# POURING NEW WINE INTO AN OLD DISCIPLINE: USING 3D TO TEACH AND REPRESENT THE PAST

By

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Historians today operate in a communication environment that is evolving as never before. New platforms, such as Augmented Reality, and new instruments of representation, primarily 3D objects, are emerging as constituents of computer-mediated communication[2]. Economic drivers, such as the formation of a consortium in Japan last year devoted to furthering the generation and distribution of 3D content over the web, suggest that in 10 to 15 years more people in more domains will be using computer-generated 3D environments to communicate[3]. For historians, this development poses specific challenges. The profession cannot afford to ignore 3D. To do so would be tantamount to dismissing the vernacular and sticking to Latin. To do so would mean ignoring the medium's potential to support new formalisms for interrogating and representing the past[4].

Instead, scholars in history and in the humanities in general would do well to construe the present as a period analogous to that faced by the first Roman scholars to appropriate the codex. As was the case with their Roman predecessors, historians today face the task of devising and testing new conventions for representation, narration and documentation to support their teaching and research. Historians need to learn how to explore data and tell stories with 3D. They further need to discern how 3D objects and environments can be used to support students' construction and understanding of the past. To meet these challenges, scholars will need to expand their focus from problem-oriented research to include practice-oriented research. The purpose of this paper if to offer the *3D Virtual Buildings Project* as a case study, one indicating how such a research agenda might be expressed and realized[5].

The *3D Virtual Buildings* is the product of a partnership between the *National Research Council of Canada*, *Industry Canada*, and the University of Ottawa. Its purpose is two-fold. Formed in 1998, its purpose is to provide students with the skills needed to generate models of historic settlements using 3D modeling software. Its more fundamental purpose, however, is to help participants realize an important concept: that historical models must be distinguished from the objects they purport to represent. Using

photographs and fire insurance maps, students through the project tutorial are afforded the opportunity to reconstruct the model shown in Figure 1, the building of James Hope, an Ottawa stationer in the 19th century. They are also afforded the opportunity to literally see a number of the problems that historians encounter while attempting to reconstruct the past. In this scenario, construction of a 3D artefact provides students with the basis to recognize and express the proper relationship between model and historic object. In this scenario, students are afforded the opportunity to learn this important concept via a representation other than print. The central premise of the project is that student-learning outcomes can be enhanced if a concept or content is communicated through more than one channel of expression, in our case via text and 3D object[6].

**Figure 1:**

National Archives of Canada, PA 9257

In the project tutorial, the project seeks to communicate three specific lessons about the historian's craft. Lesson one is that evidence is subject to misinterpretation. A naïve reader of the fire insurance map shown in Figure 2 would conclude that the structure shown here was 50 feet high. In fact, the map's cartographers followed a different convention, listing only the height of a structure's vertical walls. If a structure contained a sloped roof over and above the walls, that section's contribution to building height was ignored. Why is this important? Students learn that their interpretation of a document may not always match the original author's, or cartographer's intent. Stated another way, contemporary perception – or misperception – of a document can create a divide between a representation and the object it is supposed to map.

**Figure 2:**


National Archives of Canada, NMC-0010731
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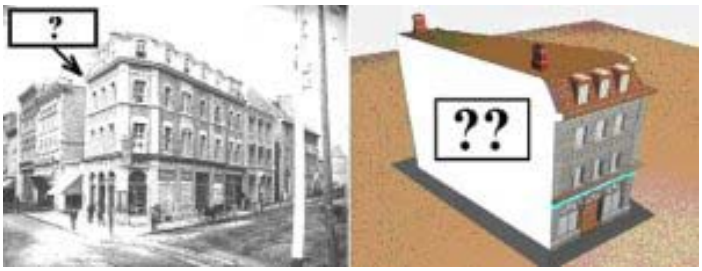
A second lesson is that evidence has gaps. In the case of the project's tutorial, the "gap" is an absence of data regarding the appearance of the wall shown in Figure 3 for the Hope building. To complete the model, students must make an informed guess as to its probable appearance based on a reading of the historic context, which in this case is the appearance of neighbouring structures. Why is this important? It enables students to realize that there is an element of uncertainty to the historian's craft, uncertainty that can never be overcome. There will always be things that historians do not know. Consequently, there will always be a distinction between representation and referent.

