In The Development of VRML Environments for the Testing of Architectural Aptitude

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Abstract. Schools of architecture offer admission based on a score system that combines school grade point average (GPA) and standardized testing. Unfortunately, GPA values can give an indication on the academic aptitude of the student but they tend to fall short on describing the potential of the student as a designer. The same may be said of standardized tests that address general verbal, mathematical and analytical skills but lack an adequate framework for measuring all the skills that aid us in performing design processes. This paper will elaborate on the feasibility of developing an on-line testing environment that may address the assessment of fundamental 3-dimentional skills as an additional indicator of potential success in the field of architecture.

Keywords. Spatial Ability, Psychological Tests, VRML.

The problem

Access to higher education for everyone is an ideal, not a reality. Most schools of architecture have more applicants than openings at freshman level. This is a common situation in undergraduate programs and it is becoming a serious problem in design-based graduate programs as well. It is common to find that top tear graduate programs in the United States have applicant-to-admission rates in the rage of 10-to-1.

At undergraduate level, schools of architecture offer admission based on a score system that combines high school grade point average (GPA) and standardized testing results. Unfortunately, GPA values can give an indication on the academic aptitude of the student but they tend to fall short on describing the potential of the student as a designer. The same may be said of standardized tests that address general verbal, mathematical and analytical skills but lack an adequate framework for measuring the skills that aid us in performing design processes. The GRE Exam is a good example of such standardized tests.

At graduate level this equation of GPA and GRE scores is even more unreliable. In the case of undergraduate applications the origin of the pool of applicant is largely homogeneous and it is possible to compare the GPA scores of students coming from a relatively small number of high schools. In the case of graduate students, the pool of applicants is extremely diverse and combines applicants that come from undergraduate programs that may display extremes on how they grade student performance. Portfolios can aid in the process of identifying design potential but it is frequent to find that the authorship of work displayed in portfolios is not always the singular merit of the applicant. In many opportunities we have found the same design project attributed to different applicants and we know that some design firms "compensate" their interns by granting them permission to use office work as their own and even furnish them with letters of recommendation that will aid them on such a misleading process.

We have searched for a relationship between design studio performance in graduate school and the GRE scores of our students. The results have failed to confirm a relationship. We have also tested the relationship between high GPA in undergraduate programs and high performance in graduate studios. Once more the results are not conclusive on showing a reliable relationship. A good student in general is not necessarily a good design student.

Current procedures

Aware of this limitation, many schools offer admission to students with high GPA scores and filter the freshman population during the first year of studies. Attrition rates in schools of architecture during the first year of studies tend to be among the highest in higher education. This tends to be a traumatic experience for the students, it is risky in terms of enrolment management and it is costly for the school because we have to teach a large number of students that lack the potential to become competent designers. Students that may never graduate.

Some schools have implemented individual interviews for filtering qualified students. In such interviews we try to evaluate their ability to observe their environment, their ability to recall imagery, their ability to structure knowledge, and their ability to imagine in a 3-dimentional context. Unfortunately, individual interviews are possible only as a last filtering process that can be applied to a small number of applicants. This process can not be applied to international students that will need a letter of admission before they can obtain a visa.

At graduate level the challenge of assessing the potential of an applicant is critical. Graduate programs are smaller than their undergraduate counterparts and therefore we cannot afford to offer admission to students that will weed themselves out of the program after a first semester or the first year of studies. For instance in the case of the Master of Architecture Program at Texas A&M University we offers 48 admissions every fall semester and looks forward to the graduation of at least 45 students every year. The margin for attrition is very limited. Further more, some of the students admitted will be offered financial awards that may amount up to $30,000 and it is certainly embracing for admission officers when a student holding a financial award delivers a poor design studio performance.

As coordinator of the Master of Architecture Program at Texas A&M University and as Chair of the Graduate Admissions Committee of that Program I have observed that our admissions process relies heavily on the experiential knowledge of individual application reviewers and that their day-to-day admission decisions are not always consistent. As a means of making the review of applications more consistent we have produced and currently use evaluation forms that offer a checklist of student performance criteria on which the reviewer must evaluate each applicant. As a template we use the list of 37 student performance criteria approved by the US National Architectural Accreditation Board (NAAB). Reviewers are asked to evaluate the awareness, understanding or ability to perform that each applicant may display in reference to each criteria.

