

‘Visual Acuity’: the Development of an Application for the Online Review, Grading and Assessment of Digital Art

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Abstract: This paper chronicles the development of an online application (‘Visual Acuity’) for the review, grading and assessment of digital art to be used by students and faculty at the School of Art Design and Media (ADM), Nanyang Technological University (NTU). Covered will be an outline of problems particular to the grading of digital art and of the shortcomings of systems that were already in place in the University. It is proposed that an enabling of comparative analysis is key to the fair and consistent grading of visual art. Also covered will be the circumstances of the project’s development and of issues particular to pedagogical practice within a S. E. Asian University. Although the project is just leaving Beta stage testing, the results are positive.

Introduction: Background to the Environment

The School of Art Design and Media (ADM), Nanyang Technological University (NTU), Singapore is a young (four years old) School inside an established University that is renowned for its engineering focus, as exemplified by its School of Computer Engineering (SCE). Despite the differences between their subject specialties, several ADM/SCE joint projects are in development, particularly in the area of computer graphics and modeling.

Serving all the schools of NTU, the Centre for Excellence in Learning and Teaching (CELT) is very active in supporting the latest advances in teaching and learning practice, such as the many tools available through its implementation of the Blackboard e-learning portal. However there was sometimes a gap between the solutions that were on offer and ADM’s developing pedagogical needs.

As a result of a collaboration between ADM, SCE and CELT an online application was developed to address these needs.

Problems Particular to Grading and Review of Digital Art Within ADM

Any grading and review application developed with the needs of ADM art faculty and students in mind has to address a particular set of problems:

Grading of Visual Art

An art teacher’s job is not an easy one. The link between an image and a metric of value is simply too obscure to be subject to easy management. In the grading and review of art work, what is needed is a system that is as consistent, accountable and systematic as the circumstances will allow.

At every level of art practice, context-driven decision-making is prime. From the ‘atomic’ scale of human perception as identified by H. Helmholtz, E. Land and others to the semantic webs of meaning as discussed by J. Baudrillard, it is clear that the entire fabric of art practice is referentially driven.

This is apparent ‘on the shop floor’ where art teachers operate, to one degree or another, according to principles outlined by the **Law of Comparative Judgment** as laid out by L. L. Thurstone (1992) and addressed

in a teaching context by A. Pollit and V. Crisp (2004) and others. At its root the Law of Comparative Judgment is the contextualization of quantitative judgment through a process of pairwise comparison (e.g. X is *bigger* than Y but *smaller* than Z). Comparative Judgment is easy to implement if the teaching is being delivered within a traditional-media based studio environment where drawings and paintings pinned up on a wall, but in a digital lab it can be cumbersome and slow. The loading of work files (e.g. .psd) and their previews (e.g. .jpg) onto the professor's computer from handed-in CDs is a slow process, as is their cross-referencing with other sets of needful information such as attendance and previous performance.

To enable efficient Comparative Judgment students photos, student names, notes, messages, assignment descriptions, assignment grades and assignment submissions should all be easily cross-navigable and sortable. Also, it is as important that a student's work be reviewed in the context of work by their peers as in the context of previous work by that same student. It was felt that this multiplicity of references is needed should a fair judgment be arrived at and is close in style and intent to the Analytic Hierarchy Process as outlined by T. L. Saaty (1986). An ease of access across this range of information was regarded by the authors as the prime requirement of any application or approach that they developed.

Other Problems

The project began with a informal review of current grading practice within the School. From this it was apparent that ADMs **grading structures** had developed in a manner that could generously be described as organic. Practically all faculty had developed unique ways of grading that might or might not have involved letters, numbers, criteria, weighting etc. To construct a model that could perfectly serve all of these would be impossible and the best that could be hoped for was a majority favor.

To avoid the problems of storage, audit and display that would accompany an institution-wide system that catered to every Asian name permutation, NTU choose to store the entire name, in whatever configuration it was inputted, as just one data element. Unfortunately, the benefits of this solution did not extend to the teachers, who found this system (or apparent lack of it) confusing and inconsistent. Without an intimate knowledge of the many **regional naming conventions** it was very hard to know for sure by which name a student should be addressed in class.