**Figure 3:**

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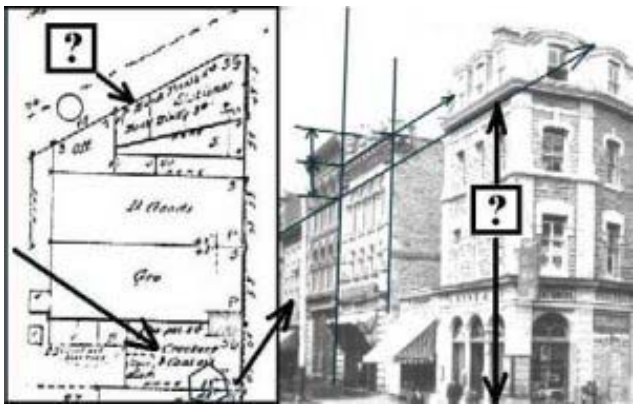
The third lesson of the project is that documents reveal more about the past when they are interpolated. Using this insight, our students are able to calculate the height of the Hope building. The fire insurance map on the left shows of Figure 4 indicates the absolute height of neighbouring structures, but not the Hope building. The photograph on the right indicates the relative height of all structures of interest. By placing the two together, students are able to ascribe an elevation point to the part of the Hope building indicated in Figure 4. Thereafter, using a little simple math, students are able to calculate a serviceable approximation of building height, namely 46.82 feet. Hence, through judicious combination of source material, students learn that a closer mapping between model and referent can be obtained.

**Figure 4:**



In 1999, 2000, and 2004, the project conducted informal field tests in classrooms at the high school and university level. Some positive, but limited, results were obtained. Some students were able to generate very good models, such as the ones shown in Figure 5. A few students indicated an understanding of the central concept we were trying to communicate, namely that historical representations are mediated representations. However, the project's field tests also revealed two important constraints that hinder the widespread use of 3D in the history classroom.

**Figure 5:**

Ottawa, 1878, corner of Sparks and Elgin Streets
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One important constraint was the complexity of the computer-aided drawing (CAD) software we provided our students, Nemetschek's *VectorWorks*. Many students required two to four weeks of sustained effort to master the software. And because of the software's inherent difficulty, many students were hindered in realizing the objective we set for them.

A second constraint hindering student performance was the interface of our CAD package. It, like many 3D modelling packages, is based on the supposition that users have a highly developed spatial intelligence, one capable of mentally visualizing and rotating the 3D wire-frame abstractions users see on their screen. In our experience, many students do not have this ability. They can perceive an object, say from the front, and perform an operation on it. But once they use the software to shift to a different view of the object, say from the right, many have a hard time interpreting what they see on their screen. The software imposes a cognitive load on students, one many are unable to meet.

As a result of its field tests, the project has reached three conclusions on the future viability of 3D as an instrument to support historical instruction. First, due to the limited success we enjoyed with some of our students, and findings in literature devoted computer-supported learning environments, project participants still believe the central

premise of the project is sound. Communication via multiple modes of expression – in our case via text and 3D model construction – can heighten student learning outcomes, and the development of critical thinking skills. The problem was not the conception underlying the project. The problem lay in its implementation.

Second, students in future will require access to alternative methods for generating and perceiving 3D objects. They will also require more time to learn and use 3D, if such objects are to be effectively exploited to support learning. Viable programs of instruction will require easy-to-learn software governed by a multi-modal interface, one that permits users to use voice, gesture and other methods to generate and manipulate their models[6][7]. Emerging media such as Augmented Reality, a form of representation in which computer-generated objects are integrated into a user's view of real space, may facilitate future students' perception of content.

Third, future iterations of this project and others will need to change the media they employ to support course instruction, particularly for 3D modelling. During our various trials, our students did not enjoy following printed course materials that were hundreds of pages in length. In retrospect, there is nothing surprising in this observation. Adults do not like using lengthy software manuals. Neither do teenagers. Future instruction will need to rely on alternate media such as streaming audio and video.