Some criteria are easy to assess, others are in particular difficult. We have particular difficulty assessing Spatial Ability. In that framework we would welcome the availability of a geographically distributed testing environment able to assist us in the assessment of the spatial ability of applicants to our schools of architecture.

Testing for spatial ability

Clements and Battista (1992) define spatial ability as consisting of “cognitive processes by which mental representations for spatial objects,

Figure 1. Login into the Digital Charrette

relationships, and transformations are constructed and manipulated”.

The American Psychological Association (APA) offers guidelines for the search and development of psychological tests. However, all of these make reference to tests delivered making use of 2-dimantional media or 3-dimentional objects. The most common methods of assessing spatial ability are based on the following tests: Surface Development, Block Rotation, Perspectives, and Visual Memory. These are generic tests.

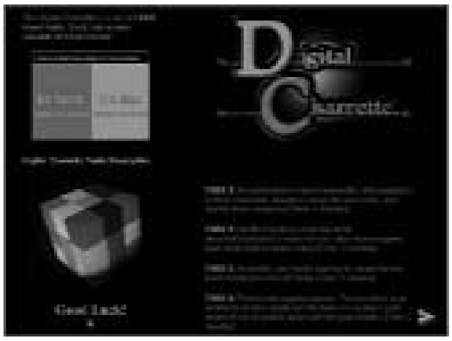

Figure 2. Task Description

Galen Buckwalter and others (1999) suggest that tests of spatial rotation ability that are administered in a Virtual Reality environment may prove to be a superior method of assessing spatial cognition.

With our current ability to simulate 3-dimentional space by means of VRML code and growing ability to deliver such simulations by means of immersive environments, it is evident that we can potentially improve the way we test for spatial ability. In such a framework, we are interested in the development of a VRML-based test environment that may be administered on-line to students that apply for admission to Master of Architecture Programs as an additional factor of assessment in the process of admissions.

Figure 3. Task One: Identifying viewpoints in a VRML model

In 2001, within the Master of Science in Architecture at Texas A&M University, Kameshwari Viswanadha developed a prototype of such a testing environment. The Digital Charrette (Viswanadha, 2001) was a VRML-based testing application that could be delivered via the Internet and was able to address 4 tests, namely: Identify viewpoints, volumetric subtraction, volumetric addition, and the creation of a positive model with a negative reference. Figures 1 to 6 illustrate the interface of the application.

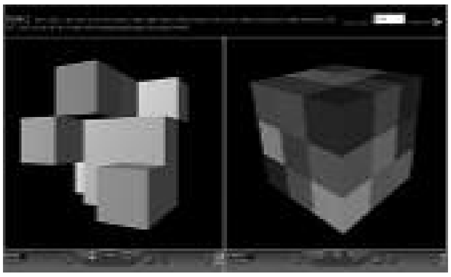

Figure 4. Task Two: Subtractive task

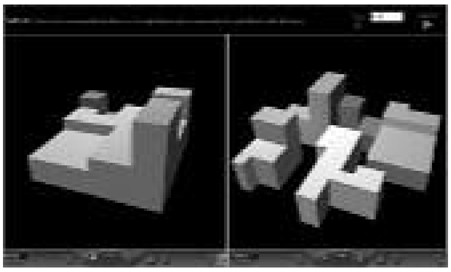

Figure 5: Task Three: Additive task

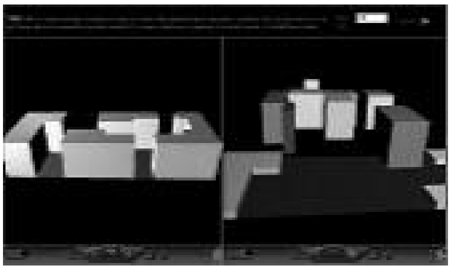

Figure 6. Task Four: Positive model of negative space

In late 2001 the Digital Charrette was tested among a small number of graduate students of architecture and a positive relationship was found between their performance in the VRML-based test and their design studio grades. These are preliminary results that point towards a positive potential that should be subject of further study.

We are currently considering the possibility of implementing a number of additional improvements on the Digital Charrette and testing it within a larger student group. This is a work-in-progress report that seeks to promote collaborative research on this subject.

Acknowledgement

I would like to acknowledge the assistance of Ms. Kameshwari Viswanadha on providing me with new illustrations of the interface she designed for the Digital Charrette.

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