The Anywhere Museum: Genres of Teachable Moments

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Abstract
A great teacher perceives and utilizes *teachable moments* in the classroom, that is, moments in which classroom activities, attention, and conversation come together to create an opportunity for conceptual change. The Anywhere Museum implements the teachable moment in the environment as an instrument that provokes and yet has the proper content to support inquiry. We enumerate the socio-technical characteristics of the genre, explain the relationship between the Anywhere Museum and other related genres (advertising, museum presentations), and give an in-depth description of the building of components of the Anywhere Museum on the Virginia Tech campus. The results of the research are a set of patterns that begin to suggest the opportunities and boundaries nascent in the genre.

Keywords
Concept Design, Content, Context-Aware Computing, Exhibit Design, Genre, Informal Learning, Pattern, Ubiquitous Computing / Smart Environments, User-Centered Design / Human-Centered Design, User Experience

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Figure 1. CARPE DIEM

"Did you get the correct change?"

The boy was much more interested in the candy than the money, but this was part of the deal. He had given the cashier the dollar bill and gotten some change back. His mother had asked this before so his first instinct was to answer, "Yes" and be done with it.

"How much was the candy bar?" she asked.
"75 cents."
"How much did you give him?"
"I gave him the dollar."
"So how much did you get in return?"

Now things turned a bit harder. The boy looked at the coins, thrusting them towards his mother, he said, "Here they are."

"So what coins do you have and how much do they add up to?" she persisted.

"Two dimes and a penny. 21 cents."
"How much is 100 minus 75?"
"21. 21? No, that isn't right. 25 – Hey I was cheated!" He was sure that his mother wanted him to see that.

"Yes dear, it should be 25, but there something called 'tax' that makes it 21. How much is the difference?"

In "family" math [23], the parent recognized that the opportunity in the moment, here the complicated idea of 'taxes'. She uses her routinized 'correct change' question to point out that taxes are extra.

The Anywhere Museum: Informal Learning Anywhere

The term "teachable moment" describes an occasion in learning during which the activities, attention, and conversation of learners come together to create an opportunity for conceptual change. A teachable moment is most often associated with an event that causes learning that is somehow out of the ordinary flow of everyday experience. It might involve a student who is ostensibly studying photophylic behavior in worms who asks how you can tell which end of the worm is the mouth. It might be started by a student who notices that, by changing of the scale of axes on a graph, all linear relationships that pass through the origin can be made to *appear* to have a slope of one (1). It might be started by a student studying fossils of footprints who wonders why we don't have fossils of SUV tracks.

In all cases, the teacher takes the thought and at once reinforces the creative impulse and the understanding of the content area by building on it to make a larger pedagogical point. For example, the teacher might mention the number of tracks that are fossilized compared to those lost, or the time scale that fossilization takes, or might turn back to the class the question of whether tracks from SUVs are currently being fossilized or not.

Interactional technology is increasingly employed to augment the environment for pedagogical purposes. Whether it is to explain the historical significance of artifacts in a museum or improve public awareness of the functions in a waste treatment plant, the technologies turn the environment into a momentary classroom. To be worthwhile, this classroom must build on the students' zone of proximal development (as shown in Figure 1 [28]), that is, it must be something the student is capable of learning. Further, it must find a way to "make it all come together" to create insight.

In other words, interactional technology used to create teachable moments defines an "Anywhere Museum."

ANYWHERE MUSEUM

The Anywhere Museum implements the teachable moment in the environment. It is an instrument in the environment that both provokes the audience and contains the proper content to support subsequent inquiry.

The opportunity to design in this new genre arises because of a confluence of socio-technical facts:

- The contemporary condition is life-long learning.
- Situated, embodied technologies are increasingly able to provide information that is contextualized to particular locations and activities.
- People are differentially open to learning based on time, place, mood, prior experience, and knowledge.
- Often the best time and place appears ad hoc with respect to the intentions of the target person.
- Often the best amount of information is small.

The current paper is a design research investigation. In the next few sections, we will describe the Anywhere Museum genre as a kind of teachable moment, explain the relationship between the Anywhere Museum and

Figure 2. Informal Learning in the Museum Setting.

