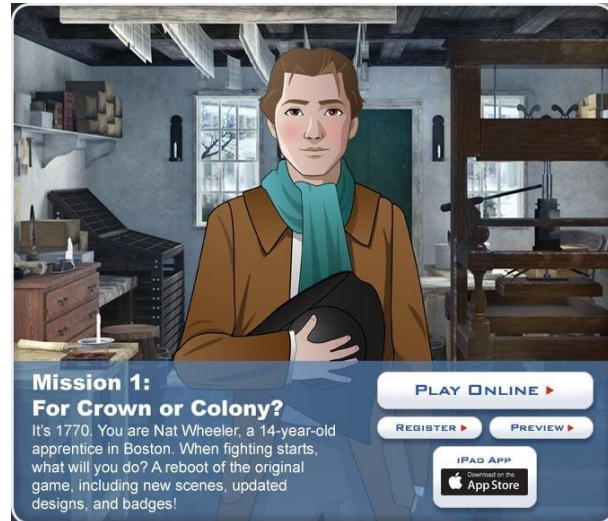
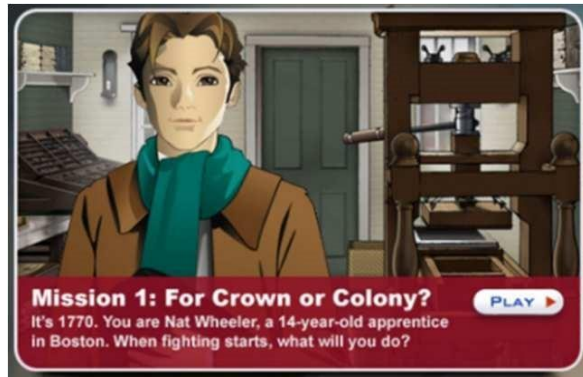


Not Becoming History: The Challenges and Opportunities in Revitalizing the Educational Game *Mission US*



Web graphics for the original *Mission US: For Crown or Colony?* (left, 2010) and the upgraded game (right, 2018)

Introduction

There are numerous challenges in keeping an educational game “current” — from changing technology to evolving history content, pedagogy, and even attitudes towards the use of games to teach history. How can we create flexible, sustainable models that allow us to more adeptly address these challenges and keep pace with shifting needs?

This white paper explores this question through the case study of the revitalization of *Mission US*, the groundbreaking interactive-gaming series that engages middle school students in US history. *Mission US* combines popular gaming conventions with rigorous social history and instructional design to immerse players in the drama of our nation’s past. The product of a collaboration between WNET New York Public Media; the American Social History Project, a research center focused on using media to enhance history teaching; Electric Funstuff, a leading educational game designer; and Education Development Center, a leader in educational research and technology, the games are deeply rooted in research and scholarship and include rich support materials to help teachers integrate them into their curricula. The series has won multiple Parents’ Choice Awards, the Japan Prize, and the Games for Change Award for “Most Significant Impact.” Evaluation shows that *Mission US* builds children’s knowledge of history and their historical thinking. Teachers call it “a great way to make history real for 21st century learners” and “the best history resource I have seen in years.” First prototyped in 2007 and launched in 2010, *Mission US* has more than 2.8 million registered users, including 90,000 teachers, to date.

Almost a decade after its launch, *Mission US* is facing a technical challenge that must be overcome to sustain its impact. Because the first five games were built in Adobe Flash, they have limited accessibility on mobile devices and will no longer be playable on any platform once Flash is phased out in 2020. Several years ago, the team recognized the need to upgrade the game engine and re-make each mission in new technology. In this paper we will discuss the process of revitalizing the first *Mission US* game, *For Crown or Colony?*, outcomes, and lessons learned.

The Challenge

"I have used Mission US with my fourth and fifth grade students for years. What are my options to continue to use your wonderful curriculum?" — A teacher seeking assurance that Mission US will survive the end of Flash.

Investments in quality educational games over the past decade have been substantial. According to [Metaari's latest report, "The 2019-2024 Global Game-based Learning Market,"](#) revenues for the worldwide educational game market are projected to reach \$24 billion by 2024, with a worldwide five-year compound annual growth rate of 33.2%. Yet as technologies change, a generation of web-based games created in Flash technology will soon be unsupported by the latest technology. iCivics and BrainPOP, among others, are two platforms that required significant migration to new technologies. Free, popular web-based educational games such as WNET's suite of *Mission US* history games will no longer be accessible to US history teachers who now teach with them regularly. Even more importantly, future teachers and students will be unable to benefit from these rich and proven educational tools.

To continue the success and impact of a series like *Mission US*, the project must add new games while sustaining and enhancing its existing games — which requires upgrading the core technology, redesigning the graphical user interface to support tablets and increase accessibility, and developing a process and tools to port existing assets (notably scripts, data files, and animations) to new formats. The *Mission US* game engine was built in Adobe Flash, a technology that at the time ensured distribution in schools because it did not require IT administrators to install or approve it. However, with Adobe announcing an end to Flash support by the end of 2020, Flash-based games will no longer be supported on web browsers after that time — rendering them essentially unplayable. Most major web browsers have already moved away from Flash support and we are already seeing more memory restrictions, security warnings, and ominous pop-ups that scare potential users away.

Flash-based games are also at a disadvantage for mobile devices; they cannot be played through a mobile web browser, and publishing them as apps using Adobe AIR is onerous as it has very specific requirements and is poorly documented. In addition, games built in earlier versions of Adobe Flash — like many of the earlier *Mission US* games — used a much more

primitive version of the current internal scripting language, making it unfeasible to make updates or fixes to the game for the past several years.

Unless *Mission US* finds solutions to its aging technical infrastructure, users will either experience degraded or inconsistent performance, or lose the ability to play the games entirely.

The Opportunity

Faced with this eventuality, WNET secured funding from the National Endowment for the Humanities to rebuild the first and most popular game in the Mission US series, *For Crown or Colony?*, in updated technology. In doing so, the team saw an opportunity to enhance the game in a number of important ways. New 3D animation tools and higher resolution would enhance the game's visual design by allowing us to portray settings and characters in greater detail. Rebuilding would also allow us to update and strengthen the historical content and storyline, the user interactions, the accessibility features, and the educator support materials, incorporating input from teachers and advisors.

This revitalization also provided an opportunity to add instructional features introduced in later games — like digital badges — as well as new supports for diverse learners in school and out-of-school settings. These innovations, many of which have been requested by users, range from basic tools to assist with comprehension to more sophisticated game features that enhance humanities learning.

