Student-designed text-based simulation games for learning history: A practical approach to using Inform 7 in the history classroom.

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The current crop of best-selling video games is tour-de-force of graphical delights. Players are treated to immersive 3D environments that are beginning to border on the photo-realistic. In a seemingly endless cycle, video card makers develop hardware that enhances to ability to light and shade virtual worlds realistically and game developers respond with games that have ever more impressive visual effects. Indeed one of the key requirements to play most current computer games is a powerful video card.

The dominance of graphics in video games, however, was not always so. The ancestors of the modern multi-million dollar graphical extravaganzas were humble text-based adventures. Players explored virtual worlds devoid of graphics, exploring labyrinths, battling monsters, and flying spaceships represented through text descriptions. So long as the graphical capabilities of computers were primitive, text adventures stood a chance. Infocom, perhaps the most successful marketer of text adventures in the early and mid 1980s, boasted that their text adventures relied on the most sophisticated graphics system of all: the human imagination.

Computer graphics continued to improve and, ultimately, destroyed the commercial value of text-adventures by the end of the 80s. Then, amateur enthusiasts took up the torch. Aided by the Internet, these enthusiasts write and share and discuss new works of interactive fiction, the term fans favor. Still, the genre has a following today among amateur enthusiasts. A number of sites are devoted to these games, which are freely available to download and play. The quality of new games is promoted by an annual competition for interactive fiction designers.[1]

As this hobbyist community has developed, so has a handful of programming tools intended to make designing interactive fiction easier for those without a computer programming background. Though these tools are helpful they are still technologically formidable and require game makers to write in code resembling the programming language C. Version 7 of *Inform*, the free software that enables the creation of text-based games,[2] offers an easy way to incorporate text-based computer simulation design projects into history classes.

[1] Baf's guide to interactive fiction (http://www.wurb.com/if/) is the place to start. The Interactive Fiction Competition, now 13 years old (http://www.ifcomp.org/), holds yearly competitions and makes the games of all contestants available online. Interactive fiction games come in different types of files. The free program Gargoyle (http://ccxvii.net/gargoyle/) will run most, if not all interactive fiction files.

[2] Graham Nelson is the creator of *Inform*. See http://www.inform-fiction.org/I7/Welcome.html to download and learn more about *Inform*, version 7.

By designing simulations with *Inform*, students can have rich, immersive, and challenging educational experiences reconstructing a historical world. Moving beyond the dry transmission of historical information, these experiences can hone critical skills of historical thinking, especially the ability to reconstruct elements of past societies in a valid and plausible fashion. It is the purpose of this article to explain why designing simulations in general is a powerful method for learning the discipline of history, to illustrate why *Inform* is an excellent tool with which history students can design interactive computer simulations, and to outline a set of classroom practices for teachers wishing to incorporate *Inform*-based simulation projects in their own classes.

The Genre of Interactive Fiction

Understanding the significance of *Inform* as a tool for learning requires some familiarity with the concept of text-based computer games. These games, often referred to as interactive fiction,[3] immerse a player in a world represented and manipulated entirely through text. Some well known commercial examples from the 1980s include *Zork* and *Hitchhiker's Guide to the Galaxy*. In text-based games, players receive information about the world and its inhabitants in the form of text descriptions[4] and interact with that world by entering text commands. Game-play in classic text games generally takes the form of puzzle solving, finding and using the right object to overcome the right obstacle. Consider the following example drafted to illustrate the style of play in text-based games (*note that the ">" indicates where the player enters a command*):

A Mission in the Forum
by Jeremiah McCall

Sacra Via
The Sacred Way, a major route through the center of the city, runs from the northwest to the southeast. To the northwest is the forum, the center of public life at Rome.

>go northwest

Forum
The Forum Romanum is bustling with merchants, politicians, slaves, and street vendors. The law courts of the praetors are thronged with bystanders, and the old and new shops along the Fulvian and Sempronian basilicas are teeming with activity. A hundred transactions are occurring at any given moment, and the air is buzzing with possibilities. To the north stands the comitium, the meeting place of the Roman assembly and the rostra, the podium for addressing the Roman assembly. Further in the distance is the curia, the hall of the Roman senate. Northwest of the forum the Capitoline hill looms large with the temple to Jupiter standing as a guardian over the city. Southeast of the Forum runs the Sacred Way (Sacra Via).

You can see Cicero and Fulvia here.

>look at Cicero
A serious looking Roman garbed in a toga with a wide purple stripe. He seems to be intent on going about his business.

>look at Fulvia
A striking looking Roman in a pale blue dress. She seems to be going about her business.

>ask Cicero about business

[3] It must be remembered that the community of text-based game makers produce works of fiction, hence the name *Interactive Fiction*. These tools can also be used, as I propose, for creating simulations rather than fictional works.
[4] One can also display images in *Inform* to supplement text (see note 11). The severe memory restrictions of text games in the 1980s precluded this possibility.

Cicero says, "I am on my way to the senate chambers. There are important matters to be decided. Please don't delay me."

>Ask Cicero about senate
Cicero growls, "You are trying my patience! All Romans know that the senate house is on the north end of the forum. Now, stop pestering me!

>inventory
You are carrying:
a letter

>look at letter
A letter sealed in wax, its contents hidden from prying eyes. It is addressed to Cicero.

>give letter to Cicero
Cicero pauses for a moment: "Well?" he says, "hand it to me." He breaks the seal and glances at the contents quickly, murmuring appreciatively. "Very good," he finally announces and looks at you. "Here's a coin for your trouble; now I need you to do a bit of undercover work for me. Your employer won't mind. Meet me at the back of the senate house in half an hour."