The Shortcomings of Pre-Existing Systems Within NTU

In the development of a application that would serve these identified needs, the existing toolset was the author's first point of reference. These were all found to have shortcomings.

NTU's **Blackboard** implementation, called 'edveNTUre', had been designed to serve the many engineering Schools that are a major feature of the University. Though they worked well for text and exam orientated areas such as art history, they did not efficiently serve the courses that delivered studio practice disciplines such as photography, film etc. The only tools within edveNTUre that were capable of accommodating a review of visual data were:

The **forum tool**, which enabled discussion to take place between the professor and the students. Images could be posted as links but would not preview easily. The threads were also displayed 'collapsed fashion' which made it difficult to navigate quickly from one entry to the next. This made visual comparison very difficult.

The **Wiki tool** was an improvement on the forum tool. A thread could be visually navigated in a single stream from start to finish. It was also possible to filter a thread so that only posts from a single student were visible. However, the process for handling the source and preview files was less than elegant. Despite being asked not to, students would often upload huge previews that slowed down the review process. Source files were even more problematic. They could not be uploaded directly from the blog or Wiki, and had to be linked to via the Digital Drop-Box. This process was not straightforward and students were always getting it wrong.

The Forum and the Wiki edveNTUre tools were both usable, though not ideal, for the review of student work but they could not accommodate the storing, collating and sorting of grades in relation to this work. Though cross-comparison between such things as the attendance register and the wiki tool was possible, it was not easy or quick, with each tool being very monolithic in its nature.

The authors briefly cast their eye to solutions that had been developed outside of the University. Project e-scape, developed at Goldsmiths' College by R. Kimbell, was an engaging attempt at a web-based learning

environment aimed at the teaching of design and technology to secondary education. Though not suitable for the needs of higher education, of interest to the authors was the project's embracing of comparative analysis in the grading and review of visual work.

Interim Solution (FileMaker)

FileMaker is a relational database development application made by FileMaker Inc. Using this, it was easy enough for one of the more technically-savvy members of ADM faculty to create an interim solution (Figure 1).

Though the result made grading and attendance-tracking a lot simpler, it had many disadvantages, for example, data such as students' names and mail address needed to be manually inputted by the teacher and its user preferences were not very sophisticated. It is possible that a better FileMaker solution could have been developed given enough time and resources, but it would never have had the flexibility of a home-grown solution.

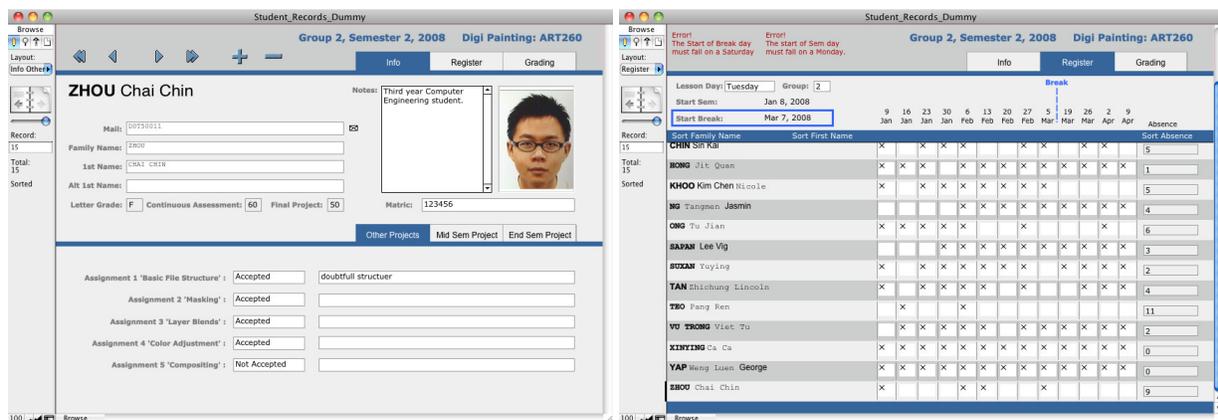


Figure 1: FileMaker interim solution: student details view and register view.

Despite its shortcomings, this approach was an improvement on the existing solutions. However, in retrospect its best function was as a high-level prototype. Many of the ideas that had been arrived at in its development went on to be implemented in the final application.