Various exhibits engage and entertain users. Some users learn through self-directed contemplation, some through directed pedagogy, some through teachable moments.

other related genres (advertising, museum presentations), and give an in-depth description of the building of components of the Anywhere Museum on the Virginia Tech campus.

The Specifications of Teachable Moments

The Anywhere Museum rests on the notion of technology-supported teachable moments in the environment. Such teachable moments often begin with a thought-provoking message to the intended audience about something in the physical environment. The audience could be all passersby, or a selected subset of people physically present. The message, which could be a drawing, a piece of text, or some more active media, is delivered by one of several potential mechanisms: cell phone, environmental display, or even special purpose equipment. Message initiation may be a "push" from the designer or a "pull" from the user (even a label on an object such as "Pick Me Up.") The initiating message may be the only component, or prolonged interaction may be involved. Interaction may involve only one person in the moment or more. It may leave a trace for subsequent exploration or not.

There are a number of environmental and situational requirements that establish where and when this kind of user experience can be created:

- The *location* should have potential for intellectual exploitation.
- The *audience* should be receptive to interruption. At minimum, they should not be annoyed by being distracted and, better, should be able to take a few moments to ponder something. That is, a person waiting for a bus is better than one driving a car.
- The *moment for activity* must present itself naturally or be technologically amenable to creation.

In general, *the disruption of flow becomes the opportunity*.

At first blush it might seem like advertising or museum exhibits scattered about the landscape would create these teachable moments. There are significant differences however.

ADVERTISING MOMENTS

Like many forms of advertising, teachable moments can occur anywhere in the general environment. As with billboards and flyers or large screen displays in restaurants and bars, messages are delivered to passersby competing for momentary attention. In contrast, however, advertising is not necessarily contextual and usually seeks to avoid rather than incur provoking thought. Regardless of whether seen while driving on the highway or walking down the street, advertising seeks to arrest attention without much regard to the current focus of attention or current purposes of the audience[1] -- or things located around it.

Also, advertising does not ask for reflection but only to leave an "impression"; by-and-large, it seeks indirect routes to persuasions [18, 4, 8]. The goal of the impression is to raise desire for a product and associate the product name with satisfying that desire. The con-

[1] except, of course, when it is used to attract drivers off the interstate for a quick meal or a brand-name product shows up prominently in a feature film

Figure 3. An exhibit from the Exploratorium in San Francisco.

The exhibit is designed to stand by itself. Note that there are instructions for use and some questions that it wants the user to reflect upon. A docent or teacher might know which is the most provocative question or how to re-phrase one of them to be heard by the learner.

trast becomes more pronounced when one considers that both genres intend to change life-long behaviors but in very different ways; while informal learning attempts to promote active inquiry and reflection, advertising aims at increasing product consumption and intellectual passivity. In fact, reflection is arguably quite at odds with the immediate result and long-term effects that advertising hopes to achieve.

MOMENTS IN MUSEUMS

The Anywhere Museum shares some similar characteristics with traditional museum exhibits and didactics. Most art and some history museums rely on audio guides to annotate the visitors' experience, and in science and technology museums such as the Exploratorium, the Tech, and the Chicago Museum of Science and Industry, the exhibits themselves are interactive devices. These devices and techniques largely overlap with Anywhere Museum techniques and devices.

Both museums and the Anywhere Museum share a considerable regard for the teachable moment; however, it is not the essential component of museum learning. Whether focusing on art, human history, natural history, science or industry, museums are places where cultural values are collected and presented; each kind of museum has conventions for getting its visitors to think about the artifacts and absorb underlying values. By-and-large, in the museum, learning is not a momentary interruption in the on-going flow of the user's experience, but a product of a planned and regulated sequence. The audience is intended to accumulate ideas in an orderly (although not necessarily sequential) fashion. Therefore, the underlying experience in the museum genre is reversed compared to that in the Anywhere Museum.