>ask Fulvia about business
Fulvia says, "I am delivering a message on behalf of my husband, the consul Antonius"
>ask Fulvia about Antonius
Fulvia says, "Ah yes, my husband. He was Caesar's right hand man while Caesar lived. Now he is responsible for restoring order to the Republic." Glancing to make sure Cicero is not within earshot she adds, "and he is no friend of Cicero. If you share similar sentiments, you might be of great help to him."

As this excerpt illustrates, players navigate a virtual world by entering commands in the form of words.[5] A player of a text adventure expects to learn about the world through observation and dialogue. By studying the descriptions of locations, people, and things and conversing with the inhabitants of the fictional world, the player gains helpful clues to solve puzzles and progress through the story contained within the game.

Designing Simulations Games to Learn the Discipline of History

Historical simulation games are games that attempt to represent some aspect of the past faithfully. The example above should indicate the potential for using *Inform* as a tool to design simulation games. This line of thinking, however, begs the question: why arrange for students to design historical simulations at all? Quite simply, the design of simulations as a classroom exercise provides a powerful means of practicing the discipline of history. Fundamentally, history is the discipline tasked with developing meaningful interpretations of the past. Historians build their interpretations upon valid evidence and plausible models of how humans interact, cultures function, and societies change. For a student to learn to act as a historian, therefore, they must evaluate evidence and use that evidence to analyze historical systems. They must explore the relationships between the peoples of the past with each other and their environments.

History students, consequently, are taught most authentically and meaningfully when they learn to study history as a discipline rather than a subject. This entails moving far beyond the rote learning of teacher's and textbook's assertions about the past and developing several critical skills:

- The ability to evaluate and analyze evidence about the past
- The ability to combine pieces of evidence into a plausible interpretation of the past
- The ability to discriminate between the critical and trivial parts of a historical event or process

[5] Standard command words in text games include: ask, tell, look, inventory, and go north/south/east/west.

- The ability to use these skills to develop defensible, coherent, and meaningful interpretations of the past.

Taught this way, students come to appreciate the discipline of history as a lens through which they can view the world. They learn to "do" history by forming their own justifiable conclusions about the past. In the process, students learn fundamental skills of analysis, interpretation, critique, and synthesis that will serve them well.

The learning benefits of simulation design justify assigning simulations alongside traditional essays. Designing a simulation that faithfully reflects a historical process requires the historian's critical skills for developing a compelling written argument: the ability to analyze and contextualize evidence, distinguish between the trivial and the essential, advance a defensible account of causation, and, in doing so, construct a plausible interpretation of the past.[6] Both a historical simulation and a written thesis are interpretations of history. The fundamental historical reasoning supporting both types of projects is quite similar, though the design process and final products are quite different.

A simulation design project offers particular learning opportunities offers that papers cannot, further indicating the importance of using them in high school history classes. Fundamentally, designing a simulation, even a very primitive one, requires a considerable amount of analysis and synthesis. A simulation game is a simplified virtual world that models a vastly more complicated historical event or process. To design such a simplified system successfully, students need to consider the "moving parts" of the historical process in question—the interactions of people with each other and their environment. In order to make the simulation work—in order to make it function as a game—the interactions between historical characters will need to be defined as rules. Doing so requires a level of commitment to detail, an appreciation of relationships, and a sense of historical imagination not often displayed in the average secondary school essay, textbook. This is because a paper or book may rest statically on its assumptions without the author being aware of them. A simulation, on the other hand, plays out the primary assumptions of its creators. For example, one might assume from references in popular culture that on a medieval manor a lord felt free to treat his peasants however he wished, taxing, working, and even killing them on a whim. When researching and simulating a medieval manor on a basic level, however, the peasants are clearly the economic producers while the lord is the manager. At the most basic level then, a simulation designer will note that if a lord destroys his peasants, he will no longer have any producers and his manor will fail—during the testing of the simulation if not before. The trick then as a designer is to represent the relationship between peasants and their lords in a way that best fits the evidence and reasoned guesses about the past.

Since simulations games can focus on varied causes more than particular outcomes, designing them also provides an excellent opportunity for students to consider outcomes produced by different environments, factors, and decisions by the people of the past. Such considerations can be vital for helping students appreciate that human actions in the past are not pre-determined. There are historical factors that promote some actions and discourage others. Ultimately, humans make choices based upon the situations in which they find themselves.

This discussion of this kind of analysis sounds complicated, or perhaps simply overambitious. The beauty of a simulation design project, however, is that it requires high level thinking that is packaged in a format readily understandable and engaging to many, if not all, kids: the game. The trick is to guide the students through the analysis by introducing them to the more easily digestible concepts of simulation design. There are three fundamental concepts of simulation design.

[6] It is worth noting that the learning benefits of student-designed simulation games apply to fields other than history. Certainly, the principles outlined here can be readily adapted for use in other fields.

1. The role(s) of the player(s) in the simulation must be established. What historical character is the player adopting and how does this influence her actions in the simulation?
2. What are the objectives of the character? What is it that the player, in the role of the character, is actually trying to achieve in the simulation world?
3. What are the tools, resources, and decisions available to the character as she attempts to achieve her goals?

Any historically valid attempt to address these elements will require researching the available evidence. Thorough consideration of the elements goes a long way toward forming a dynamic, historically plausible interpretation of the past.

The very act of designing a simulation requires an ability to analyze systems, weigh possibilities, and reconstruct chains of cause and effect. All of these skills are at the heart of historical reasoning. They are the purpose of history and should be the goal of our efforts as high school history teachers.