The Development of the Solution

During a Teaching and Learning Seminar that had been organized by CELTS, ADM faculty presented the FileMaker project. During the event, faculty from SCE approached them with the suggestion that the project be handed over to a couple of SCE students as part of their Final Year Project (FYP). A completely customized solution could then be developed and perhaps even implemented into edveNTUre.

Most of the basic functionality had been already been identified in the development of the interim solution. However, SCE suggested that an extra workbench component be added. This would enable the arrangement of assignments in free visual association to each other.

Also to be included was a student user component. From there a student could edit their own user information. They could also upload assignments directly to the database and communicate with the teacher via a chat-like interface.

From that point onwards, ADM and SCE met on a weekly basis to identify and address all aspects of the application development. ADM was clearly the customer driving the application development, and SCE was the vendor, designing and building the application. However, the delineation of roles did not impede their close collaboration on the project. Although it was never referred to as such, to all intents and purposes, the application was the subject of Joint Application Design (JAD). This enabled the team of professors and students to

evolve the requirements according to the needs of the teachers and within the limitations of the technology, in a transparent and conducive manner.

Development Issues

The development of the application was not a simple affair. The development model the evolved was a ‘trickle down’ approach, with resources being borrowed, improvised and begged. The team began as two FYP students (good programmers but first-time application builders), two members of faculty from ADM and SCE and a manager from CELT.

PowerPoint was used to enable an exchange of information visualization ideas between the team. Though not perfectly suited to the purpose, it nonetheless proved to be reasonably effective in the conveyance of those ideas. Google Sites was used as a vehicle to exchange more sophisticated information.

Because of the grading guidelines in SCE for its FYPs, the two FYP students had to manage their projects such that they were self-contained and separate. It was the responsibility of the faculty members to define the shared assets and structural commonality between the projects. The two projects were:

The Database- (SCE08-0161):

Development of a Web Platform to Enhance the Interaction of Faculty with Their Students and Integrate with edvENTure

“...will provide an enhanced information exchange between the faculty and his/her students.” (SCE student Wang Shunde)

The Workbench- (SCE08-0164):

Development of an Extensible and Scalable Many-ImageObject Viewer and Add-on to Web Platform Project

“...a viewer of image objects that contains and displays hundreds of thumbnail images in a single web page, and can support tens of page instances running simultaneously.” (SCE student Lim Chee Han)

Unifying these two different applications (Figure 2) in terms of data, appearance, behavior and workflow was not easy, especially as they were being authored by two different people.

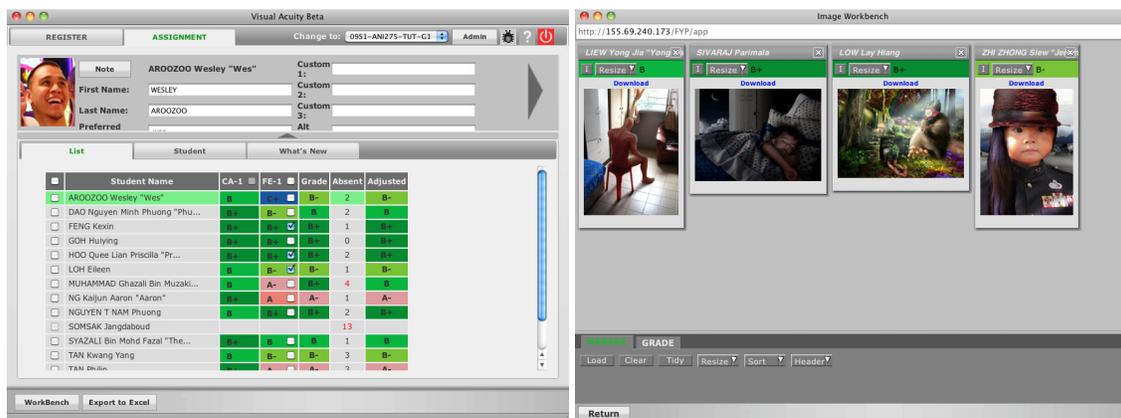


Figure 2: Database (left) showing three images selected in the submissions list view. Workbench (right) showing the selected images loaded.

