

# When Boston Isn't Boston: Useful Lies of Reconstructive Game Models

AURÉLIEN CATROS AND MAXIME LEBLANC

Using qualitative comparative analysis, this article assesses how faithfully the reconstructive game models (RGMs) used in video games simulate historic cities. Employing Kevin Lynch's concept of imageability, it looks in particular at similarities and differences between a 1775 map of Boston and the RGM of the city featured in Ubisoft's *Assassin's Creed III*. By comparing the construction of landmarks, paths, nodes, edges and districts within the game model to the historic conditions recorded on the map, it demonstrates that a feeling of verisimilitude is achieved not through complete accuracy but through specific combinations of sufficiently accurate historic elements. Based on these findings, it discusses the theoretical implications of designing RGMs and sheds light on the use of architectural heritage reconstitutions as an educational component in video games.

The video game industry is increasingly turning to history as a resource to build meaningful stories that will increase the sense of immersiveness through the use of shared references. Historical material can also be used to build the virtual environments in which these stories take place. Such models may be called reconstructive game models (RGMs) since they pretend to show what historical spaces looked like, according to a process that at first glance seems similar to that which archeologists engage in. While art historians are increasingly interested in RGMs — examining their differences within scientific historical reconstructions and why such differences should be a topic of concern — architects remain reluctant to analyze them according to their own expertise.<sup>1</sup>

Among the numerous games based on history, perhaps the most famous are strategy games such as *Sid Meier's Civilization*, *Europa Universalis*, and the *Total War* series, as well as first-person shooter games like *Call of Duty* or third-person shooter games such as *Red Dead Redemption*. Ubisoft's *Assassin's Creed* series is a third-person stealth game often touted as featuring some of the most historically accurate reconstructive architectural models, despite the presence of numerous nonobvious anachronisms observed in-game.<sup>2</sup>

*Aurélien Catros is a Ph.D. candidate in Architecture at the Université de Montréal, Canada.*

*Maxime Leblanc is a Ph.D. student in Architecture at McGill University, Montreal, Canada.*

Nonobvious anachronisms, as described by Douglas N. Dow, are differences with reality “that [have] been skillfully blended in.”<sup>3</sup> Since the release of the first *Assassin’s Creed* game, such anachronisms have been pointed out by art historians, and the game series has come to serve as something of a canonic example of this phenomena in video games.<sup>4</sup> Yet this has not affected public perceptions, and *Assassin’s Creed* RGMs are still believed to be great guesstimates as to what cities looked like during the featured time periods.<sup>5</sup>

In order to respond to public desire for realistic games, research on historical likelihood has been at the center of Ubisoft’s game designs for more than thirteen years, beginning in 2007 with their first opus, *Assassin’s Creed (AC)*, which offered a reconstitution of Jerusalem, Acre and Damascus during the thirteenth century. However, it was the two following games (*AC II* and *AC: Brotherhood*) that strengthened Ubisoft’s reputation as a studio in pursuit of historical accuracy in their models. The games depict famous Italian cities such as Florence but also small towns like Forli, San Gimignano, and Monteriggioni during the Renaissance. And the series’ fourth installment (*AC: Revelations*) continued the storyline of previous games focusing on and around the cities of Rhodes, Masyaf and Constantinople during the same time period.

For its next game, however, *Assassin’s Creed III (AC III)*, Ubisoft turned to North America’s East Coast during the American Revolution, focusing on events that took place in Boston and New York. To improve the sense of verisimilitude, its designers worked alongside historians, using numerous archives to improve the level of accuracy of their reconstructions.<sup>6</sup> Compared to previous games, the proximity to the present day opened up the possibility of sourcing details of these environments from more accurate archival documents. The series then continued with games featuring reconstructions of New Orleans (*AC Liberation*) and the Caribbean (*AC IV: Black Flag* and *AC Rogue*) during the same period with similar attention to accuracy.

In 2014 Ubisoft Montreal returned to Europe and introduced a reconstructive model of Paris during the French Revolution (*AC Unity*), and the following year it released a game depicting London during the Industrial Revolution (*AC Syndicate*). However, from 2017 onwards the company returned to setting its games in more ancient times. It thus appears that archeological sources rather than archival documentation were used to create the historical RGMs for *AC Origin* (2017), *AC Odyssey* (2018), and *AC Valhalla* (2020) — which take place in the first century BCE, fifth century BCE, and ninth century CE respectively.