Inform 7 as a Simulation Design Tool for Students

Inform allows users to create text-based simulation games using natural language commands.[7] Because *Inform* commands follow English grammar and syntax, a student with no knowledge of programming can learn the basics of the program in the span of a few hours, and then create simple interactive computer simulations of history and literature. The same can be said for teachers: with a bit of practice learning the basics, a teacher without programming experience can be ready to lead students in an *Inform*-based project. The relatively modest time commitment required to learn the basics frees students and teachers to remain focused on the critical learning in their subject of study rather than on the complexities of programming. There are very few, if any, other computer design tools that offer this combination of ease of use with the potential to create quickly sophisticated historical settings and content. Adobe Flash®, a multimedia design tool for Internet content, for example, allows students to create stunning graphical programs with modest programming skills; nevertheless, Flash ActionScript®, the underlying programming language for Flash, is a legitimate high level programming language that takes a prohibitive amount of time to learn in classes where the focus is on subject matter other than programming. There are role playing game makers that require little or no programming skill. These, however, are significantly more complicated and time consuming to use than *Inform* and tend to be based on systems of fantasy graphics that generally bear little resemblance to any particular historical reality.[8] The artistic style of these programs is far too likely to undermine a student's focus on rigorous historical interpretation. Finally there are game makers that allow users to create 2-dimensional video games in the style of Pac-Man, Space Invaders and the like. These are powerful game design tools but it is difficult for the novice to develop true historical simulations with these platforms—they are better suited to creating fictional games. In the future it is likely that commercial game modification tools will reach a level of simplicity that easily enables high school students to design graphical simulations. At the moment, these tools are still too complicated for a general audience. The toolset accompanying

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[7] *i.e.* commands that read as natural English sentences rather than as computer instructions. For example the statement "increase the value of counter" is rendered in many programming languages as "`counter++`" and "counter is a number that varies" is "`int counter;`" The real payoff comes with statements such as "the subway platform is a room", which requires a class definition and constructor in Java and C++.

[8] RPG Maker (http://tkool.jp/products/rpgxp/eng/), for example, is a good RPG creation tool for hobbyists but features fantastic, anime-style artwork. Eclipse (http://www.freemmorpgmaker.com/index.php), from an artistic perspective, seems to be a variant of RPG Maker. It allows users to create their own multiplayer online games. While the educational potential of creating multiplayer online games should not be underestimated , Eclipse is limited in the same ways as RPG maker.

Obsidian's *Neverwinter Nights 2*[9] role playing game, for example, is sophisticated and relative easy for hobbyists to create their own adventures. The *NWN2* toolset is easy to use relative to earlier game modification tools, however, and still requires a devotion of time and energy that makes it impractical as a tool for designing simulations in school.

Inform, on the other hand, is quite easy to use. Consider the portrayal of the Roman forum at the beginning of this article. Very few commands and concepts were needed to create this scenario, as illustrated in the following instructions:

"A Mission in the Forum" by Jeremiah McCall

The Sacra Via is a room. "The Sacred Way, a major route through the center of the city, runs from the northwest to the southeast. To the northwest is the forum, the center of public life at Rome."

The Forum is northwest of the Sacra Via. "The Forum Romanum is bustling with merchants, politicians, slaves, and street vendors. The law courts of the praetors are thronged with bystanders and the old and new shops along the Fulvian and Sempronian basilicas are teeming with activity. A hundred transactions are occurring at any given moment and the air is buzzing with possibilities. To the north stands the comitium, the meeting place of the Roman assembly and the rostra, the podium for addressing the Roman assembly. Further in the distance is the curia, the hall of the Roman senate. Northwest of the forum the Capitoline hill looms large with the temple to Jupiter standing as a guardian over the city. Southeast of the Forum runs the Sacred Way (Sacra Via)."

The player is carrying a letter. The description of the letter is "A letter sealed in wax, its contents hidden from prying eyes. It is addressed to Cicero."

Cicero is a man. Cicero is in the forum. The description of Cicero is "A serious looking Roman garbed in a toga with a wide purple stripe. He seems to be intent on going about his business."

Fulvia is a woman. Fulvia is in the forum. The description of Fulvia is "A striking looking Roman in a pale blue dress. She seems to be going about her business."

Understand "the business" or "business" or "occupation" or "what are you doing" or "what is he doing" or "what he is doing" or "what is she doing" or "what she is doing" as "[business]".

After asking Cicero about "[business]":
say "Cicero says, 'I am on my way to the senate chambers. There are important matters to be decided. Please don't delay me.'"

Understand "senate" or "senate chambers" or "the senate chambers" or "the senate" as "[senate chambers]".

After asking Cicero about "[senate chambers]", say "Cicero growls, 'You are trying my patience! All Romans know that the senate house is on the north end of the forum. Now, stop pestering me!"

Instead of giving the letter to Cicero:
Say "Cicero pauses for a moment: 'Well?' he says, 'hand it to me.' He breaks the seal and glances at the contents quickly, murmuring appreciatively. 'Very good,' he finally announces and looks at you. 'Here's a coin for your trouble; now I need you to do a bit of undercover work for me. Your employer won't mind. Meet me at the back of the senate house in half an hour.'";
Now Cicero has the letter.

After asking Fulvia about "[business]", say "Fulvia says, 'I am delivering a message on behalf of my husband, the consul Antonius'".

[9] For more information, see http://www.atari.com/nwn2/US/index.php .

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After asking Fulvia about "Antonius", say "Fulvia says, 'Ah yes, my husband. He was Caesar's right hand
man while Caesar lived. Now he is responsible for restoring order to the Republic.' Glancing to make sure
Cicero is not within earshot she add, 'And he is no friend of Cicero. If you share similar sentiments, you
might be of great help to him.".
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Several features of this simple program are worth noting. First, as stated above, the instructions the designer gives to *Inform* take the form of grammatically correct English sentences. Certainly, these sentences must be written correctly—*Inform* cannot understand most variations of English statements. Nevertheless, they make sense to students and are essentially free from the abstraction and symbolism of high level programming languages such as C++ and Java.