To conclude, the purpose of this paper has been to suggest that for historians there are rich opportunities to be garnered from using 3D objects and environments, and that they must make every opportunity to seize them. Put simply, aesthetics has a bearing on epistemology. Our capacity as scholars and students to perceive important ideas and trends is often dependent on the methods we use to represent data and evidence. For historians to derive the latent benefit of 3D, however, they will need to devise a research agenda devoted to ensuring 3D supports their aspirations as researchers and teachers. Now is as good a time as any to start.

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**Endnotes:**

[1] Copyright: John Bonnett, *Pouring New Wine into an Old Discipline: using 3D to Teach and Represent the Past*, NRC 47170. © 2004, National Research Council of Canada.

[2] For an introduction to the emerging field of Augmented Reality see Steven K. Feiner, *Augmented Reality: A New Way of Seeing*, in *Scientific American*, April 2002. Available on-line: http://www.sciam.com/article.cfm?colID=1&articleID=0006378C-CDE1-1CC6-B4A8809EC588EEDF.

[3] *Japanese Consortium Formed to Create 3D Display Market*, «Electronic News», 4th March 2003. Available on-line at http://www.reed-electronics.com/electronicnews/index.asp?layout=article&articleid=CA281462&rid=0&rme=0&cfd=1 [28th July 2004].

[4]. A growing number of scholars in North America have begun urging colleagues to consider anew the aesthetics of history. The premise is that 3D offers potential, as a formalism for interrogation, capable of unearthing patterns that others may not, and as a formalism for narration, for presenting dynamic patterns that others cannot. On this point see David Staley, *Computers, Visualization and History: How Technology Will Transform Our Understanding of the Past*, London and Armonk, NY: M.E. Sharpe, 2003; William Thomas, *Blazing Trails Toward Digital History Scholarship,* «Social History», 2001, 34(68), pp.415-426; Chris Butler, *The Use of Flowcharts in the Teaching of History*, in: Orville Vernon Burton (ed.), *Computing in the Social Sciences and Humanities – Wayfarer CD: Charting Advances in Social Sciences and Humanities Computing*, Chicago, University of Illinois Press, 2002; Tom Taylor, *Historical*

*Simulations and the Future of the Historical Narrative*, «Journal of the Association for History and Computing», September 2003, 6(2). Available on-line: http://mcel.pacificu.edu/JAHC/JAHCVI2/ARTICLES/taylor.HTML. [12th February 2004]; Tom Taylor, *Using the Simulation CIVILIZATION in a World Survey Course*, «History Microcomputer Review», Spring 1994, 10:1, pp.11-16.

[5] *The 3D Virtual Buildings Project*. Available on-line at: http://3dlearning.iit.nrc.ca/3DVirtualBuildings [28th July 2004]. For a fuller description of the project see John Bonnett, *Following in Rabelais' Footsteps: Immersive History and the 3D Virtual Buildings Project*, «The Journal of the Association for History and Computing», Settembre 2003, 6(2). Available on-line at: http://mcel.pacificu.edu/JAHC/JAHCVI2/ARTICLES/bonnett/bonnett.HTML. [28 July 2004].

[6] On this point, see David H. Jonassen, and Chad S. Carr, *Mindtools: Affording Multiple Knowledge Representations for Learning*, in: Susanne P. Lajoie (ed.), *Computers as Cognitive Tools, Volume II: No More Walls*, Mahwah, NJ: Lawrence Erlbaum Associates, s.d., pp.165-196.

[7] For an introduction to the subject of multi-modal interfaces in computers see: Stéphane H. Maes and T.V. Raman, *Multi-Modal Interaction in the Age of Information Appliances*, «IEEE International Conference on Multimedia and Expo, 2000, I, pp.15-18; Yigal Arens, *A Knowledge-Based Multi-Modal Interface*, «AI Systems in Government Conference, 1990. Proceedings., Fifth Annual», 1990, pp.112 –119; Kenneth Cox et al. (eds.), *A Multi-Modal Natural Language Interface to an Information Visualization Environment*, «International Journal of Speech Technology», 2000, 4, pp.297-314.