Establishing a clean, intuitive GUI was a key aim of the development process. It should be observed that this was not an important part of SCE FYPs, where proof of concept and algorithm design were usually held in higher esteem than usability. Great attention was paid to how the application's ‘flow of use’ was served by the visual vocabulary of its design. Informing this were two key principles:

- That **consistency** of color, form, behavior etc was observed throughout. (e.g. light green was used everywhere to denote ‘I am here’ such as: selected tabs, selected students, button mouse-overs etc).
- That as much as possible of the GUI was made **unobtrusive** or hidden until the context required it (e.g. by clicking on a small arrow the top information panel could be hidden thereby increasing screen real-estate, also the gradual reveal of tick boxes in the preferences as shown in Figure 4). A key factor in selecting this approach was the large proportion of ADM faculty who were less that comfortable with using digital applications.

The design process was 70% a process of simplification (Figure 3). Given the digital art roots of its user base, it is not surprising that the exemplars of good GUI design were all drawn from the world of digital arts, e.g. iPhoto, Final Cut Pro, Modo etc.

After the student’s FYPs had reached a reasonable conclusion and the results handed in, the project was moved to CELT where the same two students were hired as developers. Their job was to work on the project with a view to its integration into edveNTure.

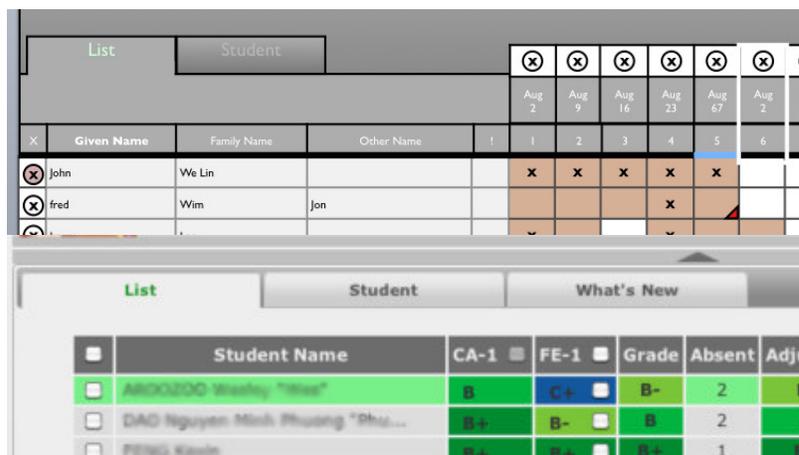


Figure 3: The Assignment List View in Prototype (top) and current Beta (bottom) showing the effect of the simplification process.



Figure 4: The gradual reveal of tick boxes according to previously inputted information.

The development of the workbench component of the application was handled by a system called the Echo3 Web Framework by NextApp Inc (©2002-2009). This system was fairly easy to configure and localize and its adoption was a key success factor in the project.

The last and possibly most intransigent of issues the team faced was the data synchronization between

the workbench and the database. They were two separate servers, and the main problem was ensuring that data entered on one was automatically refreshed on the other. For security and integrity reasons, we chose to have a pull approach, where the database server pulled updates from the workbench. However, certain values, e.g. grades and assignment structure, had to be dynamically processed according to algorithms in the data-tables, and the pushing of the result to the workbench server was problematic. If the two applications were active at the same time data could become out of sync. This was solved by a manual refresh being effected during the navigation from one application to the other within the same window. Not an elegant solution from a computer engineering point of view, but effective and transparent to the user.

Beta Testing

The project has been in beta for one Semester at the start of which it acquired the name: Visual Acuity. The testing group of nine faculty were chosen for their range of IT confidence (some high, some not so) and the subject areas that they worked within (most digital, some traditional media). The project is still in beta but so far the feedback has been very positive. The user survey requested narrative responses to the following questions:

- Was grading simpler using Visual Acuity? If yes/no, then how?
- Was taking the register simpler using Visual Acuity? If yes/no, then how?
- What things do you think could be improved about Visual Acuity?