Second, these statements are essentially logical propositions that create the environment and its inhabitants. *Inform* does the heavy lifting that allows a player to interact with the world. More precisely, the *Inform* compiler takes the designer's instructions and adds the functionality that allows a player to move in the allowed directions, look at people, take and drop items, ask and tell things, and carry out designer-created verbs. This allows the student to function as a high level designer, concerned primarily and appropriately with the historical content with which she will infuse her world and characters, and largely untroubled by the more obscure complexities of computer programming.

Third, it takes very little knowledge of *Inform* to create the structures of a world that players can navigate, populated with characters players can engage, and containing objects players can use. The instructions above include: creating and describing rooms, objects, and people; placing people and objects; defining a series of player typed words as members of a question topic; responding to a question topic and responding to efforts to give an item to a character; and transferring an item to a character's possession. Though *Inform* offers many more commands, these basic ones, when reused with different descriptions and combinations—are more than enough to create a world full of locations, characters, and items with which the player can interact.

There is ample room for increasing the sophistication of these simulations. *Inform* includes a high level set of tools, and skilled programmers will find almost everything they would hope for in a specialized programming language of this sort.[10] Continued use of *Inform* can provide opportunities to explore more complicated concepts, a bit at a time. At its simplest level, however, *Inform* enables students to create characters, dialogue, objects, and a virtual geography—the building blocks of a world—quickly.

As an additional benefit, the technical requirements for *Inform* are very modest as are the requirements for playing the finished games. The program is free and is less than five megabytes, which means it can be downloaded even on dial-up lines. There are versions for Macintosh OS X, Windows 95 through XP (the XP version works in Vista), and Linux. If students are working in teams, which really is desirable for this exercise, even a modest computer lab should suffice for implementing a classroom project of this type.

Beyond the critical role that simulation-design thinking can play in history education, there are sound pedagogical reasons for assigning students an *Inform* simulation design project. Such a project addresses the needs of a number of different learning styles, particularly when students are grouped into design teams. Logical/sequential learning is addressed through the programming, verbal learning through the development of written dialogue and descriptions, and interpersonal learning through the collaborative efforts of the design team. Visual learning can be supported through displaying images as

[10] Conditional statements, loops, and data tables, basic file I/O are all included in addition to the ability to extend the language in new ways. "Informese" is an object oriented programming language containing the flexibility and extensibility associated with such languages.

part of the game.[11] Even without images, strong spatial learners fare well in laying out the relationships of rooms using compass points. In addition, simulation design projects also address the highest levels of learning in standard taxonomies of educational objectives. Designers must not only analyze evidence to provide the basis for their simulations, they must also evaluate the critical historical processes, characters, and props that need to be included and synthesize the information they have gathered into a new form, the simulation itself.

Furthermore, an *Inform* simulation design project allows students to take charge of their own learning by tackling design-based problem solving in groups, a practical challenge. In order to produce a successful simulation, student designers have to work through problems collaboratively and practically, each contributing insights and program instructions to the final project. The energy spent practicing effective collaboration and working out design solutions that marry humanities to technology will serve most, if not all, of these students well.

Inform projects also provide an excellent opportunity for authentic assessment. Beyond the real-world practice of computer game design—a rapidly growing field—the process of designing a system is used in many fields today, from web and graphic design to marketing. In the immediate aftermath of a project, the peer audience for a text-based game is far greater than that of a typical class expository essay or even a project involving visual aids. *Inform* games are created in a format that is easily shared with others and there are many sites hosting interactive fiction. It requires little additional effort to post students' projects on a school site, offering the potential for their work to be viewed by the outside world. With the right level of motivation there will be students interested in pushing the envelope with *Inform*. Outstanding examples from these students can be submitted to an Interactive Fiction competition or archive[12], providing further recognition for, and a greater appreciation of, the authenticity and value of the exercise. One could even expand on the authentic skills learned during the project by requiring students to design a package, historical overview, and marketing blurb for their simulations.

Finally the level of engagement inspired by *Inform* is quite striking. Though there are a few—as is the case with all forms of learning activities and assessments—whose response to the simulation design project is lukewarm, most of my students have reacted enthusiastically. Out of the 60 students who worked with *Inform* this year at Cincinnati Country Day School, 10 went on to create their own projects purely for personal enjoyment. When busy teenagers devote free time to the program, there is clearly something powerful at work. Quite simply, the enthusiasm is sparked by the power to create worlds. One student captured this sentiment nicely, noting,

> You kind of felt like you were in a movie. You could make up characters. For example, when [my teammate] said, "I really wanted that character to be an old guy." You could do that yet still be in the parameters of Rome. I thought that was a cool way of looking at it because you could surround yourself with the game of *Inform* and really put your players [in positions where] they could talk to these powerful people and the characters would react. I think this immersed players in Rome more than you would have thought in a video game.

Another voiced a similar appreciation of the ability to create: "I like [*Inform*] because (pause) … I've never written a play before but it kind of felt like writing a play, getting into that mindset [of characters]."

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[11] *Inform* has the ability to display static images in JPEG and PNG formats. For more information, consult the documentation contained within the program, or view the relevant part of the online manual at http://www.inform-fiction.org/I7/chap21.html

[12] See note 1.

