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Archaeology Excavation Simulation

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Abstract Museums offering archaeological programs often attempt to use the "sandbox approach" to simulate archaeological excavation work. However, in light of the definition of simulation, and given the realities of actual professional practice in archaeological excavation, the author argues that the activity of troweling for artifacts in loose sand places the emphasis of such programs on activities that are not realistic and therefore actually counterproductive — if not miseducational. The author presents an alternative approach to simulating excavations in museums that is much more realistic and places the program's primary emphasis on the precise skills professional archaeologists actually must carry out in excavating and analyzing archaeological sites.

The pointed mason's trowel is the primary tool of archaeological excavation work. Placing a trowel in students' hands so they can encounter the "clink" of artifacts hidden in a sandbox or other loose medium is a common approach used by museums to simulate excavations of archaeological sites. On the surface, this might seem to be the most obvious way to allow museum program participants to experience what archaeologists actually do in the field to recover important information about the past. Nevertheless, this article examines the nature of sandbox troweling compared to actual excavation practice by professional archaeologists. It also follows the call for critical museology, based on new museology in which "a critical stance is being taken towards old assumptions and ways of working."[1] I believe that self-reflexive analysis of museum practice is absolutely necessary here. Beyond museology, from the perspective of the science being simulated, attending to the actual appearance of professionally excavated archaeological squares points directly to a much more effective method of simu-

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lation outlined below that: 1) is a much more accurate representation of select significant aspects of the process and results of excavation work, 2) requires participants to apply the specific psychomotor and analytical skills archaeologists actually use, and 3) is easily repeated in a museum or school setting.

Simulation Program Perspective

Typically, museum archaeological excavation simulation programs as well as many of those recommended by the Archaeological Institute of America employ sand or other material (including baked cakes) salted with artifacts to simulate archaeological sites that can be "excavated" by participants using trowels.[2] However, this sandbox approach misdirects program emphasis toward the troweling activity that is itself patently inaccurate. It is crucial here to consider the nature of actual archaeological sites. Generally, they are composed of relatively hard packed layers of soil more or less interspersed with plant roots and non-artifacts. Indeed, apart from the "clink" of a trowel on an artifact, the sandbox experience is so far removed from real archaeological excavation work as to be miseducational. This is particularly so kinesthetically, for example, where students stand at raised sandboxes instead of working on their hands and knees as archaeologists typically do. Archaeological troweling skills (using blades filed sharp to slice through roots and hardpan) are best taught and experienced on an actual archaeological site where trowel users develop blisters and then calluses. In this light, a strong case can be made to avoid unrealistic museum sandbox activities and to redirect the program emphasis toward the skills archaeologists employ that can be simulated correctly. This is important, given the ethical requirement for accuracy in museum programs.[3]

Turn next to the definition of simulation in order to understand other significant problems with sandbox troweling. Simulation is: 1) a model or set of circumstances imitating a real or hypothetical thing, state of affairs, or process, 2) a representation of select key characteristics of the operation or features of one process or system through the use of another, and 3) a simplified version of reality bounded by artificial constraints and a limited number of variables. Related issues include: 1) valid sources of information, 2) selection of cardinal characteristics and behaviours to model, and 3) validity of outcomes.[4] Unrealistic troweling in a sandbox cannot be a valid source of information for students. Actual archaeological site soil conditions are neither easily nor accurately replicated. Logically therefore, other significant elements of archaeological processes should be selected for simulation. Surely, museum simulations should aim for more valid

Figure 1 Under the direction of professional archaeologists led by Mike Kelly, high school students from Thompson, MB, the author, and other teacher supervisors excavated the site SIL 182 located on Sandhill Bay, Southern Indian Lake in northern Manitoba, Canada. This prehistoric boreal forest site was being salvaged in 1975 prior to flooding caused by the hydroelectric Churchill River Diversion Project. Photo by the author.

outcomes than what is essentially a sandbox "treasure hunt" that is far removed from actual archaeological skills and modern priorities of the profession.[5] In short, we cannot replicate the entirety of reality in a simulation and, therefore, need to make wise choices upon which elements to focus the simulation exercise. We must examine actual archaeological excavation practices to identify the elements that can be simulated accurately in a realistic way.