Since the environment of each Ubisoft game is based on real cities, developers face the problem of historical accuracy throughout their design process. According to developers, a reconstruction of a city from antiquity differs substantially from that, for example, of London from two centuries ago.<sup>7</sup> Indeed, the nature of sources differs greatly between these two types of reconstructive models. This article will focus on examples

from the recent past, primarily the last three centuries. Half the games in Ubisoft’s *Assassin’s Creed* series take place during or after the eighteenth century and use archival documentation. This makes it the most covered time period and the most representative of the *AC* series as a whole. The recency of sources should also, in theory, provide developers with more accurate documentation from which to build their games.

This article will analyze the first of six games which take place during the eighteenth century, *Assassin’s Creed III*, released in 2012, which paved the way for future games using a historic approach to game design. It tells the story of Ratonhnhakéton “Connor” Kenway, a Native American Mohawk assassin who finds himself in the midst of the American Revolution (between 1775 and 1783). Among other famous historical events in colonial America depicted in the game, the hero witnesses the Boston Massacre in 1770 and the Boston Tea Party, which took place three years later. Full RGMs of the island of Boston and New York City were created by Ubisoft for this game, but we have chosen to focus only on assessing the model of Boston because it is the first city a player is immersed in, and because the insularity of the city makes identifying the model’s limits easier (FIG. 1).

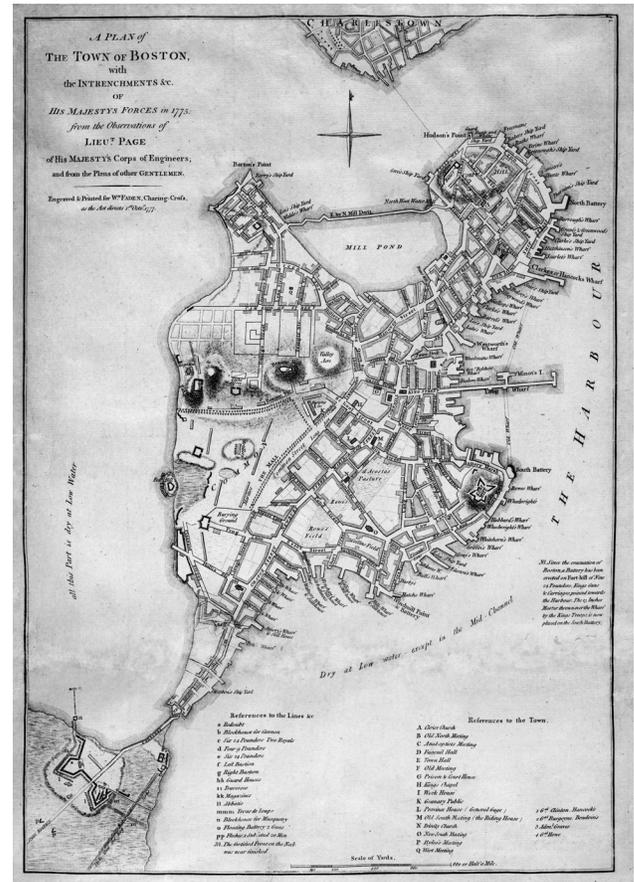
In order to assess the accuracy of this RGM, it was necessary to seek out primary sources (such as historic maps) as a means of comparison. Among these, we focused on the town plan created by Lieutenant Thomas Hyde Page to describe its fortification by the British in 1775, which is regarded today as “the most informative record available for the town of Boston at the time of the American Revolution,” according to the Norman B. Leventhal Map and Education Center (FIG. 2).<sup>8</sup> Considering multiple interviews with Ubisoft’s historians, who have claimed the use of extensive historical documentation to ground the game (as well as the large quantity of open-access digital documentation on the Boston Library’s website), we assumed the game’s designers had access to this map during the game’s development.<sup>9</sup> And following this assumption, we hypothesized that any difference identified between the game and historic reality could not be considered a careless mistake, but was rather a purposeful modification carried out by the Ubisoft team.<sup>10</sup>

Accounts in video game trade journals show that the resulting model is credible enough to make players and critics believe they are immersed in a historical reconstruction.<sup>11</sup> Rather than pointing out each nonobvious anachronism, we aimed to measure how accurate the RGM really was compared to the historical map. This allowed us to measure how accurate a reconstruction needs to be to induce a feeling of verisimilitude for a nonspecialist audience.