Inform in Action – Initial Experiments and Preliminary Conclusions

The strengths of Inform as a learning tool are evident. After exploring the theoretical implications of this tool, I began a round of classroom experiments with Inform early in 2008. At the time of writing this article, I have assigned and assessed seven *Inform* simulation design assignments at Cincinnati Country Day School: an initial round of projects in four classes and a second set of projects in three classes several months later. My students have ranged from seniors in a simulation design class, to ninth graders and tenth graders in typical World and European history classes. The seniors' efforts have provided insight into the higher levels that can be attained with these sorts of projects. Outstanding students in college preparatory school, all with the required semester of introductory programming under their belts, they offer a glimpse of the value of using *Inform* simulations even at the college level. They are an outlier, however, in the sense that, since they are taking a simulation design course, they have an extraordinary amount of class and homework time to devote to their *Inform* simulations. More generally applicable information came from the ninth and tenth graders. Few of these students had completed their introductory programming class, and the time constraints of the course allowed for a more widely applicable test of the usefulness of *Inform* in a survey history course.

There is a great deal more work to be done on the theoretical and practical aspects of simulation design projects to be sure. These initial implementations, however, provided enough qualitative evidence—from classroom observations, video-taped debriefings, and the projects themselves—to craft general guidelines. Because these implementations were practical rather than experimental in their design and purpose, the guidelines below are assuredly tentative. Nevertheless they should help interested educators use *Inform* assignments in their own classes and also suggest areas that need more consideration by teachers and researchers alike.

Project Guidelines

The ninth graders were initially tasked with designing a simulation of Roman women protesting to repeal the Oppian Law[13] in 195 BCE; they simulated an early medieval village on the verge of converting to Christianity for their second simulation. The tenth graders, on the other hand, first simulated a 24 hour period in the life of an average English textile factory worker in 1830, and subsequently simulated a section of the Western Front trench system in World War I. Seniors in the simulation design class were given free rein and instructed to design a historical simulation of their own choosing. They chose a range of topics: the My Lai massacre, the moon landing, student civil rights protesters at a Woolworth lunch counter, and medieval manor management.

The ninth and tenth graders received the following guidelines for the project:

- Include a historically reasonable layout of the geography and historically reasonable placement of historical characters
- Allow the player to ask historically reasonable questions to the characters in the game and receive reasonably historical answers.
- At the minimum, allow the player to explore the environment, and use conversations to understand the motivations and attitudes of different characters. If possible, allow the player to achieve a goal.
- Include a recorded design document that:

[13] For an excellent overview and inclusion of the Roman historian Livy's account, see http://www.womeninworldhistory.com/lesson10.html .

1. Explains why the team designed the simulation the way it did.
2. Explores what the team thinks the simulation's strengths and weaknesses are with respect to historical validity.
3. Considers the extent to which the team's characterization of the past, including portrayals of cause and effect, was reasonable.
4. Refers to valid evidence in the consideration of points 1-3.

The ninth graders used the Roman historian Livy's account[14] as their main source for the first project, and a variety of selected medieval and modern sources for the second project. The tenth graders were instructed to draw from a selection of primary sources and secondary sources for both assignments.[15] Seniors had to research their simulations independently.

The critical difference between the first and second round of assignments was the added requirement of a design document. In round two, students had to complete a detailed plan of room names and descriptions; character names, descriptions and responses to discussion topics; item names and descriptions; and key character actions. Before beginning work on actually programming their simulations, each team had to submit a complete design document for approval. As will be noted below, this significantly enhanced the project in several ways.

Group selection and organization.

The ideal size for simulation design groups is between two and four members. When selecting group members, the two factors that are most important in this type of assignment are the students' relative levels of motivation and aptitude with *Inform*. Work can get distributed unevenly if the group members are not all roughly as motivated to succeed at the project. Furthermore, a potentially ineffective group is created if one or two programmers are far better than the others in their group. This results in the programmers doing the majority of the work. Interestingly enough, I have found that the most motivated and most successful programmers are not necessarily the most successful traditional learners. Thus students who might not ordinarily be the most successful in classes taught through traditional methods have the opportunity to shine.

One effective method for balancing the workload and allowing students to play to their strengths is to create different leadership roles for the design teams. Such roles could include:

1. Project manager – the overall leader responsible for guiding the job to completion
2. Lead programmer – responsible for making sure all *Inform* commands work together and are error-free
3. Lead writer – responsible for overseeing and proofreading the dialogue and descriptions written for the simulation
4. Lead researcher – responsible for identifying the critical elements from the materials that need to be incorporated into the simulation; responsible for raising concerns when the simulation is not consistent with the evidence.

While each team member will be responsible for the overall success of the simulation, each will also be the primary person responsible for one aspect of the simulation. In this way a higher degree of

[14] See note 13.

[15] The Internet Medieval Sourcebook (http://www.fordham.edu/halsall/sbook.html) and Modern History Sourcebook (http://www.fordham.edu/halsall/mod/modsbook.html) are outstanding resources for primary and contemporary sources. Texts on these sites are generally public domain, or at least copy permitted. Because the translations can be quite ornate, I tend to adapt the texts for my students.

accountability and ownership can be generated for each member in the group. Assigning specialized roles also serves to address differing learning styles—those with strong interpersonal skills functioning as managers, strong sequential/logical learners serving as programmers, and verbal learners as writers and researchers. Finally, this division of labor, particularly if the students are allowed to make the assignments within a group, can help students learn to identify and promote their strengths.

Time Requirements and Inform Instruction

After introducing the assignment and forming the design teams, some class time is necessary to instruct the class on the basic techniques of *Inform* programming.[16] Approximately two hours are needed for this task—in my case, 2.5 50-minute periods. As it happened one class had several breaks between days of instruction due to snow days. This class had greater difficulty retaining and using the basic *Inform* skills than classes that received all of their *Inform* instruction over 2.5 classes without interruption.

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The following concepts were introduced during the days of instruction for the initial projects:

- Creating rooms and establishing routes between rooms
- Creating characters
- Asking characters about topics and receiving replies.

These elements correspond to those used in the code sample on pages 7-8.

