

INTERACTIVE STORYTELLING, GAMIFICATION, AND ONLINE EDUCATION: STORYTELLING MADE EASY

Trevor Rasmusson

John R. Bourne



Trevor Rasmusson. Learning Innovation, American Sentinel University, 2260 S Xanadu Way # 310, Aurora, CO 80014; trevor.rasmusson@americansentinel.edu



John R. Bourne. Editor-in-Chief, International Journal on Innovations in Online Education; john.r.bourne@gmail.com

Abstract

This paper was created to stimulate thinking about the art of the possible in using storytelling for online education. We explore the possibilities for storytelling, visualization, peer discussion, gamification, and interaction as a learning paradigm. Written for educators and instructional designers/technologists, this paper provides concrete ways to engage in digital nonlinear storytelling at no cost by using open source software.

KEY WORDS: digital story telling, unity, twine

1. INTRODUCTION

1.1 Why Stories?

A story provides a description and event or events. In the traditional worlds of storytelling, both oral and written linear stories are commonplace, often becoming the basis for books, papers, films, and television. A detailed description of both historical and contemporary storytelling is provided in *Wikipedia* (Storytelling, 2016). In this paper, we are primarily concerned with a form of storytelling called “Nonlinear Storytelling” and specifically because we believe that a strong link in nonlinear storytelling with gamification can dramatically improve learning in online education.

Others have cited that storytelling provides improved recall over simple presentation of hard facts (Gillett, 2014). While this paper is not a scientific study, it is hard not to believe this finding; we think everyone has experienced the ease of recalling a story as contrasted with a collection of disjointed facts.

This paper is dominantly for online educators with little to no experience in digital storytelling. How educators can *use* stories, *create* digital stories, and *disseminate* stories to online students, while increasing the achievement of desired learning outcomes will be explored.

1.2 Which Disciplines?

Where is storytelling most useful in higher education? While the focus of this paper is on higher education, clearly storytelling is also useful at earlier educational levels. Some academic areas in which storytelling can be used in higher education are shown in Table 1, ranging from traditionally used to almost never used.

TABLE 1: Disciplinary Span in Storytelling

Discipline	Comment
English, Languages	Stories are extensively used in teaching, especially in English as a second language
History	History is a discipline ideally suited to stories
Religion	Religious studies make use of stories in many studies
Business	The case study is a core element of business education
Health Care	Health care, especially nursing, is filled with storytelling. Medicine uses stories, but often do not explicitly label clinical finding as stories
Physics/Chemistry Science	Physics and chemistry seem to not provide stories; perhaps are found only as adjuncts to simulations
Engineering	Storytelling is almost unknown in engineering studies

What can be learned from considering the span of storytelling in the disciplines? First, storytelling, broadly defined, seems more widespread than might be suggested from a literature review. Second, however, one might deduce from the above listing that many disciplines do use some storytelling but also do not specifically label the activity as storytelling. An example is in medical education (“The patient presented with...”). Recounting a patient’s problems is obviously a “kind of” story but not cast as a “story” in the medical education world. Third, the hard sciences, including engineering, do not frequently use stories, and instructors prefer to focus on analysis of hard data. Some use in civil engineering instruction is made using stories about disasters, for example, the Tacoma bridge failure (Tacoma Bridge Disaster, 1940) or other infrastructure collapses (Engineering Disasters, 2016). Although stories about such disasters are reasonable to have in a civil engineering course, it is more difficult to find stories in other areas of engineering. Other engineering disciplines should likely use more stories about improper designs and, more important, allow students to create and test designs in a story context. In contrast to engineering, business education is usually about connecting a core business method to a story about that method and how it is used in a real-life case. Business stories come in the form of motivational case studies that add very significant realism to learning about business.

Can the adding of motivational materials assist educators to provide more realism to their teaching? We advocate creating materials that will do just that through the use of the

relatively simple, recently invented, and open source digital storytelling methods described below.