Another contrast between museums and Anywhere Museums is the role of context. In the museum, informal learning is framed or *contextualized* by (1) its location (a museum) which imparts legitimacy and explicit value to the experience, (2) the authoring or "curating" that selects, edits, and sequences the items seen, and (3) annotation through didactic textual panels, human docents, and audio guided tours. In the Anywhere Museum, context is used differently. The given environment, with its range of participants and purposes, is used, but it is neither authoritative, nor controlled/curated as a whole.

The museum audience has either chosen to go to the museum or been coerced into attendance. The museum curator controls the entire environment (though not precisely what the audience does with it). In contrast, the audience of the Anywhere Museum has not made a choice to be at a museum and is, in fact, interrupted.

There is a belief among some educators that the museum-going process develops a sort of "slow motion" reflection, working in the background that reinforces the meta-process of continuous learning. Annotating the exhibits is a link from the immediate experience to the slow-motion reflection. As we have noted, there are numerous commercial means of annotating museum experiences (particularly taped and digital audio guides) and some very interesting and useful research as well. A notable example is Woodruff et. al. [30, 9]. Museum kiosks are also now commercial commodities.

However, user experience research in interactive exhibit design is still rather rare [12].

LOCATING THE DESIGN SPACE OF THE ANYWHERE MUSEUM

Figure 4 summarizes the relationship between the design space of the Anywhere Museum compared to that of advertising and normal Museum exhibits.

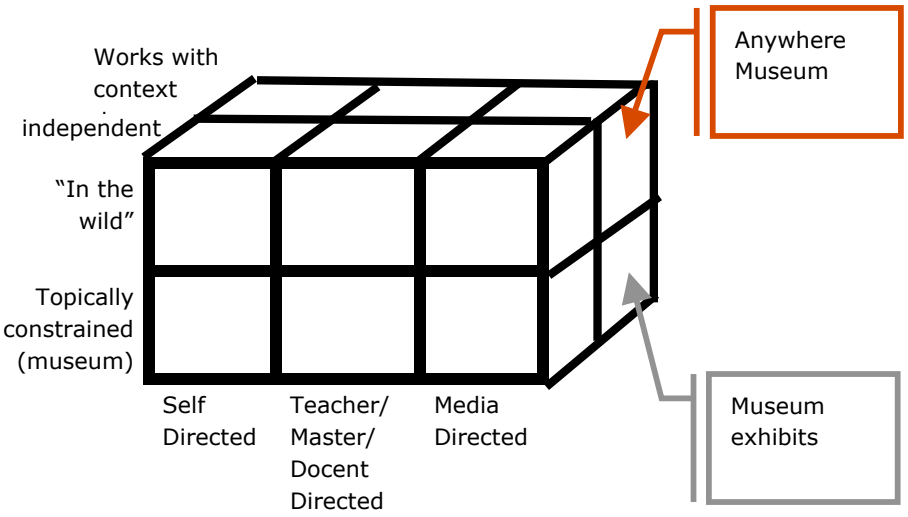

Figure 4. The Design Setting of the Anywhere Museum.

X Axis is relationship of parties.
Y Axis is environment
Z Axis is content–to-context relationship

There are three major axes: the source of guidance for the learner, the environment in which it occurs, and the relationship of the message to the context. The box shows that informal learning using an exhibit in a science and technology museum is mostly "media-directed" (although sometimes a docent or teacher directs activities), in a topically constrained environment, and planned. (Of course, if the exhibit is used in an unintended way, then it would be an emergent occasion.) To the extent that reading a billboard can be thought of as informal learning, then it would be "in the wild", media directed, and independent of the context.

ENVIRONMENTAL ANNOTATION

Occupying much the same design space as the Anywhere Museum but with very different goals are electronically-enabled social games. Steve Benford's various pervasive games [2] and Pam Jennings' tangible interface [13] annotate the environment without otherwise modifying it. However, the content is primarily designed to provoke social interaction, not inquiry for its own sake. Benford's social real/virtual games are intended as teaching tools, but they require that users become players in a game which in turn establishes its own narrative context supplanting the existing environment. While Benford's projects requires a commitment to the role of game player and Jennings' a much more casual commitment of time, attention and public behavior, both become the primary activity of the moment and ask for a change in current purposes of its participants.