Student reactions to the assignment at this point tended to be extremely positive, primarily because of the excitement that accompanied being able to create micro-worlds complete with characters and items. To make sure, however, that the focus remained on the historical aspect of simulation design and not programming prowess, students were instructed that they could limit their simulation to the elements above. In other words, if their simulation only allowed a player to move around a virtual world and speak with characters, that was perfectly satisfactory and, if well executed, could earn as high a grade as a more sophisticated piece of programming. For those who did want to go further, however, and implement a bit more goal-oriented behavior in their simulations, two additional topics were addressed:

- Giving objects to characters
- Giving each character an attitude of friendly or hostile and changing dialogue based on character attitudes
- Changing attitudes through conversation
- Giving items to characters

For the second round of projects, students received a refresher and some more advanced concepts.

It is probably best to think of the initial outlay of time as an investment in future simulation design projects. Once students have learned the basics of *Inform*, they will be equipped to complete multiple simulation design projects of this sort over the course of a year. The second round of projects confirmed this: a successful *Inform* refresher took only 50 minutes. Even though six weeks had passed, retention of the *Inform* skills initially learned was high.

Both ninth and tenth graders received three additional days in class to work on their first projects. This commitment of time was longer than absolutely necessary; the absence of a formal design document in the first round meant group work was less focused and, consequently, required more time.

[16] For a guide of basic techniques, visit the Inform guide I created for my students on my *Historical Simulations in the Classroom* website (http://www.historicalsimulations.net/inform/informguide.htm) .

As a general rule, it is valuable to have students conduct at least some of their design work under supervision so that a teacher may provide appropriate support. Furthermore, the students in a group must have the ability to work together, whether in common study halls, during class time, after school, or even through email and IM collaboration. Overall, one can reasonably expect that three days is enough in-class time to devote to the project, depending upon class size and other management factors. During the second round of projects, the amount of class time decreased to 50 minutes of design time. Students' increased familiarity with *Inform* and the organizational assistance of the design document enabled them to plan more efficiently in class and work more independently outside class. In any event, some homework time will also need to be allotted to completing the task. It takes time to reflect on a design and produce a working simulation. My students had a deadline roughly 10 days after the start of the assignment, and allocated three homework nights to the project.

***Addressing different learning styles*.**

As noted above, simulation design projects already address several different combinations of skills and strengths, particularly when the designs are conceived and implemented by teams. Though it is beyond the scope of this article, it is worth noting that *Inform* programs can include sounds and images, extending the ability of a simulation project to reach learners of different strengths. Indeed, several students noted during their debriefing sessions that they would have found the inclusion of images more helpful from the perspective of game play. Copyrighted work should not be used in student games, however, especially if those games will be made available on the Internet. Ideally, students should create their own artwork for the game using a commercial graphics program or one of the many open source programs.[17]

The Critical Role of the Design Process*: *Scaffolding Historical Thinking

The historical learning that takes place during the design process is, in a very real sense, the true goal of this type of exercise: during this period the fundamental deliberations take place on how to characterize the past faithfully. In order to maximize the learning potential in an activity of this sort, it is critical to provide guidance for the design period. Knowing this, I had emphasized to my ninth graders that they needed to outline their simulation before writing the actual code. In practice, however, I found that the lure of coding was just too strong for students. Consequently their simulations, while reasonably valid, showed distinct signs of being more game-like, more based on what they knew about *Inform*, or what they thought was flashy about it. In the second round of projects teams had to outline the rooms, items, characters and interactions before they began to code. This planning significantly improved the depth of descriptions and dialogue. A clearer rubric detailing the criteria for a successful simulation was also provided to help students produce a better design from the very beginning.

Whenever possible during the design process, students need to be reminded that the ultimate goal is simulating reality. Therefore, a designer should always consider first what likely happened in the past and only then how that could be represented in *Inform*. To design in a backwards fashion – from what one can do in *Inform* to what happened in the past – tends to lead to significantly flawed simulations. Indeed, the teacher's role as a guide and facilitator is essential in the early design process. By monitoring conversations and offering appropriate questions and comments, teachers can guide their students toward developing more plausible simulation games.

The following incident illustrates particularly well the importance of guiding students during the design sessions. After a couple of girls learned on their own initiative how to make new command verbs,

[17] GIMP is the leading open source, free, graphics program (http://www.gimp.org/) . The basic paint program included with Windows and Mac operating systems will also suffice.

one was playing around with the code and found she could have her Roman woman bake a pie. She was excited by her new ability to shape her *Inform* world and asked me whether it would be okay to have her character give a pie to a Roman official to persuade him. I asked her if, based on the evidence she had read, she believed pie baking was a means by which the women in question got the Oppian Law repealed. We agreed that there was nothing in the evidence to support the pie baking hypothesis. When questioned further, she concluded that protests and rioting were the methods used by the Roman women in this episode – therefore these were the types of actions she had to model in her simulation. Happily, these are exactly the sorts of conversations and considerations that should take place if one is designing a historical simulation.

Discussions of these sorts occurred throughout the design sessions, a sign of active collaboration and problem-solving. One group debated about how to use a petition as a mechanism in their game and discussed the technical details of making a game character sign a petition. Another group decided to allow players to ask characters about rumors—a common feature in commercial role playing games—to add depth to the game and discussed what types of rumors would count as historically valid. Those working on the Roman simulation discussed how women were able to bring about political change, and all groups discussed the issues of character motivation. All had to spend a fair amount of time working with the geography of the Roman Forum, layouts of English factories and early Germanic villages, or systems of trenches, deciding what the key locations would be and how they should be rendered. Though not easily assessed, these design sessions are the places where the most important learning took place as students worked together to solve problems using a given set of tools and evidence.

