time. The project was implemented as a shared-assessment program involving three units from two schools. Three units were selected to accommodate the nature of project, which required the design and construction of front- (i.e. interface design) and back-end (i.e. software design) of the physical product (see Table 1 below). Initially, it was proposed to involve *Design & Technology* students to assist the construction and installation phases of the project. However, it transpired that the unit schedule did not align with the rest of the units involved to be included in the project. This meant that some accommodations had to be made for the relative paucity of construction skills in the student set.

Units	Descriptions
Interface & Information Design	This is a second year undergraduate unit mainly undertaken by students in Interactive Media Development major. The unit introduces students to the concepts of interface and interaction design.
Software Design	Postgraduate unit taken by students in the Master of Computer Science. The unit covers the object-oriented design of software and its implementation.
3D Animation	This unit provides students with skills in 3D animation for purposes such as film and video, advertising, and broadcast graphics. Techniques covered include keyframe and inverse kinematics animation, particle systems, advanced lighting and camera techniques, as well as the output and basic editing of animated scenes.

Table 1: Brief description of units involved in the project.

Each unit was a full semester program (12 weeks) started in July 2010 and completed in November 2010. The students were allocated into four groups of between eleven and twelve students with complimentary skills–i.e. four to five interface designers, four to five software programmers, and one or two 3D designers.

Project Requirements

To simulate industry project parameters and to explore the questions mentioned earlier, three sets of requirements were outlined for the project (see Table 2).

Requirements	Descriptions
Product	The product must entail three levels of design: visceral, behavioural, and reflective designs encompassing a holistic product-user experience including the beginning, middle and ending.
Installation	The product must address and satisfy the University's risk assessment criteria. The product also must be easy to install and dismantle.
Budget	AU$100

Table 2: Design requirements for the shared-assessment project.

Firstly, students were required to consider the three levels of design by Norman (2004) as part of the finished product features. The product requirement was intended to encourage students to capture the entirety of users' product experience including aesthetics, functionality, and socio-emotional aspect of user-product relationship. In addition, to further promote the focus of socio-emotional aspect of the project, *Seductive Experience* theory (Khaslavsky & Shedroff, 1999) was introduced, asking the students to consider a narrative product experience including an enticing product introduction, an engaging interaction with the product, and a memorable ending.

Secondly, students were required to consider the health and safety issues related to the installation of their proposed products. ECU safety officers delivered a health and safety workshop as part of the *Interface & Information Design* unit to train the students with appropriate knowledge and skills for the project. As the final product was to be installed in a building space, it was necessary to consider the construction process and schedule. Students were required to propose products that entailed easy installing and dismantling in less than 5 working days. The last week of the 12-week semester was scheduled for the construction of the final product allowing students up to two weeks to complete the project before their exam period started.

Lastly, a project budget of AU$100 was arranged for the construction of the final product. A small budget was proposed to encourage students to experiment with new ideas and promote innovative use of technologies outside of the digital realm (e.g. piano staircase and scratch mat by TheFunTheory.com).

Project process

The project development process followed a commonly used iterative process involving four phases; identify requirements, design, build prototypes, and evaluate (Preece, Rogers, & Sharp, 2002). This four-phase iterative process also has been adopted by many developmental and multidisciplinary HCI projects (e.g. Shaer, Horn, & Jacob, 2009; Zuckerman, Arida, & Resnick, 2005) as a tool promoting collaboration efforts in students and reinforcing fundamental HCI concepts–designing usable and enjoyable products.

In the first phase of the project, students carefully examined users' needs through a scenario-based design, which is an informal narrative description describing human activities or tasks in a story (Caroll, 2000). Telling stories is a natural way for people to explain what they are doing or how to achieve something. Thus, analysing a target audience in the form of storytelling allows students to concentrate on the users rather than fitting themselves in the 'I am the user' box where they consider themselves as the universal user–developing products based on their interactions and preferences in products. In turn, it allows exploration and discussion of contents, needs, and requirements of a project in more detail. Some groups went beyond the project requirements by conducting interviews and surveys with potential users (i.e. 1st year undergraduate students) to further strengthened their user research and tease out product requirements (i.e. functional and non-functional requirements including how the product should behave).

In the conceptual design phase, each group produced a design document outlining; user analysis, product requirements, and user interface style guide. Each design document also included three low-fidelity prototypes to encourage students to explore a variety of design solutions and reinforce the concept of iterative design. After completion of the design document, an interim presentation was organised to share the project progress and exchange constructive feedback with everyone involved in the project. Interestingly, there were recurring design themes and solutions in the project: the use of LED lights and motion sensors. The students explained that the project requirements, such as the low project budget and installation schedule, affected their decisions leading them to choose similar materials.