2. HISTORY AND RESEARCH IN DIGITAL STORYTELLING

The literature on digital storytelling is relatively sparse. Various papers in conferences and journals have appeared. Examples of paper are referenced at the end of this paper. Most are old but nevertheless do not vitiate the usefulness of their findings (e.g., Robin, 2006; Barrett, 2006; Brenner, 2014; are more recent paper). Paper about storytelling in learning English (including as a second language) are a popular topic in the literature. Adding multimedia to a story is also often discussed. Research has been conducted that shows that storytelling enhances recall and learning (e.g., Oaks, 1995; McDrury and Alterio, 2004).

“The Programme for International Student Assessment (PISA) indicated that the use of technology in education can increase various skills of learners. The findings also suggested that digital storytelling can enhance several learning skills including writing, designs, library and research, technology and communication” (Smeda, et al. 2014). Hence, one might wonder why storytelling has not been more prominently used throughout higher education.

In some disciplines, storytelling is natural and well used (English, business), but in others (science, math, engineering), there is little evidence for storytelling as a learning paradigm. In a digital world, we have the opportunity to have flexible stories, often cast in the form of a nonlinear story. Nonlinear stories are just that—the stories don't proceed from beginning to the end; instead they give the learner/reader the choice of going down different paths. A problem with this paradigm, although very attractive, is that it is difficult and time consuming for the author to provide multiple pathways to pursue.

As a learner, the “power of choice” is an empowering and motivating strategy that some believe should be included within curricula. One of the main issues that students experience with motivation is not having a sense of autonomy. Autonomy represents a sense of personal responsibility over the learning process, paired with advising, when necessary. Autonomy be achieved through nonlinear storytelling, because the choices made by the reader in the story change the final outcome. Through those choices, learner/readers have the ability to learn from their mistakes in a safe, risk-free environment. Another benefit comes from the availability of immediate feedback, since the story changes with every decision made.

3. CONNECTION TO GAMES

The word “gamification” has been used to define how one introduces gamelike capabilities into venues traditionally outside a game. Video games permit solving puzzles, engaging play in simulated venues that provide challenges, often connecting with others in multiplayer games, feeling achievement in “winning” a game, and assessing the learner’s skills. These are all educational virtues that can be adapted to games that have a purpose of educating. First-person shooter games are commonplace, but educational games are less well-known. Business games (e.g., Capsim, 2016) have attracted faculty at hundreds of universities to use the game/simulation of building a business. There are games that mimic reality, games that are completely fictional, adventure focused, sports-related, and many other types. Our interest in this paper is educational—how can a gamelike, storylike activity help people anchor their learning in a memorable experience with takeaways that permits analogic application of learning to other areas.

Games and stories are close cousins, indeed. Linear stories provide a step-through learning experience, but nonlinear stories engage the learner by having the learner *have to* make choices. Likewise, the choice-making paradigm is clearly observed in many adventure games (e.g., take the right fork, take the left fork). The game’s story develops differently, depending on choices made. A homely example is the story of Little Red Riding Hood [*Wikipedia* on Little Red Riding Hood (LRRH), 2015] taking food to her grandmother in the woods. Of course, you can read about LRRH in a text story, but if you are actually playing the part of LRRH in the game, you will recall the experience longer. And, perhaps, if you replay the LRRH game you can avoid the clutches of the wolf.

Interesting games in a variety of topics are available on the web. Consider the board game in which players are cast as theater managers who must recruit players (Shakespeare Board Game, 2015). Or, consider the Public Broadcast Company (PBS) game for choosing a play to write, created entirely from simple html scripts (PBS Game, 2015).

4. BUILDING NONLINEAR STORIES

The authors believe that nonlinear stories cast in the form of a game provide a remarkably simple way for students to experience this mode of learning. One technique for creating a simple text-based story, with graphics and video, as needed, is to use Twine* (2016), an open source and free computer tool that permits creation of a story/game with almost no technical knowledge (at least at the start). An example of a game/story will be provided below, but first Twine will be examined more closely.