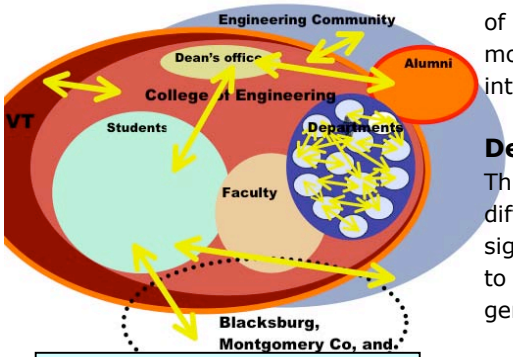

Figure 5. Virginia Tech College of Engineering Communities

The contextual challenge is best illustrated by the joke: a mechanical engineering ("ME") student, an electrical engineering ("EE") student, a chemical engineering ("CE") student, and computer science ("CS") student are riding in a car. It suddenly sputters to a stop. The ME student says, "It sounds like a broken piston." The EE says, "I think it's the ignition system." The CE says, "Something has contaminated the gas." The CS student says, "If we all get out of the car and get back in again, maybe it will start."

Claudio Pinhanez [20] has used projection onto a white-painted room to call attention to salient aspects of the environment. Thus the existing environment is modified, altering the context. However, this work is intended to provoke reflection.

Design Challenges

This research addresses design challenges of two very different – but intertwined – sorts: those about designing a genre of Anywhere Museum and those specific to the situation into which particular instances of the genre are inserted.

We will ground these high-level challenges with an extended description of on-going research into the use of informal learning to reinforce the formal learning environment at Virginia Polytechnic Institute and State University (Virginia Tech). The particulars of this situation have their own challenges that inform the design and genre.

GENRE DESIGN CHALLENGES

Genres are socio-technical systems: they are an ecology made up of producers (such as authors, editors, publishers, designers, film studios, TV networks, museum curators), consumers (audience, readers, viewers), media, content, content form, and associated expectation. Consumers' expectations are the most significant determinants of the content and form. To characterize the system (to characterize the elements and the links between them) is, in the usual case, to characterize the consumers and their expectations. (See How of XFR for another example of genre-based user experience design. [11])

An audience for, say, an action movie, would consist of people wanting a form of escape from day-to-day concerns. In contrast, the audience for a teachable moment is people who are open to learning (or, as we shall see, "opennable" to learning). The action-movie audience is absorbed in a situation that compels attention and produces the desired inner state. The teachable moment audience is often engaged by some non-learning activity only to find themselves reflecting upon something to which they had not given much prior thought. Much of the related literature on teachable moments focuses on opportunities to learn to quit smoking, for example, when a loved one is diagnosed with lung cancer (for examples see [3, 15, 19]). The teachable moment involves a switch in attention and consciousness.

This characterization locates the expectation in not the audience, but the producer – the teacher, the docent, the parent, etc. But there is a meta-expectation at work with the learner: the learner encounters a teachable moment as a situation that engages attention and so it might be said that the primary audience expectation is "to be engaged". Whereas most genre work focuses on the audience expectation, any genre of teachable moments anticipates the expectation that ought to be there.

GENRE CHALLENGE 1: NOT JUST ANY KIND OF ENGAGEMENT

What is provocation in the Anywhere Museum context? In a classroom context, the good teacher experiences "everything coming together" to make a line of discussion work for the class. Here, the designer must guess about both the audience and their permeability to the question at hand. For example, we would like students

Figure 6. Typical Campus Bldg.

Engineering? Which discipline? How would you know?

Figure 7. Typical Hallway

Carefully controlled bulletin boards, minimal sanctioned signage, and undifferentiated public spaces creates a generic user experience disconnected from particular disciplines.

to think about why a particular intellectual problem is of interest at a given moment in time in a given discipline. But if we ask directly, many are likely to reply that the professors already know the answer to that. Other problems may be best presented as questions. There are many competing theories of knowing and inquiry at different levels. The challenge to the designer is to find a method that fits with the situation at hand and succeeds in provoking.

GENRE CHALLENGE 2: WHAT IS IT ABOUT?