Groups that leveraged their members' expertise and formed strong communication bonding showed deeper engagement with the project through creative design solutions and user understanding. Groups that failed to exchange ideas and maintain regular contact between the members presented weak design concepts and lacked convincing articulation of product feasibility. One student in the problematic groups noted such problems in his/her post-mortem report:

"…our leader not communicating with the programmers and 3D designers really left us in the dark about the functionality issues also which caused our product to be flawed in many ways. The organisation with members, communication issues let us down in terms of the putting it all together… therefore was not possible to install if it would be chosen as the winning product"

The communication breakdown was mainly caused by cultural barriers where the students guarded their ideas and failed to accept ideas from students from other disciplines. This, in turn, affected the students' engagement with the project as another student in the same problematic group noted: *"we slowly cared less and*

less about this project and I'm sure the quality difference shows between our first presentation and now".

Based on the feedback received from their interim presentation, students were then asked to choose the strongest design idea from their three low-fidelity prototypes and produce a high-fidelity prototype that could be tested by users. Ten 1st year undergraduate students volunteered to test the prototypes and all prototypes were tested by at least five users to obtain the 'ideal' amount of user-test information (Nielsen, 2000). Prior to this social-emotional project, the students had never involved real users in their assignment projects, and they greatly appreciated the evaluation with potential users of their project. By observing potential users' interactions with high fidelity prototypes, the students made changes to their designs and product functionalities.

The final project presentation was held in Week 11. The groups presented their refined projects to the judging panel consisting of three lecturers from the units involved in the project. The students were given the chance to comment and provide feedback, which was also considered by the judges. The next section provides brief descriptions of the four student projects.

Student projects

All four projects shared the same goal of providing live lab usage information. Nevertheless, each group produced a unique visual and functional representation of the given goal. The products were judged against the three project requirements discussed earlier (see Table 2). Tables 3 to 6 below show brief analyses of how the projects addressed the project requirements. It is evident that Group 1 came closest to meeting all criteria. Group 1 was chosen for construction, and the students were generally happy with this choice (see Figure 1). Due to the page limits, more detail will be provided in the conference presentation.

Requirements		Judges' comments
Product	✓	The three levels of design were executed effectively through the use of existing design element to create familiarity (i.e. Feeling Lucky button inspired by Google website), visually engaging UI, and highly functional features including showing each lab's entire-day timetable as well as current lab usage information. Red LED lights indicate timetabled (unavailable) labs. Footprints from the building's entrance to the product to add a fun factor in the user experience.
Installation	✓	Satisfied ECU's risk assessment criteria and the installation requirement.
Budget	X	The proposed budget estimated AU$120 exceeding the allocated budget by AU$20.

Table 3: Assessment of group 1's proposed *iLab*.
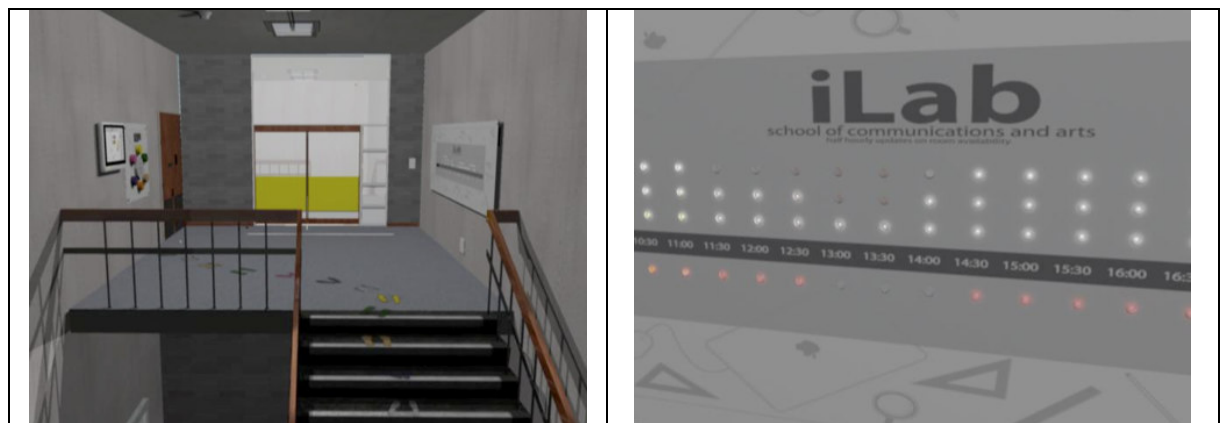
Figure 1: 3D Visual representation of Group 1's project called, *iLab*. (Left) the three-piece product installed in Building 3, stairwell, and (right) a close-up view of the main piece showing the live lab usage information using LED lights.

Requirements		Judges' comments
Product	✓	Simple and straight forward user interface with a motion sensor to activate the product. The LED display shows current status of the labs and displays a full bar when a lab is booked with a class.