Project Goals and Research Questions

Our project goals were to:

- **Rebuild *For Crown or Colony?*** using the Unity game engine and a tablet-friendly graphical user interface to ensure the project's compatibility with both modern web browsers and tablet platforms, and to lay the technical groundwork for rebuilding other Flash-based *Mission US* games (while also informing the development of new Unity-based games).
- **Deepen humanities learning** by integrating tools, such as digital badges, that help players engage with and explain historical themes.
- **Expand the project's reach** by adding literacy supports for diverse learners.

Research questions we explored include:

- What are the challenges of converting Flash-based games and web components to new engines, such as the Unity game engine?
- What additional features should be integrated into humanities-based games to support diverse learners?

- How do innovations to the *Mission US* tool set deepen humanities learning and foster historical thinking skills?
 - What best practices emerged that will benefit stakeholders in the digital humanities, including producers of other game- or Flash-based projects?
-

About *Mission US: For Crown or Colony?*

In *For Crown or Colony?* players take on the role of Nathaniel (“Nat”) Wheeler, a 14-year-old printer’s apprentice, in a carefully researched simulation of 1770 Boston. The game was the first and remains the most popular in the *Mission US* series.

As the game opens, Nat, who has grown up on his family’s farm in Uxbridge, Massachusetts, is about to embark on an adventure. His father has secured him a trial apprenticeship in the Boston shop of printer Benjamin Edes. Nat’s oldest brother Christopher, heir to the family farm, disappeared eight years earlier when he ran off to fight in the French and Indian War. With Nat’s middle brother Samuel next in line to inherit the farm, Nat’s best hope of long-term success and happiness lies in learning a trade.

Nat soon finds himself in Boston, where everyone, it seems, has an opinion on the colonists’ rights and duties as British subjects, as well as the taxes imposed by Parliament. Navigating the city as Nat, students playing the Mission are charged with a number of tasks by Mr. Edes and his wife. From selling advertisements to merchants, to confronting soldiers patrolling the wharves, Nat’s activities will introduce the player to the full strata of colonial society and the growing tensions within it. He meets fictional peers who reflect different social, economic, and political perspectives, including: Royce, a ropemaker’s apprentice who supports the Patriot cause; Constance, the niece of Loyalist merchant Theophilus Lillie; and Solomon Fortune, a free black man who works on the waterfront. Students also examine primary source documents integrated into gameplay, and interact with historical figures such as Phillis Wheatley and Paul Revere.

In addition to building historical knowledge, the mission engages students with exciting plotlines and a sense of daily life in the 1770s. Each player has a unique experience based on individual choices, skill, and understanding of the period.

Regardless of which paths students choose, Nat witnesses the Boston Massacre on the night of March 5, 1770, though the experience of the events will differ from player to player. In the aftermath of the Massacre, the player, as Nat, is called to give testimony in a deposition and must make decisions about where his allegiances lie. Ultimately, it is up to the player to determine whether or not Nat continues his apprenticeship and joins the Patriot cause in Boston, runs away to sea, or remains loyal to the Crown.

In a brief Epilogue after the player chooses Nat's path, the player learns about Nat's fate and the inexorable march of the colonies toward Revolution.

The Revitalization Process

Technical Goals and Approaches

As discussed, *For Crown or Colony?* was originally developed in Adobe Flash technology for web streaming on PCs and Macs, and was in danger of becoming unplayable. It also was not accessible on mobile devices and lacked many of the newer features that had been added to more recent *Mission US* games. The interface, file structure, and other technical elements undergirding the most recent *Mission US* game under development had been streamlined and optimized for use on tablets, but none of these elements could be incorporated into *For Crown or Colony?* without rebuilding it from the ground up.

To address these challenges, we needed to rebuild the game in a new technical framework. The two major contenders were Unity and some kind of HTML5 framework (such as React or Angular). We chose Unity for a number of reasons:

1. It publishes to web-streaming (through WebGL), PC/Mac standalone application, and iPad from the same codebase, making it an optimal platform for publishing media-rich content on many platforms.
2. Unity has good support for media and animations, including multiple sound channels. While Unity was originally conceived as a 3D game engine, significant upgrades had made it a versatile 2D platform. *Mission US* had developed a successful visual design using 2D that supports vivid, and relatively detailed, simulations of historical settings; these strengths could be sustained on the new platform.
3. Unity uses C#, a mature and powerful programming language.
4. Unity also features built-in production tools that allow for easy construction of visual scenes, and the ability to develop custom editorial and production tools to suit a specific project.
5. Our team's developers had more familiarity with Unity, and Unity developers are easier to find.
6. There is a rich ecosystem of plug-ins via the Unity Asset Store and Unity is well supported with quarterly updates and releases.
7. Unity is now an industry-standard web-based game development environment, well supported by all industry stakeholders.

Game designer Electric Funstuff (EFS) led the technical upgrade. EFS built a new Unity game engine, then rebuilt *For Crown or Colony?* in the engine and redesigned it for the new 3D environment so all its elements were compatible. This entailed converting or remaking all the images, animations, and sound files, and recreating the locations into fully textured 3D models. The work also included: re-programming the game logic, revising dialogs and designs and

creating new ones, and re-recording voiceover. After finishing builds of the game for streaming through web browsers (via WebGL) and for PC download, EFS conducted quality-assurance tests of those builds, as well as testing integration of the new engine with the *Mission US* website, to ensure the successful transfer of log-in and game data.

Deepening Humanities Learning

Several research studies have shown that *For Crown or Colony?* builds students' historical knowledge and thinking skills, fusing high motivation with a nuanced view of the past. However, we learned that students could not always show a deep understanding of different perspectives on events before, during and after the Boston Massacre. Some struggled to identify the most historically salient aspects of the game or connect their character's experiences to key concepts. For example, in the original game, Nat has the choice to drink imported British tea with a Loyalist friend, but if he does, he will be reprimanded by his Patriot-leaning boss. Not all players grasped the significance of this choice, and many would benefit from additional scaffolds to connect their choices to Boston's non-importation movement protesting British taxation laws.

Accordingly, we planned to add new game content and tools that give players more opportunities to draw explicit connections between in-game choices and broader historical themes and perspectives. At the outset of this effort, EDC's Center for Children and Technology surveyed experienced teacher users of *For Crown or Colony?* to find out what changes to the content, storyline, and interactions would improve students' understanding of factors leading to the American Revolution. We also consulted history-education advisors to inform the design of the new content and features.

Throughout the development process, we continued to identify additional areas of the game that would benefit from revision. For example, team members flagged sections of the dialogues with Phillis Wheatley – the enslaved servant who would become a celebrated poet – in which the discussion of slavery could be strengthened. We consulted with advisors from Facing History and Ourselves to review and revise those dialogues, and re-recorded Wheatley's lines with a new actress.