An Alternative Approach

As seen in Figure 1, excavation troweling is normally carried out in carefully controlled horizontal levels.[6] Therefore, the results of properly excavated squares appear as flat surfaces with artifacts and/or features (structures or other non-artifact evidence of human activity, e.g., a fire pit) that have been exposed in their original positions. This is the foundation of my approach to simulating excavations.

Simply placing archaeological artifacts and simulated features on a flat surface is the most accurate way of simulating a properly excavated archaeological square. In this light, the obvious solution to simulating the reality of stratigraphy (the study of the layers of sediment and occupation in an archaeological site) is to use layers of paper to separate one "excavation" level symbolically from

another.[7] This approach accurately and simply represents exactly how professionally excavated squares appear. This arrangement is easily produced without wasting participant — not to mention staff — time on the muss and fuss of attempting to imitate three-dimensional soil conditions. Sand or other forms of aggregate that must be removed in a misleading manner can be elegantly avoided using the approach described here.[8]

In light of the above considerations, I developed the following school program in 1994–5 while employed as Curator and CAO of The Sam Waller Museum, a department of the Town of The Pas, Manitoba, Canada. It addresses the Manitoba grade eight social studies curriculum, "People Through the Ages," for the unit dealing with "Reconstructing the Past — Archaeology." I firmly believe that the most effective approach to structuring school programs is to avoid the "one-off" in favor of serial sessions, so I organized the following program in three separate parts.

The first session involves an in-class presentation showing archaeologists working on excavations. Ideally, the images of properly excavated squares serve as exemplars for the simulation elements. This presentation helps students recognize the artifacts and features created for the following exercise. The orientation session emphasizes the need to preserve and report archaeological sites and the legal restrictions concerning excavation. Therefore, just as archaeologists do, participating students are required to read and sign a permit agreement to "excavate" the simulated site. Additional details on this program and its target excavation are pictured on the "Archaeology Excavation Simulation" web site.[9]

The second program session involves the simulated excavation activity. The exercise is portable so that it also can be set up on school premises (given the availability of sufficient open floor space equivalent to classroom size). This program originally supported preliminary mock-ups of permanent exhibitions featuring local archaeological sites, so all were delivered at The Sam Waller Museum to permit students to view the displays before carrying out the excavation activity.

The simulated site is built on the floor using three stratigraphic layers including a prehistoric bottom level, a historic middle level, and a modern surface level. The surveyed grid of the archaeological site seen in Figure 1 is simulated by means of ½ x ½ inch wooden posts glued and nailed to small quarter-inch plywood bases that serve as uprights to support the cord that marks the limits of each excavation square. I recommend that squares should be reduced in size from the normal 1 meter to 75 centimeter squares. This permits participants to measure and map findings without needing to step into the square and possibly