5. TWINE – AN OPEN SOURCE, FREE RESOURCE

5.1 Getting Twine

Twine can be downloaded from <http://www.twinery.org>. Originally created by Chris Klimas, a web developer in Baltimore, the software is provided free to the world by Klimas. Installation is straightforward, and running Twine provides a screen on which one can graphically create the story. If you wish to create a story without loading the program on your computer, you can do that from a URL on the <http://www.tiwnergy.org> page.

What can Twine do? It can tell a story in text; give students adaptive tests; employ conditional branching; show figures, sounds, and videos; and connect to other programs (e.g., Unity—the subject of another article). Interestingly, Twine runs entirely in almost any modern browser and is extensible using Javascript. This capability allows more sophisticated uses for doing complex things in a browser.

5.2 The Little Red Riding Hood (LRRH) Example

Figure 1 shows what an opening screen might look like with the beginnings of the LRRH story stored in nodes. There is a play button (bottom right); when it is pressed, play begins and a page is shown that transitions from one node to another. Nodes are enclosed in two left and two right brackets, and play proceeds along different paths depending on what choices the player makes. One can see the progression of the story by following the nodes. Creation of the story is accomplished by typing in the story that moves from node to node. The author specifies transitions from node to node using the brackets (as in Fig. 2) to direct from node to another and to enter images, videos, questions, etc. Fortunately, for the faint at heart, in the example provided, we have left out what the wolf is doing to LRRH (Fig. 3).



FIG. 1: Node-based story example in Twine

Start



+Tag

I left home with the basket that my mother gave me to give to Grandmother. Pretty soon I made it to the a fork in the road. I stood at the beginning of the trail. The trail forks left and right. To the left there was sign that said "Lake" and to the right "Grandmother's." My mother told me to take the basket to my Grandmother, but my friends all like live on the trail to the lake.