The feeling of verisimilitude with regard to such a modeled environment has previously been linked to the field of urban design through Kevin Lynch’s concept of imageability, which he developed in his 1960 book *The Image of the City*. Lynch described imageability as “the quality in a physical object which gives it a high probability of evoking a strong



**FIGURE 1.** Screenshot of the map of Boston from *Assassin's Creed III*, 2012. Source: Ubisoft, 2021.



**FIGURE 2.** "Plan of the town of Boston, with the intrinchements &c. of His Majesty's forces in 1775: from the observations of Lieut. Page of His Majesty's Corps of Engineers, and from the plans of other gentlemen." Source: Norman B. Leventhal Map & Education Center.

image in any given observer."<sup>12</sup> He exemplified this concept — which, he said, is present at varying levels in every city — using case studies of Boston, Los Angeles, and Jersey City. Although Boston at the time of the American Revolution was substantially different from the city analyzed by Lynch, it can still be considered foundational in the development of the concept of imageability. This further substantiates the use of Lynch's theory as a way to analyze the Boston RGM.

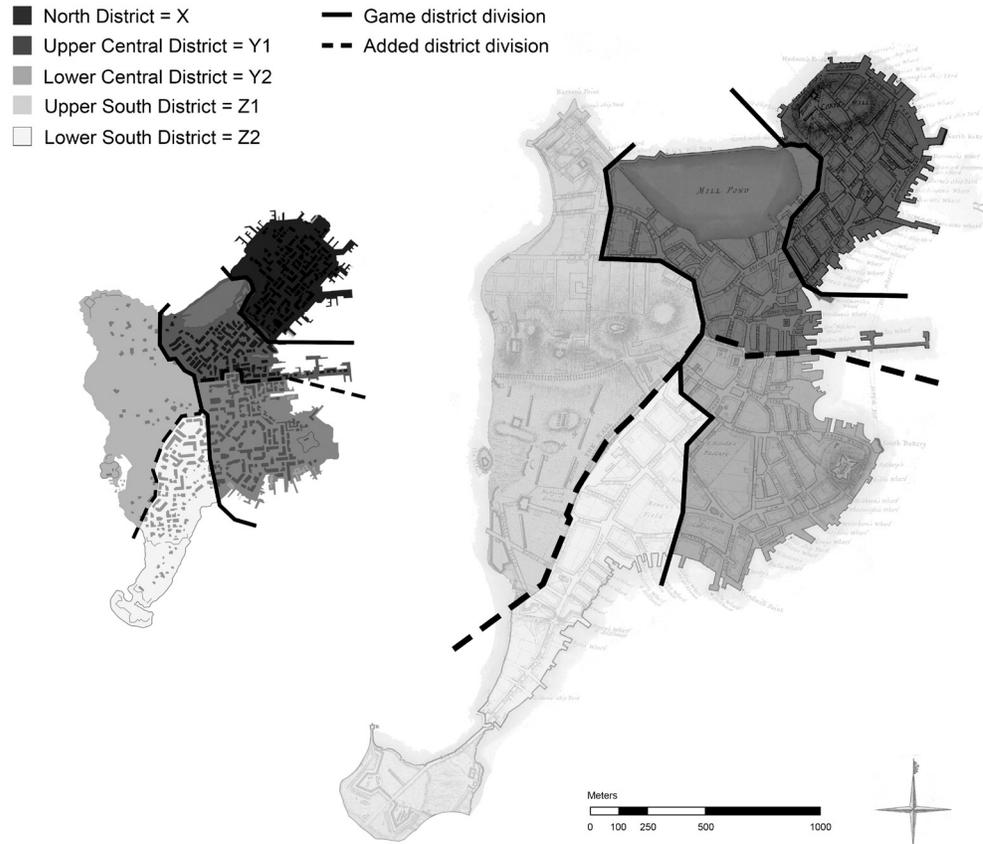
One should note, however, that Lynch's work on urban imageability is showing signs of age, as scholars and urban planners have reassessed his theories in light of the growing pervasiveness over the last two decades of information and communication technologies.<sup>13</sup> Specifically, as GPS apps become increasingly ubiquitous, people have begun to rely less on discrete city elements like landmarks for wayfinding.<sup>14</sup> Regardless, for the purposes of this study, we chose to employ Lynch's theory despite its now-contested relevance because scholars continue to believe his ideas remain significant to people's experience of place, and because these ideas offer a clear and well-known framework from which to analyze the

comparability of in-game and real-life historic Boston.<sup>15</sup> In addition, GPS, as an autonomous guidance tool, is not a feature available to players in the game or a technology that existed in the late 1700s. Since its use could not therefore alter either experience, we decided that the above critiques did not present a relevant limitation on our study. We thus hypothesized that the feeling of verisimilitude could be positively correlated with similarities between the RGM's imageability and that of the actual historic city.