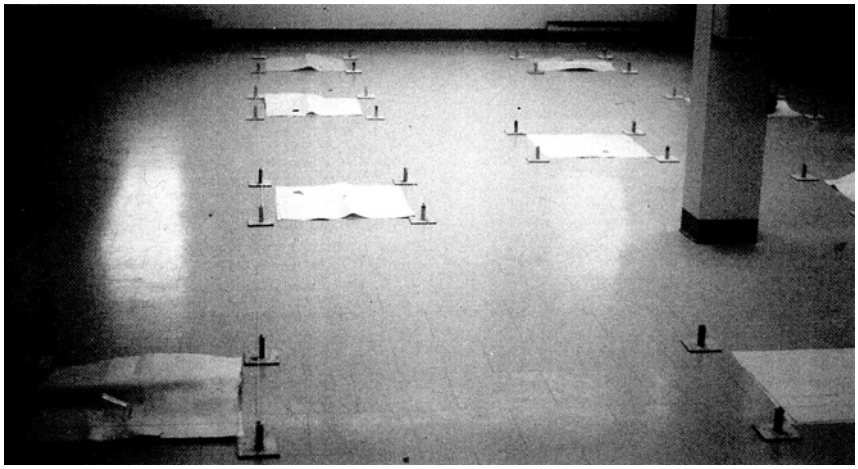

Figure 2 A setup at The Sam Waller Museum ready for "excavation" by students. Archaeological sites are often sampled in this way rather than being completely excavated, as was the case in the salvage work pictured in Figure 1. Photo by the author.

crush items hidden in the lower levels. Assigning one or two students to "excavate" each square works best.

Given that many museums possess unprovenanced archaeological artifacts or teaching collections with appropriate materials, real artifacts from an archaeological context should be used in this program to provide invaluable hands-on experience with real objects.[10] The basic strategy in this simulation is simply to place artifacts scattered or concentrated as they would be found by excavating an actual archaeological square. Various kinds of feature imitations as described below also are included. In designing the individual squares on the site, I place at least one artifact or feature on each level of every square in order to evenly distribute the archaeological recording work among the participants and to give each student at least one or two archaeological artifacts to examine during the course of the excavation activity. This also allows the design of meaningful patterning of activity areas in the simulated site that can closely replicate findings in actual excavations.

Depending on the grade level of the students and the complexity of the site desired, participants who have been oriented effectively in the first session need between an hour and an hour and fifteen minutes to "excavate" and record three levels. Students must apply previously mastered skills from the geography and mathematics curricula to measure the location of the objects discovered in relation to the cords outlining the square and map each level to scale in exactly the

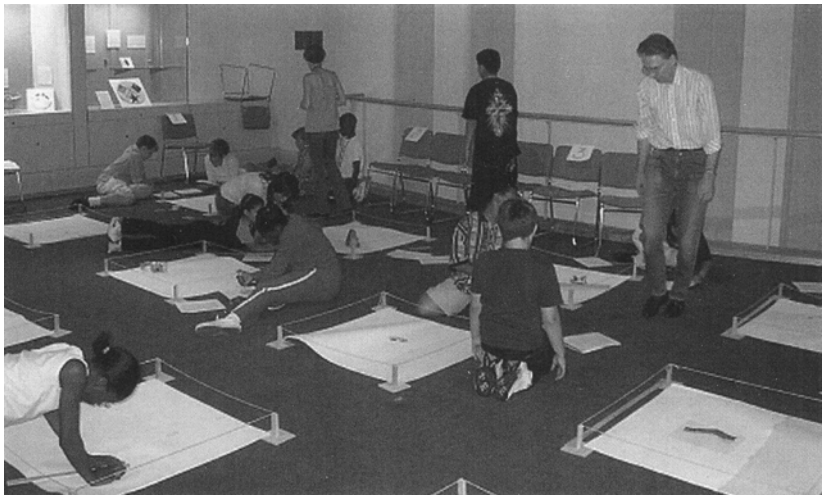

Figure 3 Excavation simulation activity as offered to students as part of a course in the Beloit Academy Summer Program by the author (as Curator of Exhibits for the Logan Museum of Anthropology at Beloit College in Beloit, Wisconsin). Note the ergonomics of participants imitate archaeologists in the field. Photo by William Green, Logan Museum of Anthropology, Beloit College.

same way archaeologists do in the field. Once findings in the square are mapped, students pick up the objects and examine them in order to record details on somewhat simplified square level summary forms. This is the same way archaeologists record their findings. The forms that challenge students to practise technical writing skills can be seen on my web site.