What should I do?

```
[[go on lake trail|lake]]
[[go to Grandmother's|Grandmothers]]
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FIG. 2: Writing a story in Twine



FIG. 3: Little Red Riding Hood in a game setting

By now the reader has an appreciation of the possibilities for integrating storytelling into a curriculum. Moving forward, a layer of nonlinear complexity can be added. Traditional

storytelling is linear. Little Red Riding Hood (2016) journeys through the woods to take food to her sick grandmother. On her way, she is stalked by the Big Bad Wolf, who finds out where she is going. He travels ahead, only to swallow her grandmother whole, disguises himself as the grandmother, and awaits the arrival of “dessert.” This is a linear story; one that goes in one line; never diverging.

However, nonlinear storytelling can become even more valuable to an educator. Imagine if the learner, as the game character Little Red Riding Hood, has the ability to take a boat down the river to Grandmother's. What if Little Red had the choice to take a friend? Would the outcome change? How would this affect the story? How would this affect the lesson?

Ultimately, one might consider connecting the story to a visual representation of LRRH in the forest in which one could play the part of LRRH, as shown below. This mockup was created in Unity3d (2016). Free versions of Unity3d are available online, which can be used to construct games.

5.3 Hospital Exploration Example

Another example of a nonlinear story is work done at American Sentinel University to develop a computer-based nonlinear story for assisting nonclinical professionals in learning about healthcare fields. In the story, the learner is the main character; a consultant brought in to assist in the integration of a hospital's Electronic Healthcare Record (EHR). The story is essentially a change-management scenario. Throughout the story, the user must make decisions on where to glean information from within a fictitious hospital. Interviews are conducted in an effort to detect the issues needing to be addressed prior to moving forward with the execution and installation of the EHR system in the hospital. If all the necessary information is not detected, the student finds that he is unable to offer recommendations to the hospital administrator and therefore may have to try again to access additional viewpoints from other characters in the story. Returning to interviews, another character is made possible by using the nonlinear backtracking capability. By immersing themselves in the story, the student learns what he should look for and who might be most involved in the integration.