#### QUALIFYING AND QUANTIFYING BOSTON'S IMAGEABILITY

Overall, we hypothesized that an RGM can be verisimilar to the city it refers to as long as each of its parts is verisimilar. According to this logic, and to make our comparison more manageable, we divided our study into five cases representing five areas of the island of Boston (FIG. 3). The game itself split the island into three main districts (North, Central and

**FIGURE 3.** District division into five homogeneous areas. Left: RGM map. Right: historical map. The maps are presented at the same scale.



South). We then further split the Central and South districts into two subareas since they were too wide and heterogeneous for proper analysis. The two districts were split following their respective main streets: King's and Queen's Streets for the Central district, and Common Street for the South district. For the purpose of clarity and ease of reading, we then gave each of the five resultant areas an abridged name. The North, Central and South districts were renamed X, Y and Z, with the additional splits represented as numbers 1 and 2.

One should note that a military split of the city into twelve wards also existed in 1768.<sup>16</sup> However, we could not argue that such a division would be meaningful to our study, and its socio-political complexity might even have hindered our work. Our study was also intended first and foremost as an evaluation of the RGM, and not as a detailed investigation of sociopolitical conditions within the historic city. For this reason, the division into subsidiary cases relied on the in-game territorial split rather than any other administrative division of the city that might then have existed.

The comparative method we then chose for our analysis was further linked to our final objective. In brief, this was to shed light on the principal causes of the acclaimed verisimilitude of the *Assassin's Creed* series. We proposed that the identification of possible causal factors (or combinations of causal factors) would require identification of correlations between

different cases with the same outcome. These correlations could then be further interpreted theoretically to explain how these outcomes were related to a general sense of verisimilitude.

The desired outcome of our study therefore was a determination of the perceived verisimilitude of different areas of the Boston RGM to historical conditions. Both qualitative and quantitative methods could theoretically have been used to evaluate such relationships. However, qualitative methods would have made comparisons difficult between more than two cases, while statistical correlation alone would not have been appropriate given the small number of cases. We thus chose to use the method of qualitative comparative analysis (QCA) proposed by the sociologist Charles Ragin in 1987. This uses a Boolean approach to qualitative comparison, which differs from both the above approaches because it allows the correlation of causes and effects between a small number of cases as long as they are greater than two.<sup>17</sup> Specifically, the methodology consists of coding the presence (labeled 1) or absence (labeled 0) of potential causes (or combinations of causes) surrounding a particular effect found in different situations in order to set up a table that summarizes the results. This table (called a truth table) might then serve as a basis for establishing a theoretical equation that would reveal the potential causes of the observed phenomena, and which might then be generalized to other cases.

In order to compare the imageability of the historic districts of Boston to those in the game reconstruction, we had to divide this intangible concept into a number of tangible metrics. It was here that Lynch's theory was particularly useful. According to Lynch, "the contents of the city images . . . which are referable to physical forms, can conveniently be classified into five types of elements: paths, edges, districts, nodes, and landmarks."<sup>18</sup> It is further notable that this taxonomy has long been used by scholars as a means to design and describe virtual environments in terms of the subjective spatial experience of players within an architectural framework.<sup>19</sup> We thus considered the verisimilitude of each of these five elements, from model to referent, as a potential cause to be analyzed for each case examined according to our qualitative comparative analysis method.

Such a classification, of course, limits analysis of a city's image to its physical, perceptible qualities. Immaterial elements, such as social, functional or historical meanings of an area, can also affect a city's imageability. However, these qualities fall outside the scope of Lynch's theory — an epistemological limit we adopted as well.

Another limitation of Lynch's concept of city image is its inherent subjectivity. However, Lynch suggested that a collective image resulting from an overlap of many individual images seemed to exist in any city, even if "each individual picture is unique."<sup>20</sup> Consequently, a reading of Boston RGM or of historical Boston would reflect, at least partially, the vision of this study's authors. Additionally, we could not ignore that games and maps are intrinsically dependent on images of the represented spaces held in the minds of their authors during their conception.