Expanding the Project's Reach

We also worked on incorporating technical and instructional upgrades to better support diverse learners, including English Language Learners, students with learning disabilities, and struggling adolescent readers. Informed by guidance from educators and advisors, the team created a set of literacy support features including an updated graphical user interface, closed captioning and pause/play/rewind functions for video animations, and text-to-speech audio for player responses. This was a frequent request from teachers since in the original game only non-playing characters were voiced, meaning a third of the in-game text did not have audio to support comprehension.

Launching the Updated Game

WNET launched the new *For Crown or Colony?* online and as a free iPad app in late 2018. While preserving most of the core game, the revitalized game included content enhancements to deepen the presentation of the Loyalist perspective and the overall political and economic context that led to the Boston Massacre, while completing storylines that were hinted at in the original, but had ended up on the cutting room floor. The updated game also included added features to bring this mission in line with more recent *Mission US* games, deeper supports for text within the game, and a new user interface.

Content changes and additions were intended to address teachers' requests, including:

- **A deeper Loyalist perspective**, reflected in updated and new dialogues with characters like the Loyalist merchant Theophilus Lillie.
- **A more nuanced political spectrum** and feedback for the player's choices.
- **New content about the culture of smuggling in pre-revolutionary Boston**, including an expanded side-quest with Solomon at the wharf at midnight that had been a loose end in the original game.
- **A new plotline involving Nathaniel's missing brother**, Christopher, designed to deepen understanding of the relationship of the colonial militia to the British Army. This storyline allows players to get clues to Christopher's fate and potentially seek him out in the game's Epilogue. It also encourages the player to interact with redcoats and learn more about their perspective.
- **Deeper post-Massacre interactions.** The deposition is better contextualized as a political process and the questions asked by the deposer and the answers available to the player are much more reflective of what was seen and who the player knows. There is also a final statement from Mr. Edes about his opinions on the player's politics and skills as an apprentice.
- **A richer Epilogue** that reveals Nat's experiences from 1770-1776, based on the player's choices within the game, to better connect the game events to the larger story of the Revolution.
- **New images and audio.** Hundreds of new images to illustrate Nathaniel's adventures have been added. All characters (including those who were not voiced in the original game) were voice recorded and many dialogs were re-written to account for new historical research and user feedback.

Feature changes and additions were intended to improve aspects of the game experience that teachers identified as important for students. They include:

- **A badge system** that deepens the consequences for player choices. The system features two types of badges: Political Reputation and Achievement. The Political Reputation badge is built by making several key decisions in the game, after which the player's reputation is established (Patriot, Loyalist, or Fence Sitter) and other characters see Nat through that lens. The seven Achievement badges reflect everything from Master Apprentice to Adventurous Spirit to the mysterious Easter Egg.
- **Hotspot collections.** Key hotspots are grouped by historical themes to help add further context and promote understanding of the relationships among the items. Students are

rewarded for completing a collection with a badge as well as a custom menu screen background.

- **Text-to-speech supports** that enable struggling readers or English Language Learners to hear all dialog responses and virtually all other on-screen text read aloud.
- **Play/pause and closed captioning** for all animated cutscenes.
- **Enhanced Smartwords and glossary** features that define the most important vocabulary and concepts about the historical time, supported with images and text-to-speech.
- **Multi-track audio control**, which enables teachers and students to control the sound levels of music, sound effects, and voice, for a better classroom experience of the game.

WNET also revised the educator materials accompanying *For Crown or Colony?* on the *Mission US* website. These additions include:

- **Revised essential questions** that address a blend of time-period specific issues (e.g., Why did protests against the British colonial government break out in Boston in the early 1770s?), and larger themes with contemporary connections (e.g., What are the different ways that Americans have defined freedom?).
- **Updated character bios** of historical figures that better reflect current historical knowledge of the time period and the contributions of individuals involved in the Boston Massacre.
- **An achievement badge tracker** to enable students to document their progress earning stars for each achievement badge.
- **A political reputation reflection worksheet** that guides students in analyzing how they received their “reputation” (Patriot, Loyalist, or Fence Sitter) and how they feel about choosing a side (or not choosing a side).

Public response to the updated game and materials was positive and encouraging. A webinar introducing the new *For Crown or Colony?* in October 2018 was attended live by 374 educators and later viewed in archived form over 500 times. Feedback from webinar attendees was extremely positive. For example, Monica Ulisse-Landrove from New Jersey commented, “The game is great and relevant! ... We use it in 5th with students with special needs. It works for all levels - especially with all of the resources.” April Rice said, “Terrific topic! I’m so eager to share with S.S. Teachers!” while Heidi Baitinger from New Jersey said, “I am so excited to try this in my classroom! I wish I had known about this sooner.”

The new game has been quite popular with users, as demonstrated by a dramatic increase in web traffic following its release. In the month following launch (10/16-11/15/18), *For Crown or Colony?* had 293,000 pageviews — an increase of 46% over the same period the previous year (200k for 10/16/17-11/15/17), and a 76% increase over the previous month (167,000 for 9/15-10/15/18.) In the year since its debut, traffic to the game has continued to increase, with over 1.5 million pageviews to date.

Sample screenshots from the new *For Crown or Colony?*

The following sample screenshots illustrate updates to the user interface, instructional and literacy supports, and designs that were implemented as part of the revitalization..

Sample dialog interaction with Solomon Fortune (a fictional free black man who works at Griffin's Wharf) from the remade *For Crown or Colony?*