Beginning with recording a modern surface level allows the interpreters assisting the students to focus on the skills involved in measuring, scale mapping, and square level recording without having to deal with many questions about the less familiar nature of historic and prehistoric materials found in the lower levels. Indeed, many students find the measuring and mapping tasks to be rather challenging to start out. Beginning with more familiar items also provides an easy entree to later site analysis. In order to simulate the structure and organization of real archaeological sites, the surface level simulates two activity areas. I create a picnic area by using such items as fried chicken bones, plastic utensils, packaging, and bottles or soda cans. A sport activity area is represented using an old running shoe, broken bat, sun glasses, a coin dropped out of a pocket, and a lost key, etc. On the modern level, I also include a fallen tree branch with no evidence of human alteration in order to generate a later discussion on what is an artifact and what is not.

Once the surface level has been recorded, students remove the first layer of paper to reveal a perfectly "excavated" square to record. By eliminating the time-wasting and inaccurate troweling activity, attention centres on other important aspects of actual excavation work. Historic level simulation elements include artifacts such as a trade axe head, padlock, button, and nail (that can lead to discussion of dating by means of nail evolution).[11] As seen on the author's web site, historic features can be simulated by means of using a very weathered wood plank cut to fit the paper square or by gluing rotten wood on stiff cardboard.

Once students map and record the historic level, removing the paper reveals another realistic square simulated as a prehistoric level. Actual stone tool production waste flakes, a scraper, and only one complete arrow head (avoiding inaccurate projectile point overemphasis) are distributed among the squares. Bone tools such as awls are useful as well. Real pottery sherds and items such as a scattering of fish bones (salvaged from cans of salmon) and fresh water clam shells replicate a food processing area. Here, features such as drying or smoking rack post molds can be simulated realistically by gluing rotten wood on appropriately sized cardboard circles. A fire pit can be simulated in the same manner by gluing

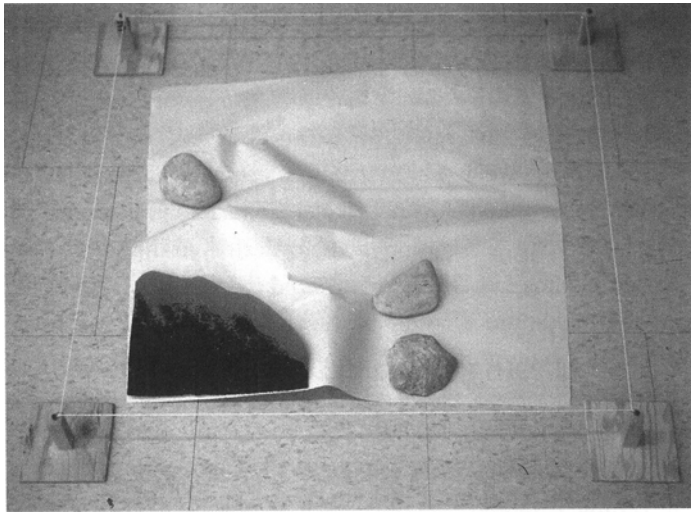

Figure 4 This simulated fire pit feature is based on actual examples located in the prehistoric SIL 182 archaeological site. Additional examples of simulated squares and the real excavated findings being modeled are illustrated on the author's "Archaeology Excavation Simulation" web site at https://sites.google.com/site/archexcavsim/home. Photo by the author.

ash, charcoal fragments, and/or modern soil from an outdoor fireplace on cardboard surrounded by a stone or two.

The third program session occurs back in the classroom. This activity is critical to the success of the program since a large part of the learning derived from participating in simulations occurs though post-activity discussion.[12] The students' square maps created during the excavation session are posted together level by level in the same relative position as they occupied on the simulated site. This permits students to see the entire site for the first time, to recognize and begin to analyse the activity area patterns. As each level is discussed, the students who "excavated" the squares report their findings to the class using their own level summary sheets as memory aids. The interpreter asks questions to focus on the meaning of key findings. At this time, a sample of the artifacts from the simulated site may be passed around the class to the other students who encountered no more than two artifacts in their square during the excavation activity. This session provides opportunities for numerous teachable moments as students are asked to undertake exactly the same analytical interpretive processes that professional archaeologists carry out as they study a site's artifacts and records.