Finally, according to Lynch, we should keep in mind that these five elements never exist independently of each other. Thus, by analyzing them separately, one might ignore their relationships. Lynch used these five elements as a grammar of a city's image, and identified them in the urban fabric to

produce city images derived from various sources including fieldwork, interviews, and maps. In order to summarize the similarities between imageabilities of the RGM and the historic city, we thus chose to produce diagrams derived from maps representing each element and then to compare them one by one.

#### LANDMARKS

In the RGM of *Assassin's Creed III*, the city contains a scattering of high vantage points that allow players to view their surroundings and discover new portions of the in-game map. These vantage points are usually bell towers or historic landmarks such as churches and meeting houses (FIG. 4). These elements resemble what Lynch called landmarks: "simple physical elements [considered to be external to the observer] which may vary widely in scale."<sup>21</sup> They can include remarkable buildings, noticeable vegetative elements, monuments, etc. As the name suggests, these elements allow the user to mark the land in order to orient themselves within urban space.

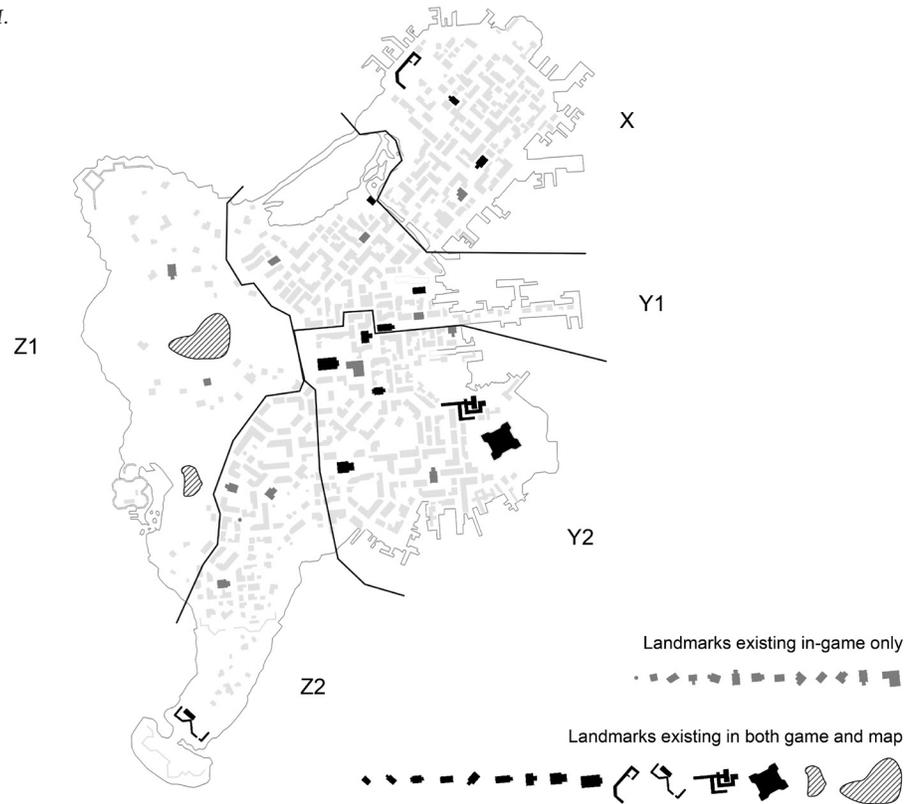
For Lynch, landmarks varied from singular elements recognizable by all urbanites (such as monuments, great domes, large towers, etc.), to more local ones recognized only by an individual familiar with a given setting (such as storefronts, doorknobs, trees, etc.). Distant landmarks, however, are prominent elements observable from a large number of different positions, which are thus useful to people unfamiliar with a city when organizing routes. To be easily identifiable, a landmark must stand out clearly from its environment on account of its shape, size or materiality. The figure-background contrast between the landmark and its surroundings thus seems to be a principal factor in its recognizability.

In addition to the selection of historical vantage points made by the game, some landmarks were added to the game database, providing players with additional historical context.



FIGURE 4. Screenshot of the game taken by the authors. View from the top of the clock tower of New South Meeting House (Y2). Source: *Assassin's Creed III*, Ubisoft, 2012.

FIGURE 5. On the landmarks in the RGM.