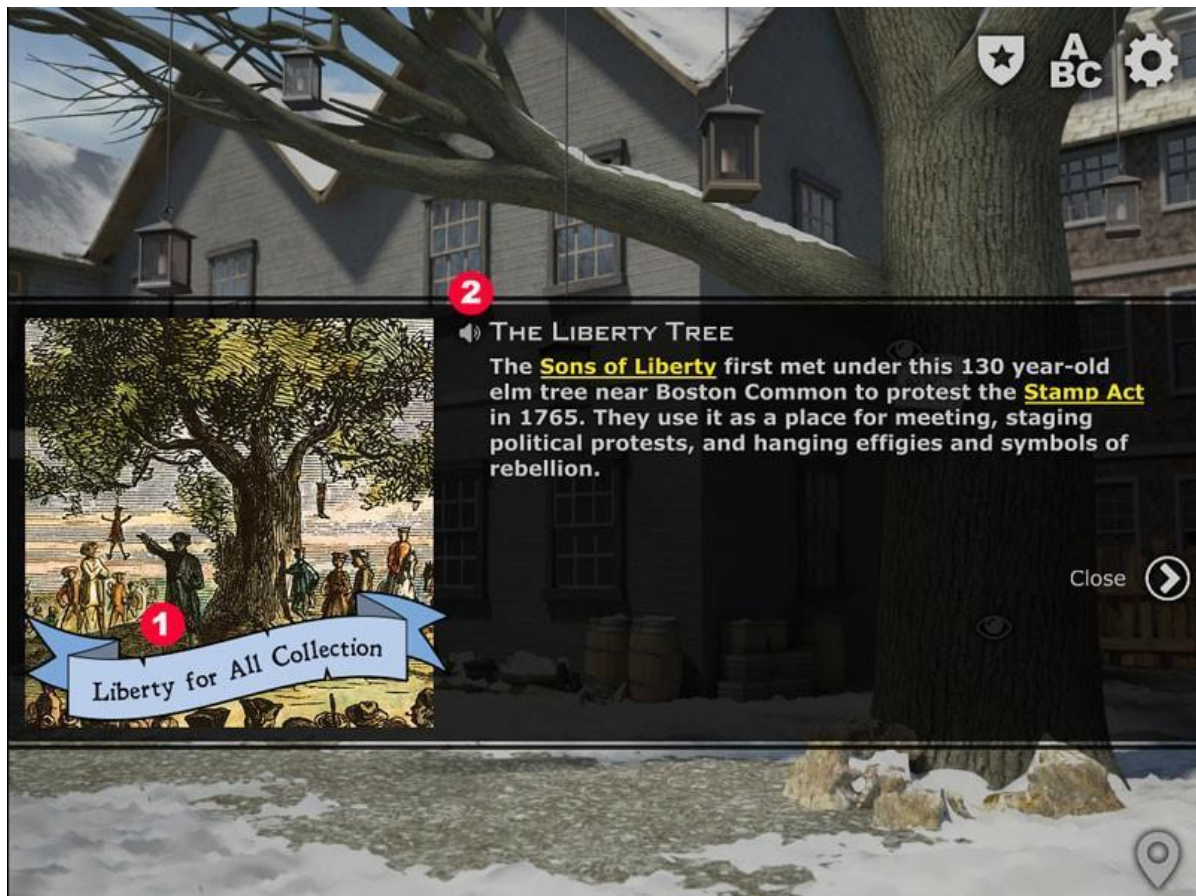
The inset on the upper right is the comparable screenshot from the original game; relative resolution is approximately to scale. Enhanced features include the following:

1. Key vocabulary, called Smartwords, can be clicked to see images and meanings.
2. Collected Smartwords and associated images can be accessed here for review.
3. Text-to-speech is available for all non-voiced text, to support struggling readers or visually impaired students.
4. All lines spoken by Solomon and other non-player characters are captioned on screen and professionally voice acted. The player can click on these lines to hear them repeated.

New Collections Feature

Hotspot collections are another new feature introduced in the updated *For Crown or Colony?*. Certain key hotspots not only open a popup with key information and an image, but are also associated with collections, which are grouped by historical themes to help add further context and promote understanding of the relationships among the items.

When students complete a collection, they earn a badge as well as a custom menu screen background for the game (users can set their screen once they have more than one available). Collections are permanent, meaning users can complete them over more than one play.



1. This screenshot shows the Liberty Tree hotspot from *For Crown or Colony?*, which is associated with the “Liberty for All” collection. After collecting this hotspot, users can access a collections page interface that shows all the themed content for the “Liberty for All” collection, including Paul Revere’s Liberty Bowl and three others.
2. Like all other unvoiced text in the game, all pop-up text has text-to-speech support.

Enhanced visual design

Upgrading to Unity enabled us to use a hybrid 2D/3D design approach to create richer, more detailed and textured designs that have significantly enhanced the visual world of *For Crown or Colony?* The following screenshots show a side-by-side comparison between the original and revitalized games.

Wheeler Farmhouse Interior



Original game



Upgraded game

Patriot Protest in the North End



Original game



Upgraded game

Summative Research

Outcomes of the revitalization of *For Crown or Colony?* were evaluated in the following ways:

1. **Educator focus groups.** EDC's Center for Children and Technology held three educator focus groups to probe teachers' reactions to the revitalized *For Crown or Colony?* game.
2. **Advisor review.** An advisory panel including an educational gaming/accessibility expert, classroom teacher, and historian evaluated and provided feedback on the components against our research questions.

Educator Focus Groups

In November 2018, EDC's Center for Children and Technology held three educator focus groups to probe teachers' reactions to the revitalized *For Crown or Colony?* game. The purpose of the research was to determine how well the new game and educator materials met the teacher and student needs identified by teachers in earlier focus groups, and to identify gaps or opportunities from which future revitalization efforts — of *Mission US* games or other games — could benefit.

Study Description

Participants. Nine teachers participated in the focus groups. They taught in schools in eight states (see table below), and included elementary, middle, and high school grades. The group was a mix of veteran *Mission US* users, who were very experienced in teaching with *For Crown or Colony?*, and some who had taught with the game but knew it less well. One of the nine teachers had already taught with the new *For Crown or Colony?*; several others were just about to do this.

Over half of the teachers taught middle grades social studies classes, specifically US history; one taught high school history exclusively; and two had taught the game with both middle and high school grades. There were three upper elementary teachers as well. The group included seven women and two men; one African American teacher and one Latino teacher.

| Teacher Name | Grade(s) Taught | Subject(s) Taught | Location |
|--------------|-----------------|---------------------|------------------------|
| Amy | 4th | ELA, Social Studies | Ohio |
| Lori | 5th | ELA, Social Studies | Texas |
| Carrie | K-5 | Media Specialist | Kentucky |
| Jill | K-8 | STEAM Director | Florida |
| Bill | 7th | Social Studies | New York (Long Island) |

| | | | |
|----------|-------------|------------|--------------------|
| Michelle | 7th | US History | Louisiana |
| Allison | 7th & HS AP | US History | New York (Upstate) |
| Lily | 8th & 11th | US History | Florida & DC |
| Ethan | 10th-12th | US History | Pennsylvania |

Procedure. Focus groups lasted 90 minutes and were conducted via Zoom conferencing software. Before the session, educators spent 90 minutes in preparation, by:

- Reading a synopsis of the new game content and features.
- Playing the revised game.
- Browsing the new teacher materials on the website.

During the focus groups, teachers were first asked to share their reactions to the new content and features — positive and negative — in an open-ended way. Researchers then guided users in responding to each new content element and feature more systematically, bringing these up on a shared screen as needed. The sessions were audio recorded.

Top-Line Findings

Teachers all agreed that the new game is a substantial improvement over the original game — which they all had used and liked. Asked what most stood out for them, educators said they were most impressed by four things that the new game provided:

- *A richer experience* of the time period, the history, and the setting.
- *Deeper learning* of challenging historical content.
- *A greater sense of consequence* for player choices.
- *A more accessible learning experience* for struggling readers and ELLs.

1. Educators agree that the new game is “a much richer experience.”

Teachers felt that the new content and story elements made for a far richer narrative and historical world — one that students would find compelling — and that they could use to advantage in the classroom.