One of the most problematic aspects of informal learning is the nature of subject matter. Many teachable moments are distinctly different than the subject at hand (When the topic is overtly cows grazing in a field, a parent may ask a small child, "How many cows do you see?" which changes the subject to arithmetic.) Museum exhibits sometimes address this by having a wide smorgasboard of prompting questions, but there is no way to know which will engage a visitor or whether the array of questions will just overwhelm any nascent reflective process.

This is compounded when technology is introduced. Almost any technology that is engaging – whether a looping video, hyperlink information kiosk, or just a really cool big button – can become the subject of attention overwhelming the content it means to deliver.

This problem is not limited to children, either. Often you will see art museum visitors focusing more on the audio tour than on the art. Not only will they barely glimpse at the painting being described but will completely skip any work not included in the tour. Therefore, often visitors can tell more about the annotation than the subject.

Thus the challenge is to use media, develop content and present it in a form that commands attention, but is still secondary to the environment it is in. From even the most narrow interaction design perspective, this is probably the biggest challenge designing the user's experience. It is the genre-level challenge that also manifests itself most prominently at the situational level.

SITUATED CHALLENGES

We are in the process of exploring the Anywhere Museum in the context of the College of Engineering at Virginia Tech in Blacksburg, VA. The College, the fourth largest school of engineering in the United States, recently developed the world's third fastest supercomputer by connecting 1,100 Mac G5's. It was also one of the first venues for research in community computing in the United States (the Blacksburg Electronic Village). It's an exciting place with more than its share of leading edge research and development, but students would never know this by looking at its buildings or walking its corridors.

The primary challenge from the client (the Dean of the College of Engineering) is to communicate the ideas that engineering is "exciting," to convey a sense of the many disciplines that constitute the College of Engineering, and to cross the boundaries between and within the various communities of Engineering at Virginia Tech.

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SITUATED CHALLENGE 1:
SHOW THAT THE COLLEGE OF ENGINEERING IS EXCITING

The client perceives engineering as a vital, manipulable approach to the world. Yet he knows that students, especially undergraduates, spend most of their time mastering details. The main charge is to enlarge student perspective.

This charge becomes a considerable design challenge in part because the administration of Virginia Tech strictly controls the appearance of public spaces. It discourages signs, public performances, notices, and other representations of academic interests outside of a few carefully vetted bulletin boards (Figure 7). For example, undergraduates can walk past the very visible and centrally-located large metal appendage to Randolph Hall (Figure 8) most days during their four years without ever realizing that it is a wind tunnel, much less that it is the largest wind tunnel at a university in North America, and that it is in constant use as a research and teaching tool.

The charge, however, is not merely to let students know that it is a wind tunnel, but to represent the experience of it that an engineer would want to have: seeing it in action, knowing which way the wind flows, what is being tested, what sort of research questions are being addressed, and what wind velocities are being used during the test. These are the matters that engineers want to know and that we hope would stimulate and interest the kind of student that the College works hard to reach.

SITUATED CHALLENGE 2:
FIND PLACES THAT HAVE SOMETHING TO SAY

A basic situated challenge is the alignment of content and communicative form with the local situation. In this example, the local situation is the communicative disconnect between the physical plant of the College of Engineering and the idea of engineering (as embodied in formal engineering education). Thus the challenge is to find places in and between the buildings in the College that can be used provocatively.

Figure 8. Wind Tunnel

SITUATED CHALLENGE 3: CREATE A SENSE OF COMMUNITY

This leads to the last significant situated challenge: how can the student experience him or herself as part of a whole – a major or prospective major in a specific engineering discipline related to but distinct from others in the College of Engineering? Learning to frame the world in terms of a discipline is an essential part of becoming a member of the community and a practitioner

in the discipline. University students are sorting out the difference between generally-framed questions, ones that are engineering-specific and ones that are, say, mechanical engineering-specific. Therefore, any instance of the Anywhere Museum should lead the inquiring mind to see these frames. One strategy to do this, for example, would be for the audience to see the frame in terms of the language of the disciplines they already understand and to extrapolate.