Among them, were some (but not all) important military forts such as Fort Hill, but also a few major city landmarks like King’s Chapel. When considering if the selected areas in the game are accurate in relation to landmarks that existed at the time, we first checked to see if important historic landmarks were modeled with a similar geometry and location in the game. Then, in order to accurately assess the impact of the presence or absence of a given landmark, we extracted the landmarks and vantage points provided by the game’s database and placed them on a diagrammatic version of the RGM (FIG. 5). After compiling these elements, we used the

1775 map of Boston to confirm their status as landmarks by cartographers at the time.

Among the five areas, four feature the most prominent landmarks: X, Y1, Y2 and Z1. But we noted that in less-built-up areas such as Z1 and Z2, the need for vantage points could have led the game designers to create landmarks (such as churches) that did not historically exist. Interestingly, every fictional church modeled in-game that serves as a vantage point is a copy of the Old North Meeting House as found in area X (FIG. 6). This structure does probably best capture Boston’s Georgian architectural style, but it is sufficiently



FIGURE 6. Screenshots of the game taken by the authors. Left: view from in front of the Old North Meeting House (X). Right: view from in front of a fictional church in the countryside (Z1). Source: Assassin’s Creed III, Ubisoft, 2012.

generic to fool players into believing that, as a nonobvious anachronism, each appearance of it represents a unique, historical structure. We also determined that all the landmarks included in *AC III*'s database did indeed exist in Boston's history. Thus, their absence on the 1775 map indicates that they were not considered worthy of mention by cartographers of the time. For this reason, buildings like the Green Dragon Tavern or the Bunch of Grapes could be deemed to be landmarks by Ubisoft, but they were apparently not significant enough structures to be noted on the 1775 map by the British military or government personnel who produced it.

Interestingly, one may note that the missing landmarks are smaller in size and appear to serve a more civilian function, such as bars and dwellings. Another notable discrepancy is the presence of the Liberty Tree, which existed up until August 1775, but which was brought down by Loyalists around the same time the historic map was being drawn.<sup>22</sup> Its absence from the historic map, whether due to its contested importance or to conflicting dates, was labeled as "landmark existing only in-game."

## PATHS

The second element taken into account for this study is what Lynch called paths. He described these as linear elements, "channels along which the observer customarily, occasionally,

or potentially moves."<sup>23</sup> Since a primary appeal of the game is the ability of its main character to climb onto buildings and jump from roof to roof, attempting to assess what constitutes a path in the game according to Lynch is difficult. However, nonplayer characters (NPCs) lack the same abilities, and they wander about the city along precomputed trajectories (as identified on the RGM map) (REFER TO FIG. 1). We, thereby, reconstructed the game's paths mostly considering these precomputed routes (FIG. 7). With respect to the 1775 map, we considered all paths identified as such, even those without street names.

While an evaluation of the verisimilitude of landmarks focused on the accuracy of the reproduction of historical buildings, a similar approach to paths was not possible because they were not designed the same way in the context of the game. Nevertheless, we identified similarities between the overall path structure between the game and the historical map in three of the five case areas: X, Y2, and Z2. For instance, the latter area is historically organized between two axes — Common Street and Orange Street (which then becomes Newbury Street and Marlborough Street) — which seem to exist in-game, even though they are not named. The many secondary streets branching off of the two avenues in-game also existed historically, even if their number differs slightly between the RGM and the historical city.

On the other hand, some areas fail to incorporate any such likeness. For example, the network in Y1 is substan-