- *[The new game] really expanded on the skills and content. Each section took a bit longer, and went deeper. It was a more well-rounded game.*
- *It's more replayable now — they'll want to go back and play again, and get to those other paths, realizing how they have to change their behavior and political leanings.*
- *The graphics and the animations make it feel way more alive; and that's important — I think kids now will respond better to this new version.*
- *It seems like there's much more content — like the game connects to the things I teach about the 1760s and 70s much more.*

2. Deeper learning of challenging content

For Crown or Colony? deals with complex ideas — growing colonial resentment of British authority, Loyalist pride in being part of the Empire, British taxation policies and protests against

them, the roles of women, African Americans, and others in the movement toward independence, and the power of the press and propaganda in creating a social movement. Teachers said that, while the earlier version touched on these issues, students' understanding of them was often weak or confused. All nine teachers felt the new game developed these themes much more clearly and fully, and that this would lead to better student understanding.

- *When my kids used [the new game], it took them longer to play, and they understood better what was going on — the clash between these ideas of wanting freedom and feeling loyal to the Crown.*
- *[The new game provides] a deeper understanding of the differences between Loyalists and Patriots.*
- *Non-importation came across a lot better in this version; it mentioned the Townshend Acts more, and overall has a lot more content.*

3. A greater sense of consequence for player choices

In earlier focus groups, veteran *Mission US* teachers had noted that while *For Crown or Colony?* had great content, it was the game that, of all the missions, kids tended most to just “click-through,” without reading dialog options carefully. The reason, they felt, was that kids had concluded that it was also “the game where choices had the least consequences.”

Teachers all said that the new game succeeded in making player choices feel much more consequential, particularly as players developed a political reputation and this began to close off dialog options — a feature they all liked, even though it might initially frustrate kids. They said this made the game a more realistic simulation of the real-world social influence that preteens live in, and therefore made it a better teaching and learning tool.

- *The options that you have, and the consequences, make this more relevant to preteens. Two girls said they went home and tried to be the most annoying Nat they could be — to see what would happen. I notice that the best-behaved kids love the “rogue” option. These options make this so much part of kids’ lives.*
- *I like the change [i.e. closing down dialog options] — it shows all the decisions that they had to make had consequences. This is much better than just choosing your fate at the end. Kids now can’t just watch their neighbor play — this makes them want to choose for themselves, and individualizes it.*
- *Limiting the [dialog] options is good — it reminded me that I had made choices. I like that kids can see the option, but can’t say it. It means I can’t just click whatever I want — there are real consequences.*

4. A more accessible learning experience for struggling readers

Participants were extremely enthusiastic about the text-to-speech supports in the new game, including the ability to hear all dialog options and other on-screen text. Teachers noted that *Mission US* games are text- and reading-intensive, and that this is a barrier for many ELLs and struggling readers. They said the new supports would be critical for struggling readers, enabling them to access the content, and participate more in discussions about it.

- *I love that this [text-to-speech] feature is there. I have a large population of students who are special ed who have accommodations. It's so important for them to be able to access this by themselves, without embarrassment, and without an aide next to them.*
- *Having these [features] will really help my ELLs focus on the content, and not get stuck in the language.*
- *These [text-to-speech] features are really important for my kids who are struggling... When I first started with the games I had individuals play; but too many were struggling with the language, so I switched to whole-class mode so as not to leave people out. Now I can individualize it again, which will be a better experience for everyone, maybe.*
- *This is also good for kids with ADHD who have impulsivity issues.*

Teachers' Responses to New Game Content

1. A more developed Loyalist perspective

Teachers agreed that the new game gave greater voice to the Loyalist perspective — a goal, since the earlier game was felt to bias decisions toward the Patriot perspective.

- *Your choices as a Patriot or a Loyalist were much more nuanced and explicit.*
- *The Loyalist perspective is stronger, and I liked that. For example, I grabbed the wheelbarrow and went down to see Solomon. I was stopped, and it's clear — you're being watched. The colonials are acting up, and the response is to crack down. There's suspicion of everyone.*

Still, teachers agreed that, for the most part, **the game still favors the Patriot perspective.**

- *Overall, I still think the game makes it a lot easier to go the Patriot route.*
- *The Loyalist perspective is stronger, but I think kids will still lean towards Patriot.*

Interestingly, teachers speculated that **the change in Constance Lillie** — specifically, her less “sexualized” and less “flirty” appearance in the new game — had the effect of removing a primary reason why students, especially male students, leaned toward the Loyalist view.

On the one hand teachers appreciated **a less caricatured Constance:**

- *Miss Lillie is less sexualized. I like this—she's a little less flirty. It was distracting before — guys would go real hard at interacting with her. But it felt like the struggle to identify as Loyalist wasn't as strong [as the romantic impulse was]. In this version she has her own motivation, her own ideas and choices.*
- *With Miss Lillie, a lot of kids want to be her friend, so I think a richer character is good, that she's not just a spokesperson for her uncle.*

On the other hand, **a more human and less flirty Constance means that players have one fewer reason to choose the Loyalist path.** The one teacher who had taught with the new game said:

- *I don't think students liked Constance as much. It may have been because she was less flirty.*

- *Only two students went with Constance, and it used to be that half of them were Loyalist. Instead, they were much more into the adventure and Patriot roles.*

This suggests two things: First, that the new game is correcting a problem in the first version — in which any “balance” between Loyalist and Patriot perspectives was achieved largely by virtue of the narrative device of romance. Second, that the stronger Loyalist voices in the new version are still in no way equal to the “Patriot bias” that students bring into the game, and that is represented by Mr. Edes, Nathaniel’s father, Royce, etc.

2. The Indenture Contract

Teachers felt that player interactions with the indenture contract that Nat and his father review and negotiate with Mr. Edes in the game’s Prologue were greatly improved.

- *The contract is a lot easier to navigate and use — this is great.*
- *I enjoyed the contract and that they had to negotiate; I liked the update with the graphics and the visuals.*

3. The Deposition

Teachers agreed that in the revised deposition scene, students would be much more likely to reflect on what they saw on King Street, and how their statements about it would be viewed by the Court, and by others.

- *I like how the Deposition is a lot more detailed. There are 3 or 4 responses to choose from, and the responses are tagged — stretch the truth, lie — kids really need to think.*
- *When my students played the game, they understood the Deposition much better. Before they would just breeze through it. Now they’re taking it seriously. I heard kids saying, “I’m so nervous. What should I say?”*

4. Interactions with Solomon

Teachers appreciated the way the new *For Crown or Colony?* elaborates on what were “loose ends” in the first version, including interactions with Solomon.