Installation	X	Address the most of the ECU's risk assessment criteria but failed to discuss one critical issue – i.e. the location of the product. The product was proposed to install in the lower area of the stairwell where human traffic is heavy. Chance of attracting a large crowd near stairs was considered unsafe, by blocking people entering and exiting the building.
Budget	X	Failed to provide detailed description and estimated budget.

Table 4: Assessment of group 2's proposed *LabTrack*.

Requirements		Judges' comments
Product	X	Simple user interface but the information provided is not clear. Difficult to understand the lab usage information. Information is provided in the form of traffic light inspired bars where the lab usage information is displayed in 60%, 80% and 100%.
Installation	X	Failed to provide a health and safety report to address ECU's risk assessment criteria.
Budget	X	Failed to provide detailed description and estimated budget.

Table 5: Assessment of group 3's proposed live lab usage product (this group did not name their project).

Requirements		Judges' comments
Product	✓	Simple and straight forward user interface with a motion sensor to activate the product. The LED display shows current status of the labs and displays a full bar when a lab is booked with a class.
Installation	X	Addressed most of ECU's risk assessment criteria but like group 2, failed to discuss dangers and risks involved in installing in lower area of the stairwell in the building.
Budget	X	The group failed to discuss the budget in the planning stage resulting an estimated over-budget of AU$439.22.

Table 6: Assessment of group 4's proposed *SoundBar*.

Discussion and Conclusion

The multidisciplinary socio-emotional project has been an enlightening and interesting trial of a developmental learning venture for both lecturers and students involved. From the lecturers' perspective, the authors have gained a valuable insight into the implementation of a collaborative socio-emotional project across multiple units. Similar to many design tools and techniques, a collaborative project involving multiple disciplines can be beneficial for both academics and students, and it can also be problematic. Every student brings field-specific skills and creativities encouraging active knowledge transfer leading to a wide range of solutions and work practices. For example, *Interface and Information Design* students were able to put their visions into practice by leveraging the knowledge and skills of *Software Design* students who have different understandings of practical implementations of designs into tangible products. Their proposed visual and software designs were then conveyed to the audience (i.e. potential users and lecturers) with the help of *3D Animation* students by building highly refined digital simulations of the products–i.e. where the products will be installed and experienced by the potential users in the proposed location (See Fig. 1).

Using a socio-emotional approach to conceptualise and develop HCI products has shown positive benefits in the students' learning and broadened their understanding of interaction design including user empathy. For example, previously in the *Interface and Information Design* unit, students often failed to see the importance of placing users as a cornerstone in project development. Students' project documentations often provided crude and superficial user information that was based on their own preferences in products they were designing. The students who participated in this socio-emotional project structure have shown a great improvement in user-centred design, demonstrating an exemplary willingness to study and understand 'users other than me'. For example, two of the four groups conducted interviews and surveys with potential users in an attempt to understand users' behaviours and even the social context of their users. This led the students to identify potential problems and sources of user frustrations directly relevant to the project–in turn allowing them to explore appropriate solutions and ability to think outside of 'I am the user' box and to perceive users as complex humans with different feelings and multiple goals, aspirations, and needs.

The installation nature of the project and the limited budget proved to be challenging. Some of the winning group of students struggled valiantly to complete the construction in time for an 'official opening'.

This was largely due to the lack of expertise in construction, which also affected students' abilities to accurately determine the feasibility aspects. In hindsight, the concern about needing *Design & Technology* students to assist the construction and installation of the project was probably justified. The construction of the project was delayed until January 2011 when the necessary resources–including some keen students–could be mustered to complete the project. In the future, involvement of students from a wider participation of disciplines should reduce the workload and improve the prospects of the project completion. Involvement of students from a wider participation of disciplines should reduce the workload and improve the prospects of the project completion.

This particular collaboration worked extremely well as the students were able to see their contribution to the project materialise providing them an opportunity to appreciate the individual efforts that made up their collaborative project. However, collaboration project management tools need to be explored. Collaboration with students from different disciplines proved to be difficult and challenging for many students as the disciplinary cultures conflicted. We observed discipline related cultural barriers to be a problem affecting the group dynamics and communication affecting the positive progress of the project development. In some groups, students failed to communicate and work as a team as they formed sub-groups according to their disciplines within a group creating cultural barriers. Communication breakdowns between team members included failing to share ideas and maintain regular meetings. These all affected the group's progress and students' engagement with the project.

This socio-emotional project was part of an on-going study on shared-assessment, to examine the value of simultaneous multidisciplinary collaboration of staff and students in learning and teaching. This paper reports an early stage of the study, whose focus has been on exploring the logistics and delivery of units involving students and lecturers of widely differing technical, pedagogical and design backgrounds. We plan to identify criteria to maximize the success and ease of running of such projects, and then anticipate expanding the study to include a wider university community including arts, music, interior design, and design technology.

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