The Anywhere Museum Pattern

The method of this research is to take these challenges as design constraints and to create patterns that are a scaffold, out of which the genre of Anywhere Museum emerges. At this early stage, the evaluation is only about the success of a pattern; to evaluate the genre will take the further development of the ecology.

PATTERNS AND THE PATTERN LANGUAGE

A pattern is a description of the elements of an abstracted experience. Patterns are a useful format for describing a proto-ecology because the idea of patterns is neither bound to a specific theory nor are patterns required to have causal structures. They often do not. The idea of patterns and Christopher Alexander's more formalized version, the Pattern Language, have gained significant (if not wide-spread) use in communicating human-computer interaction design guidelines.

Various disciplines dealing with aspects of user experience have adopted patterns. Beginning with Alexander's work in architecture [1], it has been taken up by interaction researchers [7, 5] and more recently by interaction designers creating pattern books [27].

We use patterns to establish the aspects of a genre system that can be under the control of a designer for purposes of this research; in that sense, patterns are just a design method and not integral to the idea of a genre or even to this particular genre. [10]

The technology enabled, Anywhere Museum pattern can be characterized as:

Audience

The audience consists, not of all people in the presence of the Anywhere Museum, but rather for those for whom taking a few moments out of an otherwise ordinary activity will not be a burden. The audience is then anyone who is open to turning this distraction into a question. (Of course, the better audience is one who is previously given some thought to the questions that the presentation raises – or to analogous ones.)

Situation

The situation consists of a location that has some semantics with respect to the content. The situation provides a context but it must also be surprising or in some other way momentarily arresting to the flow of everyday life. And, of course, the audience has to be present in the situation.

The social aspects of the pattern are quite flexible. People can be alone, or in groups. The only requirement is that the social situation be interruptable.

Content

Content is contextually linked to the situation and to the goals of the communication. Unlike general information presentation, it is provocative. Interactive sci-

ence museum exhibits often have explicit questions they ask of users; while conceptually provocative, the more powerful communicative form is the one that gets the audience to come up with questions. Like a good magician who gets the audience to ask themselves, "How did he do that?" the Anywhere Museum gets the audience to pause with a fact or question, and then to immediately ponder a chain of questions.

Form of Content

The form is a succinct presentation. It is attention-getting and for its duration, holds attention. It therefore treads a thin line between appearing at one with its context in order to draw meaning from it, and different enough to be gain that level of attention. The primary design technique therefore is contrast with the environment.

Placement

The Anywhere Museum is encountered in the everyday world. To use the context of the physical environment, it must be unambiguously placed. In that element of the pattern there are numerous strategies that can be employed – from "in your face" to relatively out of the way – depending on how selective to be with the audience and the form of the content.

Media

The media employed must tread the same narrow communicative path as the content and the form of the content – that is, be so compelling as to stimulate engagement, curiosity, and eventually reflection in the audience, but not so much so that the media becomes more compelling or engaging than the content.

This requirement suggests (but does not require) embedding technology into the environment. "Embedding" the media means that the media is integrated with the systems in the environment. For example, it might mean that the Anywhere Museum can read the current thermostat settings or mine class schedules. It also means that the display takes advantage of the properties of the environment. Paul Dourish [6] and Malcolm McCullough [16] among others, have written about the complex issues of embodied and embedded interaction.

Research Details

Two projects currently under development serve as illustrative examples. Neither have yet had user evaluation.

LASER SPACE OF C/o/E

Figure 9. McBryde Hall, location of Computer Science Department

The first project turns the facades of buildings in the College into displays of the activities within. It uses laser and video projection. The displays catch the attention of passersby and hints at salient elements of the discipline housed in the building.

Figure 11. NASDAQ Building, Times Square, New York

Architectural scale display makes context ever-changing.

So, among other examples, the wind tunnel will show what is going on inside; as envisioned in Figure 9, the Department of Computer Science building will show the enactment of classic "Towers of Hanoi" recursion problem central to computer science; the shear and bending moments of the internal structure will be shown on the civil engineering building, and images of flocking robots will climb the blank walls of the two Industrial Systems Engineering buildings. This project has two research goals: to understand how to create a genre of teachable moments using the media of laser projection and secondly how laser projection fits within the larger HCI research into architectural scale display.