- *It’s great that this new game really ties up the loose ends in the earlier game — like getting to Solomon on the wharf.*
- *I love that they can learn about why the type is so heavy. Whoever did the graphics — the picture of setting the type is great. For kids to click and see how a printing press works, why the type is so heavy; this is really great content. I used to have to have kids watch a video about it, but this will do it.*
- *My kids get the smuggling idea because we’ve learned about it. I like that it’s there now; it was a loose end before.*

This said, the idea that a “smuggling culture” arose in Boston as a way around taxed goods, and that it triggered increased surveillance by British authorities, was clear to only half the teachers and may need to be reinforced in the educator materials.

5. New Plotline: Seeking Nat's Brother Christopher

Teachers liked that this other “loose end” from the original game was elaborated in the new game.

- *I like that Christopher has more of a storyline. As a teacher you can guide students to that storyline.*
- *Now kids can play with the purpose of finding out more about Christopher. This is good especially for kids who have older siblings who have served in the military.*

Interestingly, the one teacher who had observed her students playing the new game felt that this plotline made the game more “gender-neutral.”

- *Kids were excited to go see the Captain. And girls, especially, liked the third element — Oh, I can go see about my brother. This is a more gender-neutral option. With the earlier game it was just — “Be a Patriot, or go with the Girl.” It's good that it's more gender-neutral now.*

6. The New Epilogue

Teachers said that the new Epilogue was an improvement over the earlier Epilogue, both in terms of form and content.

- *The Epilogue now hits on bigger ideas that we cover — the Boston Tea Party, Lexington and Concord.*
- *I like how it's not just a video that plays, but it's staged with the different choices Nat has made. And you have some options cut off, and others open, based on your choices in the game.*
- *The Epilogue is better now. I like the way it is laid out as a book — like maybe it's the first thing Nat publishes as a journeyman printer.*

Teachers' Responses to New or Revised Game Features

1. The Badge System

Participants agreed that adding badges to *For Crown or Colony?* was a substantial enhancement of the game. They felt the most important badges were the Political Reputation badges, because these clearly reinforced students' game decisions, and had consequences for how players saw their political allegiances.

- *The Reputation badges are really good, because they reinforce the choices you've made.*
- *The important thing about the political reputation badges, is that they really need to understand and defend their positions.*

Teachers viewed the **Easter Egg** badges positively, as a part of gamer culture that would be very motivating for some students, and would encourage replaying at home.

- *The Easter Egg is really a motivator. Some kids really like to learn random facts.*
- *Easter Eggs are part of gaming culture for kids. This is something that's really good to reinforce. Games are a good device to talk about narrative.*

2. Hot Spots

The revitalized *For Crown or Colony?* has many more “hot spots” for students to click on if they choose — clickable areas of the screen that display informational text and an image about a historical object or idea. These are also more visible, because they are indicated by an eye icon. Teachers liked both of these features:

- *The eyeballs and hands really help guide you — I think this will be important because kids often got stuck and struggled.*
- *The motivation of the badge will entice them to click on these hot spots.*
- *I loved all the little details, the map was great. We'll travel to Boston, and it's pretty accurate.*

3. Demo Mode

Demo mode was popular among teachers. They said that it gave both them and their students flexibility to go directly to a segment, either for game play or for demonstration and teaching.

- *I think I'll use Demo Mode to revisit parts of the game during discussion with the class. It helps me zero in on a theme, rather than start the whole game over.*
- *It will help me get down to the meat of what I think is important.*
- *I love this; I would like to be able to show students different pathways, encourage them to explore on their own.*

4. Multi-track Audio Control

Teachers appreciated the ability to adjust, or have students adjust, the audio tracks on the game, particularly the music, which some felt could become repetitive.

- *I really like the ability to mix the sound.*
- *With the earlier game I have them play with headphones — too much sound drives me insane.*

Advisory Review

Advisors with expertise in the history of pre-Revolutionary Boston, educational gaming and accessibility, and classroom teaching reviewed the new version of *For Crown or Colony?* and its supporting materials. Guided by our research questions, they evaluated the effectiveness of the game enhancements in deepening humanities learning and fostering historical thinking skills, as well as the effectiveness of the new accessibility features in supporting diverse learners.

Advisors included:

- **Benjamin Carp**, Associate Professor and Daniel M. Lyons Chair of History History, Brooklyn College; author, *Defiance of the Patriots: The Boston Tea Party and the Making of America* and *Rebels Rising: Cities and the American Revolution*
- **Allisyn Levy**, Vice President of BrainPOP's online gaming portal GameUP; former teacher with 11 years classroom experience

The advisors praised the updated game and its overall approach to historical content and humanities learning.

Carp commented: “Overall, I thought the game did a great job deepening humanities learning and fostering essential historical thinking skills. I particularly like how the game offered multiple historical perspectives, gave the perspectives of enslaved and free blacks, white and black women, Loyalists, Patriots, and people from different social backgrounds. It also emphasizes the point that history does not necessarily present a simple picture.” Levy commented that “by providing students with the opportunity to put themselves in the characters’ shoes, the entire experience offers a meaningful context that will likely be much more memorable than more traditional approaches to learning historical thinking and knowledge.”

Advisors agreed that the content of the game is historically accurate and aligned with current scholarship.

Both advisors commented that the game content is very accurate, with only very minor errors spotted — for instance, Carp noted that although the Prologue references thirteen colonies, the British Empire actually had twenty-six colonies in the Western Hemisphere, including those in the Caribbean and elsewhere in North America. Levy praised the way primary source documents were woven into gameplay. Carp also appreciated the “delightful references to several recent historical works,” including Patricia Cleary’s work on female shopkeepers, work on Phillis Wheatley, the 1970s social history on land distribution in Massachusetts, the importance of women to boycotts, social history work on Boston (by Alfred Young and others), and scholarship on the Sons of Liberty by Pauline Maier and others.

Advisors commented on the effectiveness of the game and curriculum materials in supporting the teaching and learning of standards-aligned historical thinking skills and knowledge.

Carp felt the educator materials “supported historical thinking quite well, expanding students’ historical and vocabulary knowledge, encouraging students to assess different perspectives, to think about the biases inherent in primary sources.” Levy also praised the extensive curriculum support, which “ensures that all teachers, regardless of their own background and experience with the learning content or skill with implementing game-based learning, can be successful.”

Advisors affirmed that the game supports Mission US’s overarching goal of helping students understand the role of ordinary people, including young people, in US history.

Both advisors discussed the effectiveness of placing students in the role of a young person who faces difficult choices and experience the consequences of those decisions during the time period, all while experiencing what life was like at the time, encountering other individuals with different viewpoints, and witnessing dramatic historical events. Carp noted that those choices are “similar to those a young person might face: do I pursue economic opportunity? Adventure? Romance? Will I be homesick? Do I search for a long-lost brother? Take up a political cause? Just try to be a decent person?” Levy commented that “the game allows for a safe place to try out different decisions to see how the storylines play out and gain a deeper understanding of multiple perspectives. The small details, like the tidbits of backstory players can discover

through exploring and having to prioritize tasks, build a more realistic picture of the characters and time period.”