The Simulations

It cannot be stressed enough that the ultimate success of projects of this kind lies more in their ability to promote and provoke higher level thinking skills than in their generation of particularly sophisticated simulations. That said, the results achieved by students were promising. The following examples are excerpts of high points that have been edited only for glaring errors (*player commands are in italics*).

Example 1: Roman Women Protest the Oppian Law

> Welcome to Rome, your name is Prima Amelia. You are a Roman women living in 194 BCE. Many things are happening right now and you are stuck in the middle of all the commotion. The Oppian Law states heavy restrictions on many aspects that concerned Roman women's lives including money, clothing, and transportation. As one may expect, the women of Rome were outraged by this unjust act. Two tribunes stand in the way between you and having the law repealed. Now as the climax approaches, you will lead hundreds of women to either a continued existence with a harsh law or the creation of a new peace. It's your choice.
>
> **Home**
> You are located in your home. It is not a large house but enough to accommodate you and your family. This house has been in your family for many years. The outside is a dark tan with a red roof. You are located in the kitchen standing over the table. Feel free to take the objects you see.
>
> Your husband looks at you longingly. Feel free to ask him about objects or rumors.
>
> Your loyal servant tells you about anything you ask, and she is delighted to talk to you about rumors or objects.
>
> You can also see a note and a coin pouch here.
>
> *>ask servant about rumors*
>
> Did you hear about Lucius Gracchus? He died from some strange illness. His funeral is this Sunday if you are interested.

>read note

The note says, "Please, I know how busy you are, but I implore you to come north to new street, and then northwest to the Forum. It is extremely important to your case. When you find me in the forum, ask me about the note." (Signed hurriedly by Gaius Oppius)

>go north

New Street
New Steet is the main entrance to the Forum.

You can see a woman, followers and a Tribune here.

>go northwest

Forum
This forum is very crowded with tons of people who are talking about everything from affairs to military business.

You can see Gaius Oppius here.

>ask Gaius Oppius about note

The tribune looks up at you and replies, "Yes I sent you that. We need to talk about the Oppian law. There are two tribunes that have opposed the repeal, and you need to convince only one of them to repeal the law. He is on New Street now, southeast of here. He accepts bribes, but he generally only accepts one bribe per person. Go to him now and give him your coin pouch."

Example 2: The Life of an Industrial Worker

Home
It is a small, damp room. You hear people talking and children crying outside the window. You hear mother screaming for you to wake up from outside. It is very early in the morning; it's something like 4:30 am. Your mother has to go before you, so she always wakes you up before she leaves. You are very tired, but you know that you can't be late or else you will lose pay and maybe your job. With that thought, you get out of bed and get ready for the long day ahead. The door is north.

>go north

The City Streets
The sky is a dull, nauseating shade of gray, due to the exhausts from the steam powered engines of the factories. You notice a horrible smell. As you continue to walk down the street, you notice where that smell is coming from. On the side of the street there are feces everywhere. But what else is to be expected; there's nowhere else to put it. You continue on

You can see your mother here.

>look at mother

A young woman whose face is covered in black soot because of the pollution in the air. You barely recognize her because of the obvious physical reasons. She is breathing heavily and in a hurry.

>ask mother about what is wrong

You have got to hurry to the factory before you are late, and you know what happens when you are late. I don't want you coming home crying again from being beaten. Get a move on!

…

Factory
The factory is dark. You practically choke because there is so much dust in the air; it's very musty. The factory is also very loud. With the various sounds the machines make and the screaming of children being beaten, you can barely think. You may take your break now if it will help you concentrate more once you're done. You may take your break by typing "outside"

You see the overseer is a big, strong and sweaty man. He looks unhappy. He's holding the whip; don't anger him.

>go north

your station
Your station has your machine, along with those of others.

You see your machine is big and made of steel. It has many confusing parts which you only partly understand. All day, every day -excluding Sundays- you are on your feet working this machine.

You can also see the cotton and a 2nd overseer here.

>work

The machine starts to move and steam. You begin to see the wheels turning and the cloth spinning.
The cloth has been made. Now you must take the cloth away to the bolt room (which is east) and put new cotton on the spindle.

>look

your station
Your station has your machine, along with that of others as well.

You see your machine is big and made of steel. It has many confusing parts which you only partly understand. All day, every day -excluding Sundays- you are on your feet working this machine.

You can also see a cloth and a 2nd overseer here.

>take cloth

Taken.

There were two primary weaknesses of these simulations. First, their limited use of dialogue. The initial round of designs had a tendency to allow players to ask only one thing of each character, making the whole affair rather too much like a scavenger hunt. Spending time in the second round explicitly instructing students to develop a set of conversation topics to which anyone in their game world would be able to offer some response helped a great deal. Second, and more difficult to address, is the linearity of the simulations. Players have some options but tend, as far as the major historical actions of the game go, to be led along a single path, only able to solve problems one way. The problem may be mitigated by more pre-coding planning. Asking students to brainstorm two to three different ways that a historical character might have achieved a goal should go a long way to developing less deterministic simulations. Considerations of this kind, of course, only increase value of the exercise as a way to teach history.

The strengths of text-based simulation games for learning of history are evident. These simulations involve creating imaginative, yet historically grounded prose descriptions of locales, objects, and people. This prose must be crafted based on the knowledge that students have and the information they obtain from the available historical evidence. In other words, student must analyze and evaluate

evidence in order to synthesize descriptions. Building a consistent world also requires the skills of analysis, evaluation and synthesis. Finally, they offer the opportunity to interact with historical characters albeit on a relatively superficial level. Drafting dialogue requires a basic ability to think about the concerns, attitudes, and motivations of historical people.[18] At the highest levels under the right conditions, simulations involve analyzing possibilities and determining the factors that made some decisions and outcomes more likely than others.