Projection technology limits the use to evenings when it is dark enough to see the images. The crowded class schedules of undergraduates requires most to have classes lasting through 7:00 pm so there will be a few minutes especially at the end of the Fall and the beginning of the Spring semesters when many will be exposed to the laser display.

Laser projectors are used in theme parks and other entertainment venues for their intrinsically brilliant line imaging which has a compelling quality. The initial uses will be only pre-recorded displays although it we anticipate tying the displays to the physical phenomena they represent (e.g. showing current conditions in the wind tunnel or displaying structural forces derived from strain gauges on the structure in the civil engineering building). Since flocking behavior (or playing soccer, to use another robotic research driver) can create interesting interactions, the public might interact with the robot images. (A number of previous projects have used cell phones or remote-entry/garage door opener controls to do this sort of display control in public places. [17, 21]).

AUDIO SPACE OF C/o/E

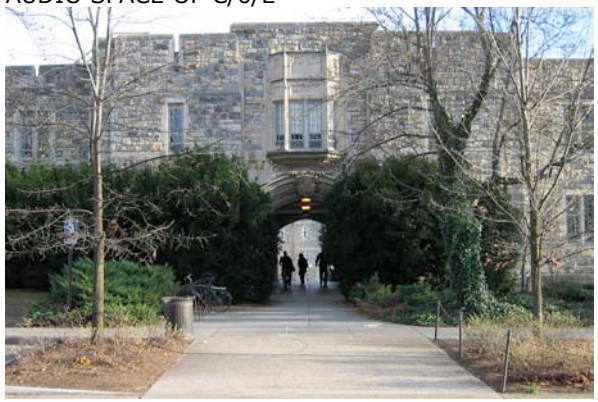

Figure 10. Norris Hall Breezeway

Norris Hall, the geographic center of the College of Engineering, has a breezeway that students in almost all engineering disciplines pass through on a daily basis. Other than non-descript entrances to a small lecture hall and some offices, a few bulletin boards for student organizations, there is nothing in the space. The idea is to make it acoustically alive with sounds from labs from disparate parts of the College. Randomly organized but

in a carefully edited collage, the sounds will be used to explicitly provoke passersby to identify the source. A simple sign will direct them to guess the location of the sound and enter it on a website. The more remotely situated one is from the sound source, the higher the score accorded[2]; the highest total score at the end of a semester will win a small prize.

Some of the sounds that have been collected are from the wind tunnel, the Ware Lab for cross-disciplinary work in mechanical engineering (racing engines, robotic cars and unique suspension systems are some of the projects), key-clicks in a computer lab, and some mining equipment in operation. It is possible to pick out phrases from engineering teams working on robots and others debugging smart pants. There are a few ringers tossed in for good measure – a ball-drop maze, generic air-conditioning, and wind noise from a cold winter day recorded at a busy bus stop.

RELATED PROJECTS

Two other projects have worked on the same list of situated challenges but outside the genre of the Anywhere Museum; they are included to further explain the opportunities and limitations of the Anywhere Museum.

In one, alternative websites were designed for ten (10) of the thirteen (13) departments in the College of Engineering. Each was intended to give the "inside" view to students about to declare a major. Each took a different, but deeply contextual approach. One used a multiplayer on-line game where another wove a narrative structure through structured information about the major.

The other project developed an ambient-plus-triangulated display in a favorite engineering student study lounge. Like many ambient display research projects, an apparently static image slowly changes to display weather, bus arrivals, and other immediately actionable bits of general information. It also has other, image-based narrative qualities. The image changes from day to day (from pencil-like sketch to cartoon to less representational forms), characters and objects come and go in some regular pattern and the characters pose in different dramatic relationships to one another. Lacking any explanation for these changes, perfect strangers talk to one another explaining what has gone on previously and their interpretation of its meaning. In this way it tries develop a sense of community. First identified by William H. Whyte, this social phenomena is called "triangulation" [29, 14].

Discussion

The Anywhere Museum is an emerging genre that implements teachable moments in a site-situated fashion. The projects we have described here are based on the elements of the pattern: audience, situation, content, form, placement, and media. These enact the goals of communication of specific information to a targeted audience with the aim of provoking reflection.