In the eight responses received everyone expressed broad satisfaction with the results. Some feature requests were for things that already existed or had been implemented within the Beta testing period and the user had not noticed (or that the software had not made apparent). The aspect that elicited the most negative feedback was the setting of assignment criteria which one user criticized as being too complex. A data entry wizard is planned as a possible solution for this. All users commented directly or indirectly on the way that grading had been made a lot easier by the inter-relationships that existed between the data. Some made mention of how well Visual Acuity served the particular needs of the school, though it is hoped the broad principles of what has been achieved are able to travel to other schools within NTU and beyond. Many have asked for the application to be made available for use during the following semester.

All feedback can be seen in the link: <http://sites.google.com/site/gradingapplication/feedback>

An unsolicited mail from one of the users reads: *I absolutely love this software! It has made grading almost enjoyable this time around.*

Formal and informal feedback seems to demonstrate agreement with the basic premise of the project: that the assigning of grades is best served if the interconnectedness of important and relevant data is observed.

Though it has yet to be systematically gathered, feedback from the students has been generally positive though not as rave as the faculty's. However, judging by the responses from the beta testers it was apparent that the students benefited from better communication between teacher and student, increased efficiency of information tracking, fairer grading, etc. The authors regard the general invisibility of the application to the students as being a good thing. It was meant to enable their education, and not be a feature of it.

We hope to conclude the beta testing with another round of feature and function enhancements, and then field the application for general use in the whole of ADM. Following this it is hoped that the application will be incorporated into edveNTure and offered for use to the wider community in the university.

Tables 1 to 3 presents a partial list of notable features of the Visual Acuity.

Assignment View		
Name / Function	Features	Cross Navigation
<p>Assignment List Where all assignments by all students are listed.</p>	<p>Grade is color-coded</p> <p>Attendance is displayed and automatically impacts upon final grade</p> <p>Entries with files associated with them have tick-boxes</p> <p>Mouse hover on letter grade reveals number grade</p> <p>Many grading models are supported (figure 6)</p>	<p>Student View by clicking on assignment entry</p> <p>Workbench View by selecting assignments and pressing Workbench button.</p> <p>To other groups via drop down menu top corner</p>
<p>Student View (Figure 5) Where individual responses to assignments are displayed and graded</p>	<p>Previews of assignments (e.g. .jpgs) are displayed</p> <p>Work files (e.g. psd) are downloaded</p> <p>Grades are assigned</p> <p>Comments made</p> <p>Comments can be selectively hidden from students</p> <p>Student can reply to comments</p> <p>All comments emailed to students and teachers</p>	<p>To assignment description by clicking on assignment name</p> <p>To next assignment by that student by pressing bottom set of arrows</p> <p>To the same assignment by the next student assignment by the next student in the list</p> <p>To other groups via drop down menu top corner</p>
<p>Whats New</p>	<p>Recent student activity is tracked</p>	<p>To other groups via drop down menu top corner</p>

Table 1: Partial list of components and notable features of Visual Acuity: Assignment View.

Register View		
<p>Attendance List Where students are listed and attendance tallied</p>	<p>Date range is set with a minimum of fuss by user prompts on first use</p> <p>Mid semester break is denoted by a blue vertical line</p> <p>Custom fields are selectively displayed in column area</p> <p>Absences are tallied</p> <p>A student's absence over a prescribed amount is highlighted in red</p>	<p>Email view by selecting students then clicking email button</p> <p>To other groups via drop down menu top corner</p>
<p>Photo Gallery</p>	<p>Large photos of students are displayed</p>	<p>To student details in top pane</p> <p>To other groups via drop down menu top corner</p>

Table 2: Partial list of components and notable features of Visual Acuity: Register View.

Email pane	Can send emails to group or individuals Copies of mails sent to teacher	
Both list views	Columns are sortable Custom field is optionally on view Mouse-over on student name reveals photo of student Notes can be made on student which indicate as note icons in lists	To other groups via drop down menu top corner
Work Bench view	Images of assignments are freely movable Images can be re-sized (S, M, L) Assignments can be graded Possible to grade between two different groups Images can be sorted by grade, name etc Arbitrary sorts can be passed onto database	To other groups via drop down menu top corner To alternate assignment loading view where assignments from different groups can be loaded

Table 3: Partial list of components and notable features of Visual Acuity: Miscellaneous.