Advisors believe the game will engage its target audience of middle school students, and provide an effective experience for teaching and learning history.

Levy commented, “I’ve observed the game being used in multiple classrooms and the engagement level is high! When I think back to my own SS/History education, having to memorize facts and dates without any context around it, I am struck by how I was able to memorize this meaningless information that I had no personal connection to, ace my tests, and now have very little ability to recall any of what I ‘learned’ during that time. [This game] provides the much needed antidote of my experience, where both educators and students are provided with a high quality, memorable, and meaningful experience that leaves a lasting impression.”

Advisors commented on updates to the game’s humanities content and features in key areas:

- **Strengthening the Loyalist perspective.** Carp felt that “the game did a fine job here, offering the player perfectly reasonable Loyalist (and neutral!) explanations for their views, and even giving the player the opportunity to adopt those views.” Levy described the game as “very helpful in gaining a deeper understanding of why business/relations between Patriots and Loyalists can be tricky.”
- **Bringing forward issues around taxation.** Levy felt that the additions were “effective in deepening an understanding of the risks of supporting smuggled items.” Carp commented that the issue of nonimportation is brought to the fore in the game as a way of protesting taxation, but was not sure the game sufficiently drives home the reasons the British needed to collect these taxes, or their economic impact on the colonists.
- **Highlighting the relationship between colonists and the British army.** Carp felt the game was effective on this topic, helping the player to understand (through the experience of the player character’s brother Christopher) that the British army protected the colonies, as well as why the troop presence was of concern to colonists.
- **Effectiveness of updated deposition scene in bringing forward political issues around the Boston Massacre.** Levy commented that “the intensity of the scene and the questioning seem like a good way to evaluate what students learned by playing the game,” although Carp felt that the deposition scene on its own was not as effective as the supporting “Mr. Revere’s Engraving” document-based classroom activity, which he felt “drove the point (about political issues surrounding the Massacre) home more effectively.”
- **Effectiveness of the new badge system in helping players draw connections between in-game choices/interactions and larger historical themes.** Levy felt that the badges would be “effective in helping students be more aware of their choices and motivate them to stick with specific efforts.” Carp described the Political Reputation badges as “effective in driving home Nathaniel’s political choices,” but felt the other types of badges to be a bit more detached from the larger historical themes and saw the badge system overall as being more effective as an in-game incentive to encourage exploration.

- **Effectiveness of the Epilogue drawing connections between the Boston Massacre and the coming of the American Revolution.** Carp commented, “Given how succinct the Epilogue was, I thought this was particularly effective. Further tensions → tea party → independence... the game works on its own, fitting the events of early 1770 into the wider context (both before and afterwards).”

Advisors praised the game’s updated accessibility and usability features.

When asked to comment on the effectiveness of the new features (such as text to speech, captioning, adjustable audio tracks, demo/select a scene mode), Levy commented: “I love that you enhanced the game with all of these! Small and subtle changes but they allow the game to reach the widest audience of players possible. The demo mode/select a scene feature is a dream for teachers who want to jump to specific parts of the game and facilitate conversations among the class.”

Technical Implementation: Challenges and Lessons Learned

In addition to external review by educators and advisors, our internal team also conducted a post-mortem review of the technical revitalization efforts, considering our initial research question: *What are the challenges of converting Flash-based games and web components to new engines, such as the Unity game engine?* While the team encountered many project-specific challenges — far too many to enumerate here — the following are some broader issues that similar projects might face.

Working with Unity

As discussed, with the expected end-of-life of Flash in 2020, we made the decision to rebuild the first *Mission US* game, *For Crown or Colony?*, in Unity. While we chose Unity for a number of good reasons (as detailed earlier), working in Unity also poses a number of challenges:

- Unity is a relatively “heavy” technology and, when deployed on web browsers via WebGL, requires some upfront loading time — potentially five to thirty seconds (depending on connection speed) before the game is loaded.
- WebGL builds are also, from a developer perspective, prone to inscrutable bugs that can be difficult to fix. Fortunately, Unity WebGL has been improving both in terms of its “weight” and its bugginess and will likely continue to improve on these fronts in years to come.
- WebGL builds will not run on mobile web browsers. We were able to mitigate this issue by publishing the game as a native mobile app, which we offer for free in the App store.
- WebGL requires relatively new browsers and/or operating systems that some school computers or devices might not have. However, most modern HTML5 solutions have this limitation as well.

Despite the challenges discussed above, we have been successful in achieving our goals for this revitalization process, as evidenced by the feedback we've received from teachers and advisors who have used and reviewed the new game.

Porting vs. Revitalizing. It is important to know up front what your goal is: porting or revitalizing? **Porting** is the process of making an interactive work in a new engine or on a new device with a minimum amount of work in terms of changing or updating UI/UX, content, or assets. **Revitalizing** involves using the original interactive as inspiration or a rough roadmap, and reconceiving it through the lens of new technical capabilities; modern design practices; new scholarship and understanding (if relevant); your own team's learning, wish lists or "cutting room floor" material; and any available user feedback and analytics on the original.

Porting is simpler, even with some specific, targeted upgrades that go beyond the absolute minimum. The downside to porting is that it may be a missed opportunity (assuming the "same old" is going to continue to be successful), or the ported product will really show its age in a new environment.

Revitalizing is high risk/high reward. The biggest risk is probably **underestimating the work involved**. You might think you have a comprehensive list of changes, but what tends to happen is the "living room effect": you start off just wanting to replace the drapes, but once you've done that, the couch looks ratty. So you replace the couch, but even though the side chairs are pretty new, they don't quite match, so... and before you know it you're refinishing the floors and gut-renovating the kitchen. If you had known ahead of time what it would take, you might never have started!

A couple of examples from our project:

- We knew we would have to rerecord some of our voice actors as we added new lines for their characters. Initially, we anticipated just recording those new lines. Luckily we were able to track down almost all of the original actors. However, once we began rerecording, we realized that we would not be able to replicate the exact room conditions and microphones used eight years earlier, so the sound was just not going to match. Consequently we ended up rerecording every single line for any character who had any new lines. Then, we even rerecorded some other characters who didn't have new lines because their original recordings had relatively poor quality audio; the contrast was noticeable in comparison to the other newly recorded lines.
- We knew we wanted to add a badge system because *For Crown or Colony?*, as the oldest game in the series, was now the only one that did not have such a system. It later became apparent that retrofitting a badge system into an existing game structure that was not originally conceived with badges in mind is more challenging than one might expect. We hadn't fully appreciated the benefit of designing a game with badges in mind from the outset.