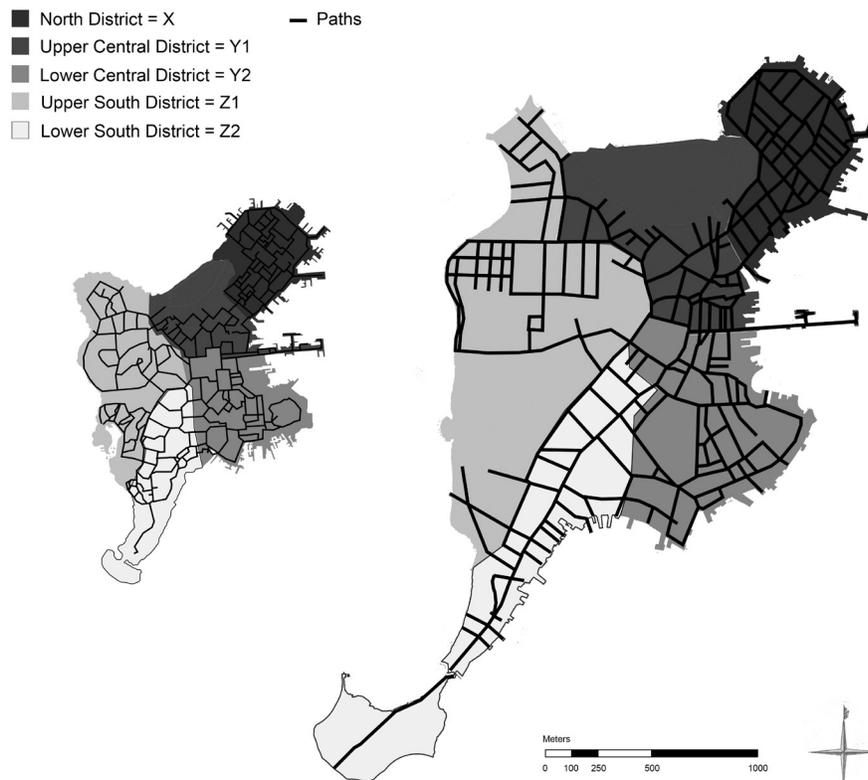


FIGURE 7. Comparison of paths between the RGM and the historical map. Left: RGM map. Right: historical map. The maps are represented at the same scale.

tially dissimilar in the game and the historical map. In addition, the map shows the beginning of a grid-like hierarchy in the upper portion of Z1, whereas no such structure exists in-game. *AC III*, instead, features many dirt roads that could have been added by designers to facilitate movement in this area of the map.

To summarize, we noticed that rather than reproducing every street exactly, Ubisoft chose to reproduce important main routes, while generating a different network of secondary ones. Consequently, areas with the highest level of fidelity regarding paths correspond to those which historically featured existing major avenues.

NODES

According to Lynch, “the concept of node is related to the concept of path since junctions are typically the convergence of paths, events on the journey.”<sup>24</sup> He defined this concept as “the strategic foci into which the observer can enter, typically either junctions of paths, or concentrations of some characteristic.”<sup>25</sup> In other words, they are specific elements in the perception of the urban landscape that consist of remarkable junctions of tracks by their shape and the visual strength of the landmark next to them.

In order to identify nodes that defined the two imageabilities we aimed to compare, we selected major avenues that had been surveyed during the previous path analysis, and we iden-

tified their intersections — which, for the most part, constituted strong nodes, according to Lynch. We then roamed the in-game RGM in order to confirm if these junctions presented the player with significant choices as to direction of travel. We designated those that did to be nodes within the RGM.

We assessed multiple characteristics when determining the importance of a node, such as the size of walkways and their surrounding elements (trees, flagpoles, kiosks, streetlamps, sidewalk interruptions, etc.), as these contributed to the memorability of a junction for the player. Once a junction was deemed to be a significant node, secondary factors such as the rate of appearance there by NPCs helped to confirm their significance. Every node was later added to the comparative diagram (FIG. 8). When comparing, we relied on road size and toponyms to assess the relevance of historical junctions as strong nodes. Paths marked as “lanes” or “alleys” were disregarded since their names hinted at their low-status at the city scale. Conversely, intersections between two (or more) paths named “streets” were regarded as strong historical nodes. The same applied to places named “squares.”

Oftentimes, nodes would be located at the intersection between areas since their boundaries often follow major paths. When this was the case, nodes were counted only once in the final tally so as to not skew the results. In ambiguous cases, we considered the number and the length of each street composing the node to determine which area to include it in.