Modeling the intellectual work of professional archaeologists, students wrestle with key archaeological concepts such as stratigraphy and relative dating (simulated symbolically by the layers of paper), analysis of artifacts (referencing the level summary sheets with their initial observations including interpretation of function), and discussion of the entire "excavated" site (reviewing the patterning and interrelationship of the square maps on each level and synthetic analysis of the relationships between and meaning of artifacts and features recorded). Students also must grapple with broader archaeological issues, including the realization that their "excavation" actually destroyed the site and the related critically important responsibilities connected to excavations (full and accurate records if the maximum amount of information is to be preserved rather than forever lost by poor practice). The Archaeological Institute of America asserts:

> An ideal simulated excavation should reflect the importance of careful digging and recording. It should also allow students to experience first-hand the results of careless work as well as the reasons for using proper procedures.[13]

For example, student "excavators" quite often neglect to record the square and/or level designations on their forms and thus readily can understand that

their effort could be wasted without accurate attention to these details. In the end analysis, the majority of tasks involved in this simulation approach — apart from lifting the layers of paper and feigned features — are identical to those archaeologists carry out in the field and laboratory.

Conclusion

In closing, I submit that simulating archaeological excavations in full scale by using actual artifacts, imitation features, and paper layer stratigraphy as outlined above accurately models real archaeological excavation and laboratory work. It is significantly more effective than sandbox excavation in matching more multidisciplinary curriculum objectives as well as the Archaeological Institute of America's goals for "less mess, more thinking" in excavation simulations. Its close approximation to the results of professional excavation technique provides much higher level of fidelity to select aspects of reality than the traditional troweling approach.

By understanding the simulation theory summarized above, developing an awareness of professional archaeological excavation technique, and engaging in a critical analysis of current simulation practice in museums, we should eliminate sandbox archaeology from museum programs and replace it with programs grounded on an ethical commitment to accuracy. I encourage interpretive planners to re-examine sandbox simulation and to refocus program emphasis where it properly belongs: on actual archaeological excavation skills and critical thinking processes made possible by the paper layer simulation program described here. In a broader context, the critical museology and theoretical approach is applicable to planning any program so that all activities are selected deliberately to establish a valid relationship to the target reality.

Acknowledgments

I am indebted to several archaeologists who have generously shared their knowledge and taught me about proper excavation procedures and other aspects of archaeological science: Michael E. Kelly, director of the excavation project at Sandhill Bay that I have simulated, Paul G. Snead, David Meyer, William B. Roosa, most recently William Green, Director of the Logan Museum of Anthropology at Beloit College, and the many others who have accommodated my photography during visits to their excavation sites. The Sam Waller Museum Technician, Bryon Farguson assisted in building the first set of simulation ma-

terials. Comments from two anonymous reviewers helped me to clarify this piece. Any misrepresentations of proper archaeological procedures or other errors are the author's sole responsibility.