The story has graphical elements. Figure 4 shows the opening screen in which the student is welcomed. Upon entering the hospital, the student has a discussion with “Mr. Brown,” the hospital administrator, who sets up the problem of changing to a particular EHR system and is asked to provide results of discussion with hospital employees. The learner's goal is to formulate a recommendation for how to proceed. Upon returning to the main corridor, the student “sees” a list of departments to visit. The student may choose which one to visit first. Figures 4, 5 and 6 show some of the interaction upon visiting the nurse's station and radiology.

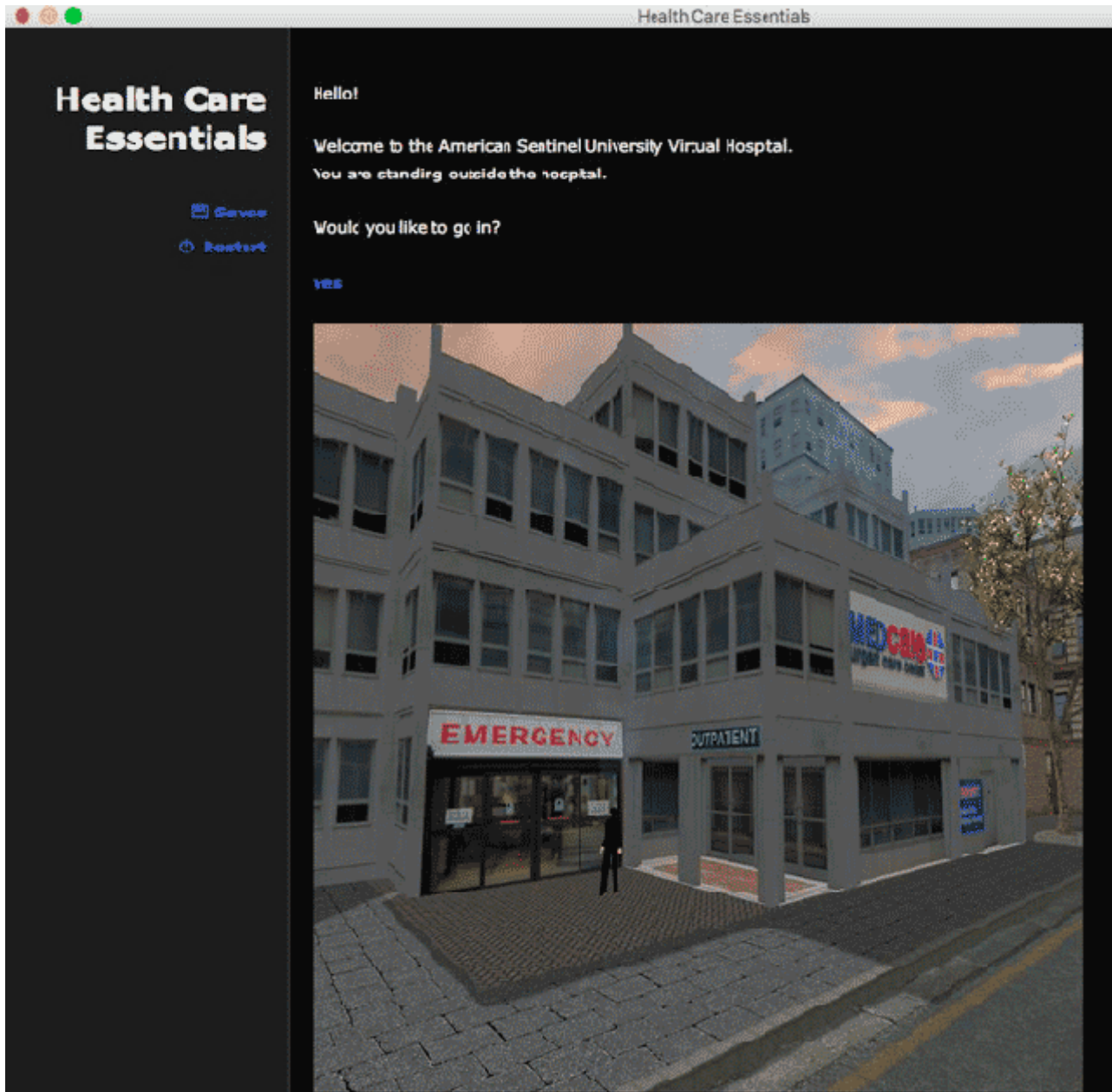


FIG. 4: Opening screen of a Twine Story about health care

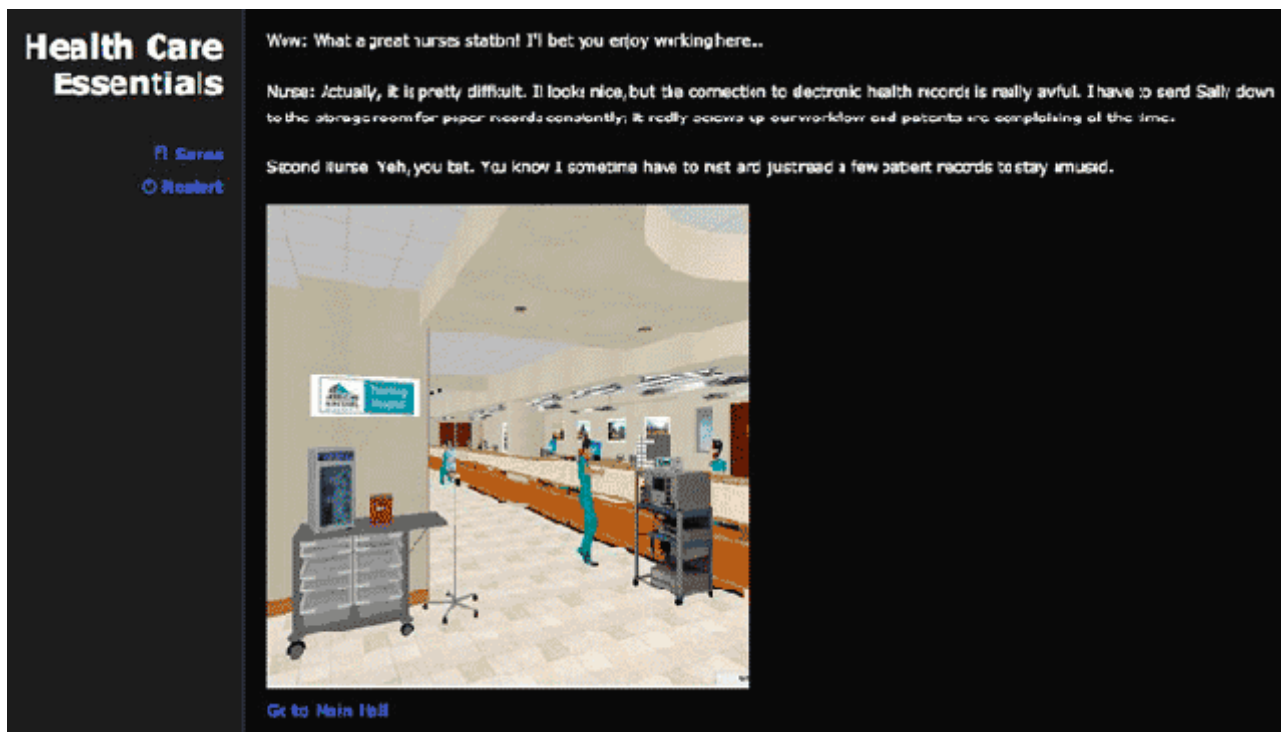


FIG. 5: Visiting the nurses station in the virtual hospital story

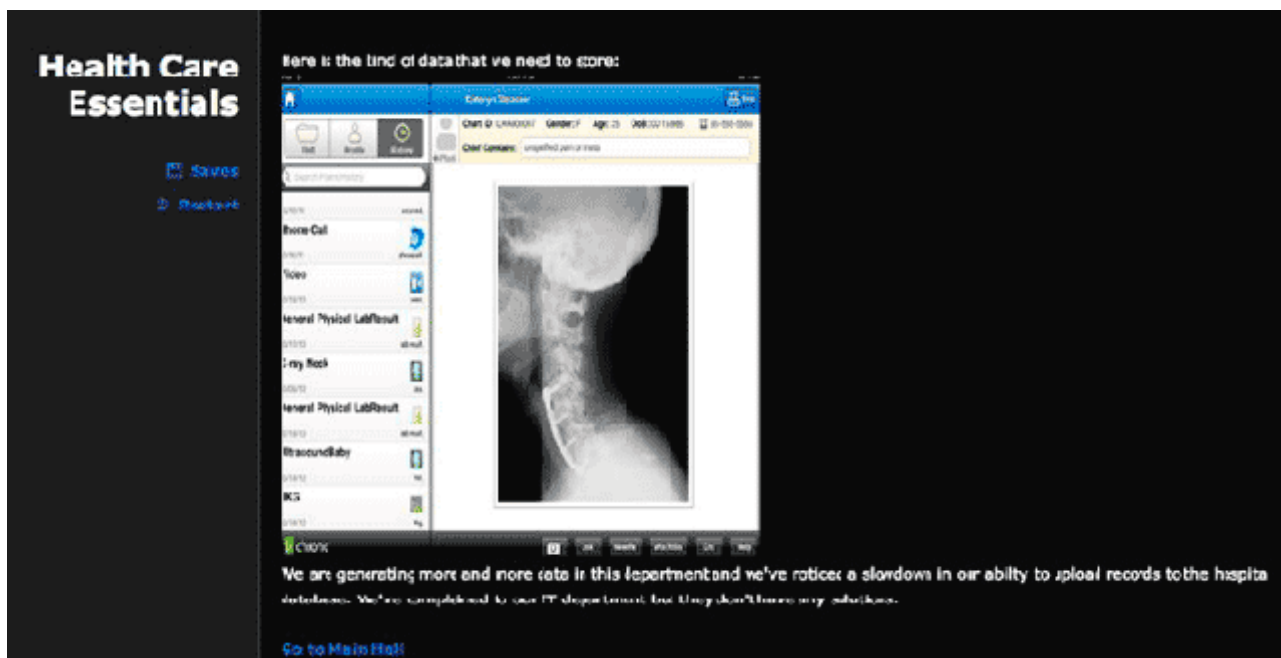


FIG. 6: Drilling down in the story to radiology information

The story is nonlinear in that the student may randomly visit any department in the hospital and secure viewpoints from any person that is available in the study. No guidance is given in advance; only instructions are provided. There is a gamelike feel to the hospital

exploration in that the student is striving to secure enough information to make a recommendation to the hospital administrator. At the end of the game, students are rated by the faculty on how good their advice was.

6. USING NONLINEAR STORYTELLING IN THE DISCIPLINES

6.1 Case Studies

Nonlinear storytelling can assist us in achieving learning outcomes in a variety of disciplines. Business programs, and other disciplinary concentrations, often use case studies to demonstrate a course concept. Business programs use case studies because they offer real-world analyses of how businesses have succeeded or failed. Case studies are a business school's version of storytelling. However, the studies come from facts; only nonfiction. But what would be the affordances of using fictional stories as well? Perhaps using fictional characters allows for imaginative exploration of a topic. When this occurs, we have the ability to morph the story presented into one that applies to scenarios that we are familiar with on an individual level.

An example would be a story in which the player (i.e., student) is cast as a member of a failing start-up. The story proceeds with the player responding to discussions about what to do to improve the likelihood that the company can survive. The student soon understands that what he does in the interaction with simulated team members will determine the fate of the company. These interactions can be a powerful immersive learning experience. No longer are cases simply reading about what happened, but the learner can influence what happens in the story. Naturally, in well-developed stories, the learner can assume different persona and secure a different experience. If a student plays the part of the CIO, they would make suggestions differently from, say, what the marketing person would make, thus creating a healthy tension, which accentuates the learning experience.

6.2 Short Courses