In sketching out the Anywhere Museum, there can be both a sense of an implicit technological imperative and a fear of further attentional pollution in the everyday

[2] That is, since computer science students do not get access to the wind tunnel, a CS student identifying it would result in a high score where an aeronautical engineering student would get a more modest score.

environment. In thinking about the consequences of the wide-spread deployment of Anywhere Museum instances, we do have some specific issues to consider that focus the promise and the anxieties.

Architectural Scale Display

It is easy to imagine the day when all surfaces in the built environment will be displays; when walls are a gigapixel or more, when all forms of display are at a resolution below the perceptual threshold. Clearly, using architectural-scale display could be used as a medium for an Anywhere Museum piece. Given the current novelty of environmental scale displays, a contemporary application is very likely to overwhelm the subject it wants to communicate, failing genre design challenge 2 ("What is it about?") and violating the media element of the pattern. More importantly, the Anywhere Museum plays off of the known aspects and expected qualities of being in a particular place. As a visit to Times Square in New York demonstrates (Figure 11), the malleability of environments possible with architectural-scale display is so great as to make the environmental contexts unstable.

Epigraphy

Literate societies are often divided into "bibliographic" (book-based) and "epigraphic" (wall-reading) cultures. Since the fall of the Roman Empire, Western culture has been predominately bibliographic – our cultural transmission has been based on paper (and more recently digital) documents. There has been a resurgence in the last 100 years of epigraphic culture – billboards, graffiti, advertising fliers, neon and highway signs. This has accelerated in the last decade with PowerPoint, large flat panel displays, and projectors.

There are two contradictory consequences for the Anywhere Museum as this trend accelerates: that the ubiquity will raise the expectation of getting more and more from the environment – one of which will be teachable moments, and the other will be that the environment will be so distracting that only elements that "shout the loudest" will be paid attention to – which is at odds with reflection.

Methods of Evaluation

The Anywhere Museum genre should be considered a success if it propagates and people understand it. Instances of it could be evaluated from the perspectives of museum or advertising phenomena. The museum community uses primarily indirect measures of success including, for example, conversations detected, revisits, and lingering. Sometimes post-hoc questionnaires are used to assess enjoyment and occasionally knowledge. Advertising is assessed by brand recognition and (very infrequently) by attributable dollars spent.

Instances of the Anywhere Museum are more properly evaluated by assessing immediate learning phenomena and growth of a long-term value for learning and thought. Demonstrating that such learning has occurred (a primary focus of the second author's work, [25, 22, 26]) remains difficult, something that teachers recognize more than measurements reliably report. Attendance, duration of visible attention, and memory (recognition or recollection) are some of the indicators of success we could apply to the Anywhere Museum, but they are in fact distal from the experiential phenomena.

PATTERNS INTO GENRES?

We used a design pattern to describe the aspects of the Anywhere Museum genre we believe to be salient. Is the use of patterns sufficient to create a genre? How can a pattern-to-genre transform be evaluated? What of other possible outcomes?

While there may not be good evaluative techniques for the learning component of the Anywhere Museum, there are more direct ways of evaluating the occurrence and success of a genre.

Genres exist in so far as they manifest internal reproduction. So the test is to wait and see if instances arise with the properties of the Anywhere Museum and determine if they exhibit the relationships anticipated in the description. The limiting questions then are how long to wait to carry out the evaluation and where to look for it.

OPPORTUNITIES

We asserted in the introduction that there were a number of opportunities that supports the emergence of the Anywhere Museum -- that:

- The contemporary condition is life-long learning.
- Situated, embodied technologies are increasingly able to provide information that is contextualized to particular locations and activities.
- People are differentially open to learning based on time, place, mood, prior experience, and knowledge.
- Often the best time and place appears ad hoc with respect to the intentions of the target person.
- Often the best amount of information to communicate is small.

In other words, we have argued that the time is ripe for the Anywhere Museum, that we can make instances of it, that the notion may be a powerful one for other people, and that, therefore, the prospect of life-long learning promoted by teachable moments is at hand.

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