Managing streaming/download sizes. This is less of an issue for an experience primarily used by single users on a good connection, but becomes increasingly challenging as bandwidth degrades, as typically happens on a school WiFi network when multiple students are simultaneously streaming.

For now there is no getting around the large, initial load that Unity WebGL deployment entails. Adding some kind of loading bar or animation is extremely useful so that users aren't left staring at a black screen wondering what is happening.

For game assets, there are many considerations. The biggest two questions will be:

1) Should this asset be preloaded or should this asset stream on demand?

Each asset should be evaluated against whether all users will see it or only some users. Also consider that for a game that is level- or part-based, all users might see a given asset, but chances are they might not see it for a given play (meaning they play Level 1 on one day and Level 2 on the next).

For assets that all users will see all the time, we recommend preloading.

For assets that some users are going to see on a given play (meaning some assets within a given level may be optional), it is a tradeoff between immediate response (preloaded) and the potential for a short lag (streamed). It's worth considering what percentage of users are likely to see the asset (e.g., 80% of users see it versus only 20%).

For assets that all users will see, but probably not until later in the experience, Unity and WebGL's concept of "asset bundles" may be useful. This is a collection of assets that is loaded for, say, Level 3 but gets *unloaded* when you go to Level 4.

2) What should be the quality of this asset and the compression on it?

If supporting a single resolution (e.g. 1024x768), this is a much easier task. If you are supporting multiple resolutions (e.g., a max of 1024x768 on WebGL but 2048x1536 on iPad) then it gets more complicated. We found the simplest approach was to make all our assets at the highest resolution. This allowed us to define the maximum display size for a given implementation and entrust Unity to compress it.

We recommend experimenting with the compression methods and level of quality (1-100%). Levels around 30-40% may sound low, but can actually look pretty good and save a lot of file size.

We also suggest reviewing Unity's log file doing a WebGL build, as it has buried in it very good reporting about asset bundle sizes as well as the size of each and every asset in it. This can be a great way to spot an asset that was not compressed, which can mean 3MB instead of 100KB!

Our developer made a custom report panel in Unity so that we could quickly see this information rather than have to dig for it. We created a spreadsheet that showed the size of asset bundles at different points of time, so we could see the effects of different choices and track progress towards our goal of <10MB per bundle (and an ideal of <6MB).

Best Practices and Recommendations

The following best practices based on our experience with the revitalization of *For Crown or Colony?* may help inform the work of other stakeholders in the digital humanities, including producers of other game- or Flash-based projects:

Technical Upgrades: Working with Unity

1. **Minimize the number of platforms for which you publish, if possible.** Even though Unity can publish to many different platforms, it is not as easy as hitting a button. Each platform, especially WebGL and mobile devices, has its own idiosyncrasies and requires extensive testing.
2. **Stay up to date with Unity versions.** Unity publishes new versions of its engine every year. Try and keep your game current by opening it in newer versions and testing if it still builds. Keep third-party plug-ins up to date. Fix any issues as soon as possible. Waiting two years from 2017 to 2019 caused significant pain points in our process.
3. **Plan training time for artists and animators who are used to working in Flash,** to allow for the Unity learning curve. Unity's tools are substantially different (even though, say, for animation they both use a "timeline" concept) and take a while to figure out, much less master. Things that were easy in Flash may be hard in Unity and vice versa.

Enhancing Learning Content:

1. **Define and focus editorial revisions on the most important learning issues.** Knowing that we needed to strengthen the Loyalist perspective, for example, brought focus and intentionality to our editorial revision process. Without this focus, the temptation to "improve" every dialog on a line-by-line basis would have been hard to resist. Yet in a multimedia digital project like ours, every line edit has additional costs (voiceover production, game logic, user testing) that can make polishing prose a very expensive and unwieldy proposition. The other advantage of focusing editorial revisions on known learning issues was that we had clear metrics for success, and now can measure whether our content revisions have had the desired effect.
2. **Take advantage of the opportunity to integrate "nice-to-haves."** In the course of developing digital projects, teams usually come to differentiate between "mission-critical" and "nice-to-have" content and features. Due to resource constraints, many "nice-to-

haves” don’t make it into the final cut. By documenting these ideas or early efforts, teams can hit the ground running during the revision process. For example, in the original mission, embedding primary documents became secondary to other key game components, and thus, were never satisfactorily implemented. In revitalizing *For Crown or Colony?*, we were able to turn back to this unfinished work and integrate several new primary documents in a more meaningful way.

3. **Involve your audience in the development process.** Focus groups and formative testing with teachers and students in the target audience have yielded invaluable insight into common misconceptions, areas where students (and teachers) may struggle, and areas where our games and curriculum materials might provide additional support. The ability to learn from the experts — in our case, educators with deep knowledge of and practical experience with the original game — helped save the development team from making false assumptions about what needed to be changed and why. Our revitalization roadmap reflected a number of priorities and opportunities that didn’t always come directly from audience input (we had our own experiences, as well), but having this perspective provided a common touchpoint for the team.

Expanding Accessibility:

1. **Prioritize enhancements with the greatest potential impact.** Our philosophy in adding accessibility features was to target the ones with the potential to have the greatest immediate impact. Based on teacher feedback over the years, we knew that text-to-speech for all non-voiced text was paramount as well as closed-captioning for all animations (which later missions did already have). The full list of WCAG (Web Content Accessibility Guidelines) is fairly extensive and is written around the assumption of HTML-based content, which Unity is not. Therefore, we are committed to continuous improvement of our accessibility, but we knew we couldn’t do everything at once.
2. **Unity can’t natively access screen readers, but you can get high-quality text-to-speech from sources like Amazon Polly very inexpensively.** We used Polly’s API to generate files for all of our text automatically and those are streamed into the game as needed. We built production tools that automatically pre-generate the files and save them into the project (rather than dynamically streaming them on demand). Although this required more work to make sure the text and text-to-speech is in synch, we avoided driving up our costs due to thousands of API calls being fired.

Conclusion

As we near the end of support for Flash, developers and producers of educational games face a pressing need to rebuild and upgrade their content before it becomes unplayable. As discussed in this white paper, there are many challenges along the road to revitalization, and we hope that the experiences documented in this white paper will be valuable to others embarking on similar journeys. One of the greatest challenges, however, continues to be that of securing the funding to support this revitalization — particularly for free public media resources like *Mission US*.

While commercial products such as books or subscription-based games have a built-in mechanism for funding new editions or versions, non-profit projects have no such mechanism and must find other ways to fund the revitalization process.

We are grateful that the National Endowment for the Humanities has shown leadership in supporting revitalization efforts like this one. Looking forward, we hope that other funders will see the value of investing in the sustainability of proven projects, ensuring that resources like ours can continue to impact the millions of students and educators who have come to rely on them.