Short courses can be easily authored in Twine. The capability of providing questions and answers adaptively is straightforward. Of special note is the capability of modifying questions to adjust to the level of the user. The hospital exploration game described above could well be a short course.

6.3 Reading Materials Presented as a Game

Another idea is to embed reading materials in a game. As faculty, we have always had trouble getting students to read materials. Perhaps one might even create a textbook in nonlinear form. Consider embedding a linear story for analysis and then using Twine

conversations to provide that analysis. Natural language systems might be a better way to do this, but Twine stories could have an advantage by easily capturing a list of the decisions that a student makes as they branch along multiple paths.

7. CONNECTING STORIES TO THE ONLINE CLASS

How are the storytelling activities that have been discussed useful in online courses? And, what are the obvious affordances?

7.1 Affordances for Online Education

The major affordance for storytelling in a game setting can be found in student engagement. If the learning activity is sufficiently gamelike and provides constant feedback about performance to the student (more than “good job”), the student will keep moving through the game. Always having the student trying to find something out is a good model to follow in constructing the game. In the hospital example provided above, the learning was tailored to a real-world outcome; that is, providing advice as a consultant. A clear need is to create a set of learning objectives and tie those objectives to student actions in the “game.”

The utility of learning together and discussion should not be ignored. We know that cohorts of learners trying to solve a puzzle is engaging. How can we enable such learning in a nonlinear storytelling system? One simple technique is to create a website or use a course management system page to embed the story on one side of the page and a discussion system on the other side [e.g., Classroom Salon (2016) would work nicely]. A third frame might show whose online reading and discussion questions synchronize with the individual's progress through the story. Because Twine may be embedded in a browser iFrame and easily connected with JavaScript on an html page, this learning together should be easily facilitated.

A more complicated scenario is to meld Unity with Twine. Unity is a 3D world (free) that educators can use to build gamelike learning scenarios with avatars, scenery, and things to do, and connect those things with a text story in Twine. Connecting Unity and Twine enables activities such as LRRH losing her basket causing the basket to disappear in the 3D world. Or hitting the wolf with the basket could cause the wolf to collapse. These visual occurrences can have a dramatic impact on student recall of their experience as Little Red Riding Hood.