Play-Testing and Debriefing

When the simulations are complete, class or homework time should be allotted to playing and critiquing them. Critiques can take the form of one paragraph responses in which students note at least one positive aspect of the simulation and one area that can be improved. The opportunity to have one's work enjoyed by one's peers can provide a tangible sense of gratification for students after their hard work and the process lends to the authenticity of this form of assessment. At the same time, students have an opportunity to practice offering constructive criticism. It is often quite difficult for students to grasp that criticism, when offered in a positive spirit and tone, is essential to the development of a project. Students' constructive comments will result in an improved simulation.

Finally, each design group should be given a chance to reflect on their completed simulation, in particular on the validities and inaccuracies of the simulation in comparison to the historical evidence available. This final debrief is essential insofar as it gives students a final opportunity to consider one more time what the evidence suggests about the past and how faithfully the simulation represents the past. By persuading students that a simulation by definition will have areas of greater and lesser accuracy, a safe environment is created for them to take risks and meaningfully critique their own work. If possible, they should debrief by having a discussion without the teacher that is videotaped or recorded so that the exercise takes the form of a roundtable. In the absence of recording tools, students could hold a conversation with the teacher. They could just as readily prepare a written document, but this runs the risk of silencing a number of comments and detracts from the group-learning format.

What was learned?

The adolescents who undertook these projects offered a great deal of constructive feedback in their videotaped debriefing sessions. While testimony from students must be taken with a healthy dose of salt—particularly when distinguishing between the educational soundness and the entertainment value of an activity—some interesting points were made that can help direct further implementations.

Beyond the learning outcomes previously outlined, an additional benefit of the simulation exercise was that it helped students learn and appreciate the details of everyday life in the past, details of which they were often unaware. Use of culturally appropriate names, places, and descriptions, and consideration of appropriate forms of address and conversation were all noted. One student went so far as to say that the *Inform* project was particularly helpful in reminding her about everyday life, noting, "when you think about history you almost forget that [the people of the past] had a day-to-day life." Another noted, "I like how *Inform* made us use actual Roman names… to see how it actually would have been to speak to a Roman." Finally, "I liked doing this because I put myself in the mindset … that

[18] These considerations lend themselves readily, of course, to a literature class, which might also explore issues of dialect and colloquialism.

we were back in Rome, and I wondered how people would be feeling … [Designing this simulation] was more of a personal experience ... versus actually just learning about it."[19]

Those who simulated Roman women felt *Inform* helped them considerably to visualize the physical layout of the Roman Forum. "I think the thing *Inform* really helped with," one student noted, " is it really showed you the layout of the Forum. You really had to know the directions." Another agreed saying, "before this I couldn't even picture Rome in my head."

Gaining a fair amount of empathy for the people of the past and their concerns was another benefit. Said one student who simulated Roman women protesting the Oppian Law,

> I particularly learned how the women felt. I know I'm a girl and I should have felt angry from the beginning, but when I was reading the document, I really didn't feel their anger. I was like "oh grow up, get a life, deal with it". But when I was playing the game and we were getting further and further into it and the senators were being jerks to us, I was like, "you know what, I'm really mad; I want them to repeal this law. I want Aemilia to make some big speech.

The designers of an English factory simulation, on the other hand, were struck with how long and difficult work days were, and how unwholesome working conditions were in factories. "[Designing a simulation] kind of helped [me learn about the Industrial Revolution] because if you wanted a good grade you had to have accurate things so in order to get accurate things [you had to draw on the evidence]."

When comments turned to improvements, the benefits of including images was mentioned more often than any other topic. Indeed, the strongest criticism offered by the tenth graders was the lack of graphics. They seemed to connect this criticism back to the quality of the games themselves, noting that the use of images would have made the games far more interesting and immersive. Arguably, though, one could make the same claim about the design experience. Since it is not particularly difficult to include images depicting each room in the simulation, it is likely worth the time and effort to help students to do this.

Final Thoughts

Educational computer games have acquired a pretty terrible reputation, often deservedly. There are some signs of progress. In this new millennium, the study of games as learning tools has become a full-fledged field of research at the university level. National conferences such as the University of Wisconsin's Games Learning and Society explore the power of games to teach both in and outside of the formal classroom. Some individual teachers have found ways to tap the power of commercial games in history and other classes. The implementation of these ideas by classroom teachers is still, however, very much an *ad hoc* affair.

Nowhere is this more apparent than in the case of student-designed historical simulation games. This concept lies at the nexus of theories of constructivist learning and computer games as learning tools: students take greater charge of their own learning and use the tools of game development to do so. This particular combination of theories is new. Nevertheless, it is high time to put the power of simulation game creation in the hands of high school students—and perhaps students at all levels. The excitement of world creation, the opportunity to analyze and recreate systems, the appeal to different styles of learning, and the opportunities to learn how to criticize and receive criticism constructively are

[19] My sense is that she meant "learning about the past by other means," for example through lectures or a textbook. It does make one pause and wonder how students experience their daily formal education and what they understand the term "learning" to mean in the context of school.

all inherent in a successful educational simulation design project. In the larger picture, students not only learn to practice historical criticism and reconstruction, they also learn a great deal about creating and implementing designs, managing projects, and creating real-world products. In short, students learn to *do* history, not receive a litany of events and interpretations passively from classroom or textbook authorities. And teaching student to think for themselves, to do history, should be our purpose as history educators.

Computer game modification tools that bring the power of game development into the hands of non-programmers are continuing to develop at a remarkable rate. There is good reason to expect that students will, within the span of a few more years, be able to create historical simulations that combine 3-D graphics and sound with the rich descriptive power of text. Here and now, *Inform* provides a breakthrough in the realm of educational simulations. With its power and relative ease-of-use, it opens a new chapter in educational simulations and places more power in the hands of student historians than ever before.