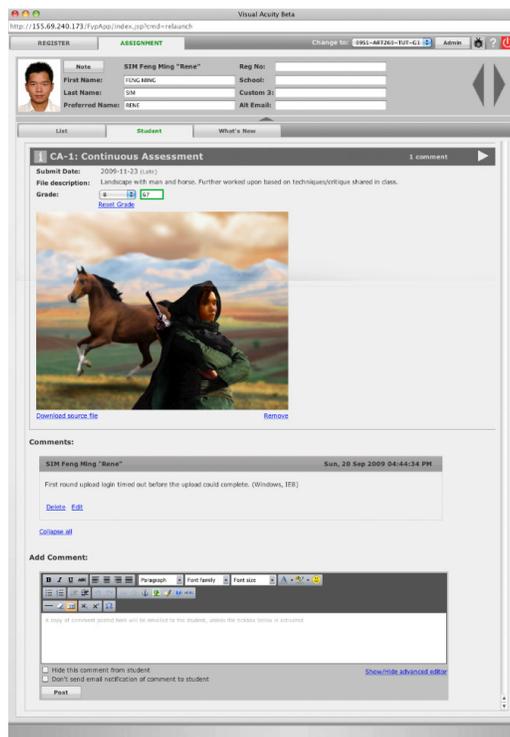


Figure 5: 'Assignment' / 'Student View' tab, where the faculty user may post comments to the student and also assign grades to work. The top grey box is common to most views and contains student data. Notes can be made and student data can be edited.

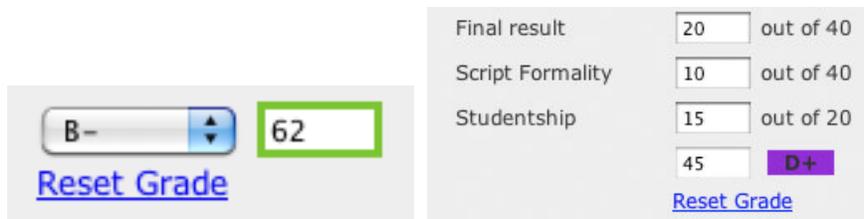


Figure 6: Many grading models are supported, Shown above: letter/number based (left) and Criteria based (right)

Asset: A movie of the application can be found here: <http://sites.google.com/site/gradingapplication/movies>

Future Work

We will conclude the beta testing with another round of feature and function enhancements. Setting of the assignment criteria will be made easier by the use of data input wizards and the help manual will be improved and updated. Possible future extensions of functionality will be explored, including adapting the workbench component of Visual Acuity to enable a class its use as a platform for group discussion. However, it will not be forgotten that one of the reasons for the successes of Visual Acuity is its simplicity and ease of use. Anything that resembles feature creep will therefore be avoided.

Conclusion

Close cooperation between a centre of educational technology and two schools (one arts and the other engineering) lead to the successful development of a digital art review, grading and assessment application. The group worked with existing resources and in a JAD arrangement. Now in beta release, the feedback from the teachers has been resoundingly positive, and from the students accepting and satisfied.

One of the authors is the Chair Academic of ADM. As such, one of his main duties in the last year was the organizing of a major curriculum revision. As is common with most modern curricula, a cornerstone of this exercise was the authoring and editing of countless Objectives and Outcomes. It is a universally received wisdom that the empirical surety these pedagogical devices offer is an insurance against the inconsistency of a subjective response to student performance evaluation. He therefore found it ironic that he was engaged in a project that placed such emphasis on relative judgment. However, in a school (especially an art school) the two approaches must learn to live under the same roof. As R. Kimbell points out:

It is not that criteria are not important in any assessment regime, because of course they are. It is just that, rather like recent converts to a new faith are likely to be the most ardent, the 'conversion' process I was witness to in the UK from the early 1980s (from norm-referenced to criterion-referenced assessment) tended to carry with it a highly simplistic formula:

- Norm-referencing is bad and even immoral (it compares children with each other)
- Criterion-referencing is good and morally preferable (it is based on objective external truths).

Inevitably, the harsh reality of assessment in schools soon demonstrated that the two are not mutually exclusive, but, rather, are dependent upon each other. (Kimbell 66)

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