The method for making the connection between Twine and Unity is to pass messages in JavaScript between the two systems. Another paper in this practical series will address how to accomplish such communications (there are browser issues about security that

must be understood). In addition, Unity is part of the simulation mix; multiplayer capabilities can be added so that students can converse and interact in-world.

8. PREVIEW OF THE FUTURE

8.1 Twine-Style Progress

In reviewing Twine progress over the last several years, there has been much progress in the development of this open source system. It is likely that more is to come. Twine combines a very simple way of creating nonlinear stories that anyone can use without knowing any programming whatsoever. It also contains the ability for those with programming knowledge to write macros in JavaScript that permit interaction with the world outside of Twine. We expect to see libraries of Twine macros become available that will facilitate integrating Twine with other programs. Several of those possibilities are examined next.

8.2 Mashups

Mashups of Twine with other systems are the most likely advances in making stories using Twine more appealing.

8.3 Combining Text with Multimedia

Adding multimedia to Twine is simple. By using the image-calling methods of html, images can be inserted into the text story. Similarly, videos (e.g., YouTube videos) can be embedded. By recognizing these capabilities, the look and feel of Twine can be extended rapidly. Twine also has the ability to use CSS (cascading style sheets), thus enabling styling the look of the page to almost any desired presentation.

8.4 Multiframe Presentation

We were also impressed that Twine can be mashed up with other programs that run in iFrames created with html. By using the Document Object Model access in JavaScript, one can exchange information between two (or more) programs running on the same server. The running on the same server restriction is invoked to avoid security issues.

8.5 Twine and Unity Together

One interesting experiment we did with Twine was to put Twine in one iFrame and Unity3D in another iFrame of a webpage and have them communicate. An example is that one may make a choice in a story and that choice is reflected in a change in the 3D world. Red Riding Hood's basket could be stolen or lost during the dialog interaction, and it would disappear from the scene in the 3D world. Likewise, the basket could disappear as the

wolf grabs the basket from LRRH in the 3D and that would be reflected in the inventory of items that LRRH carries in the Twine environment.

8.6 Multiplayer Stories

Adding multiplayer capabilities to Unity permits user-to-user interaction in the 3D world, thus effectively creating multiplayer storytelling capabilities.

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FOOTNOTES:

* At the time of writing, American Sentinel University was using Twine but is now using Articulate Storyline 360.