Notes

1. Max Ross, "Interpreting the New Museology," *Museum and Society* Vol. 2, No. 2 (2004), p. 84; Lynne Teather and Jennifer Carter, "Critical Museology Now: Theory/Practice/Theory," *Muse* Vol. 27, No. 6 (2009), pp. 22, 24.
2. Archaeological Institute of America. "Lesson Plans: Excavation Projects," http://www.archaeological.org/education/lessons/excavations (Boston: American Institute of Archaeology accessed October 23, 2011).
3. Although ICOM refers to accuracy only in its exhibitions section, the American code of ethics uses the generic term "intellectual intégrity" when referring to programs, while both the Canadian and United Kingdom ethics documents make specific commitments to accuracy in public programming. International Council of Museums, *ICOM Code of Ethics for Museums* (Paris: ICOM, 2006), p. 8; American Association of Museums, *Code of Ethics for Museums* (Washington: AAM, 2000), p. 4; Sonja Tanner-Kaplash, *et al.*, *Ethics Guidelines* (Ottawa: Canadian Museums Association, 2006), p. 5; Museums Association (UK), *Code of Ethics for Museums: Ethical Principles for All Who Work for or Govern Museums in the UK* (London: Museums Association 2008), p. 20.
4. Lesley Brown ed., *Shorter Oxford English Dictionary on Historical Principles.* Sixth Edition (Oxford, UK: Oxford University Press, 2007); *Wickipedia*, "Simulation" http://en.wikipedia.org/wiki/Simulation (San Francisco: Wikimedia Foundation, accessed November 30, 2011); cf. Paul Humphreys and Cyrille Imbert ed., *Models, Simulations and Representations* (New York: Routledge, 2012), pp. 179, 231, passim.
5. Archaeologist Bill Green, Director of the Logan Museum of Anthropology, in response to a draft of this article asserts, "the trowel-in-sandbox approach emphasizes two activities—digging and finding—that are not the core things we need to emphasize to kids about doing archaeology." William Green personal e-mail to Paul Thistle (December 16, 2011).
6. Archaeological Institute of America, "Archaeology in the Classroom" http://www.archaeological.org/education/lessons/simulateddigs (Boston: Archaeological Institute of America accessed November 30, 2011).
7. My research to date has found no published examples of the paper layer solution. Gerald A. Oetelaar, Editor of the *Canadian Journal of Archaeology*, indicated in an e-mail to the author on April 12, 2011 that Stevie Stephens had used this gambit at the Simon Fraser University Museum of Archaeology and Ethnology in the late 1970s and early 1980s. However, this program employed only small pieces of paper that students used at their own desks rather than simulating a full-scale excavation as described below. Please contact the author with any relevant published sources.
8. Cf. Archaeology TV, "Classroom Excavation Projects: Archaeology in the Classroom" introductory video http://www.archaeological.org/education/lessons/simulateddigs (Boston: Archaeological Institute of America accessed February 11, 2012) in which Shelby Brown, Vice President of Education and Outreach for the AIA, states that the aim of its simulated digs is to achieve "less mess, more thinking." The author notes, however, that many of the AIA's recommended activities involve a comparatively high level of mess.
9. Paul C. Thistle, "Archaeology Excavation Simulation" https://sites.google.com/site/archexcavsim/ (accessed February 10, 2012) shows more images of the archaeological squares excavated on the site shown in Figure 1 as well as my simulated squares and features replicating this target reality. Also see the author's brief Ignite Session video, "Archaeol-

ogy Excavation Simulation: Shift the Emphasis Back to Reality" http://www.youtube.com/watch?v=QzwWk6NRNvk accessed April 22, 2012.
10. For recent analysis of the value of handling real objects, see Elizabeth Pye, "Introduction: The Power of Touch" in *The Power of Touch: Handling Objects in Museum and Heritage Contexts*, Elizabeth Pye ed. (Walnut Creek, CA: Left Coast Press, Inc., 2007), pp. 19-24, passim.
11. David Moyer, "Nails for Historical Archaeologists" http: //www.digitalpresence.com/histarch/nails.html (Iowa City: Iowa Office of the State Archaeologist, 2002) accessed December 6, 2011.
12. Fransecky, Roger and Tojanski, John "A Primer on Games" in *Doing Sociology: A Sociological Experience in the Classroom*, Paul F. Kaplan and Clovis R. Shepherd ed. (New York: Alfred Publishing Co., 1973), p. 11.
13. Archaeological Institute of America, "Lesson Plans: Excavation Projects" http://www.archaeological.org/education/lessons/excavations (Boston: Archaeological Institute of America), accessed October 23, 2001.

About the Author

Paul Thistle has more than twenty-six years of mission and management work in museums. Although not an archaeologist, he has had excavation, survey, and emergency salvage experience. He holds an interdisciplinary MA in history and anthropology, a BEd in cross-cultural and museum education, a BA in anthropology and history, and a Museology Certificate. He has taught Museum Studies at Beloit College and certificate courses for museum associations in Canada.