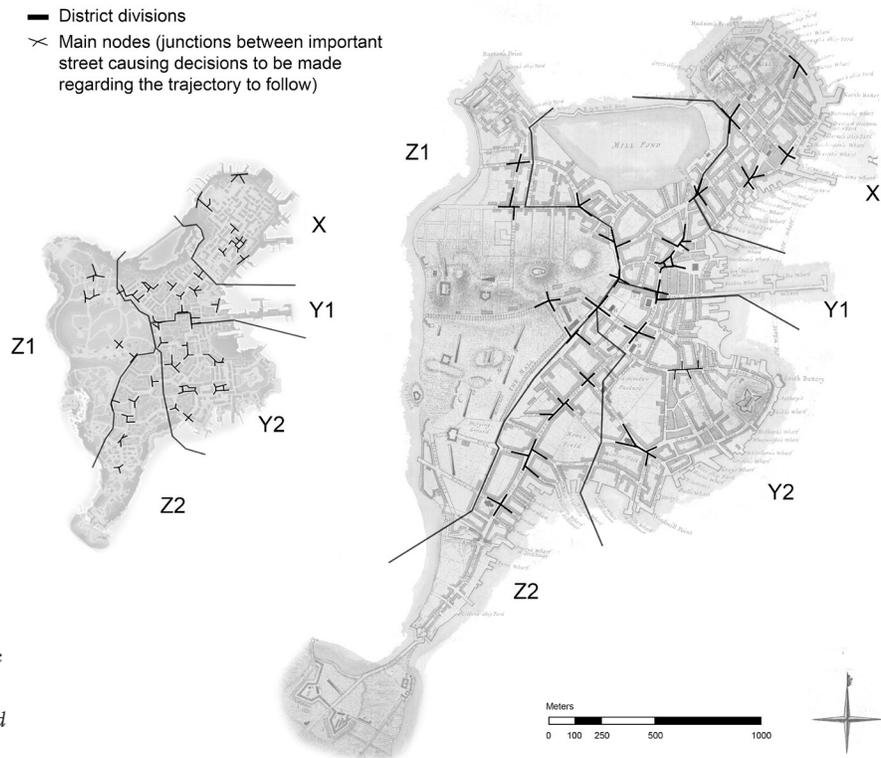


FIGURE 8. Comparison of nodes between the RGM and the historical map. Left: RGM map. Right: historical map. The maps are represented at the same scale.

CASES	RGM	1775 MAP	DIFF.	QCA VALUE
	Nodes	Nodes	Nodes	
X	6	5	1	1
Y1	9	6	3	0
Y2	9	4	5	0
Z1	4	3	1	1
Z2	6	5	1	1
GLOBAL	34	23	11	-

FIGURE 9. Number of nodes per case.

As the accompanying table shows (FIG. 9), three areas (X, Z1 and Z2) were found to display a comparable number of nodes (+/- 1) in-game and historically, and, thus, they were considered to be accurate representations for this element. However, we noticed that node accuracy was not necessarily a function of path accuracy. For instance, Z1's nodes were deemed to be historically convincing even though its paths were not. The two remaining areas (Y1 and Y2), which constitute Boston's downtown sector, had been significantly modified relative to this city-image element. We assumed that nodes had been added here as a consequence of the decision by the game designers to greatly modify the form of the urban fabric here. Significantly, this led to the number of blocks in the RGM being much greater than was the case historically.

## EDGES

According to Lynch, "Edges are linear elements not considered as paths: they are usually, but not quite always, the boundaries between two kinds of areas."<sup>26</sup> He added that edges were particularly strong in the city of Boston compared to other cities he analyzed in his book. When considering this definition, we began to survey the presence (1) or absence (0) of linear elements constituting a break in continuity between two identified zones.

During the eighteenth century, due largely to the its insularity, shores and wharves served as Boston's main edges at our study's scale. Indeed, some remarkable bulwarks framed the island, such as the three successive fortified gates of the Boston Neck (Z2). These elements were taken into account in the design of the model, as well as a few noticeable geological hogbacks that run along the west side of the island (Z1). Overall, topography and the presence of ramparts were found to be quite similar in-game in comparison to the actual city. This may reflect the fact that topography was often used at the time by city builders to create natural defenses that might

then be reinforced militarily with walls. We were thus able to confirm what Ubisoft's historian Maxime Durand said in an interview: "using old maps, texts, books, paintings, anthropology and others, we were able, for instance, to match Boston's old topography with the different hills: Fox, Beacon, Pemberton, Copps and Fort."<sup>27</sup>

Additionally, the overall shape of the island, when considered from an edge perspective, was hardly modified in the game, even if some discrepancies were found between the shape of natural shores along the west coast (Y1 and Z1) and with regard to some docks along the harbor edge (Y2 and Z2). The most explicit instance of such a modification can be observed with regard to Mill Pond, a large marshland by the north of the city (Y1), which was dwarfed in-game. However, the size of Mill Pond doesn't affect its power to divide areas as an edge, and it doesn't impact the imageability of Boston in the RGM. Therefore, it was not counted as inaccurate for the purposes of the qualitative comparative analysis table.

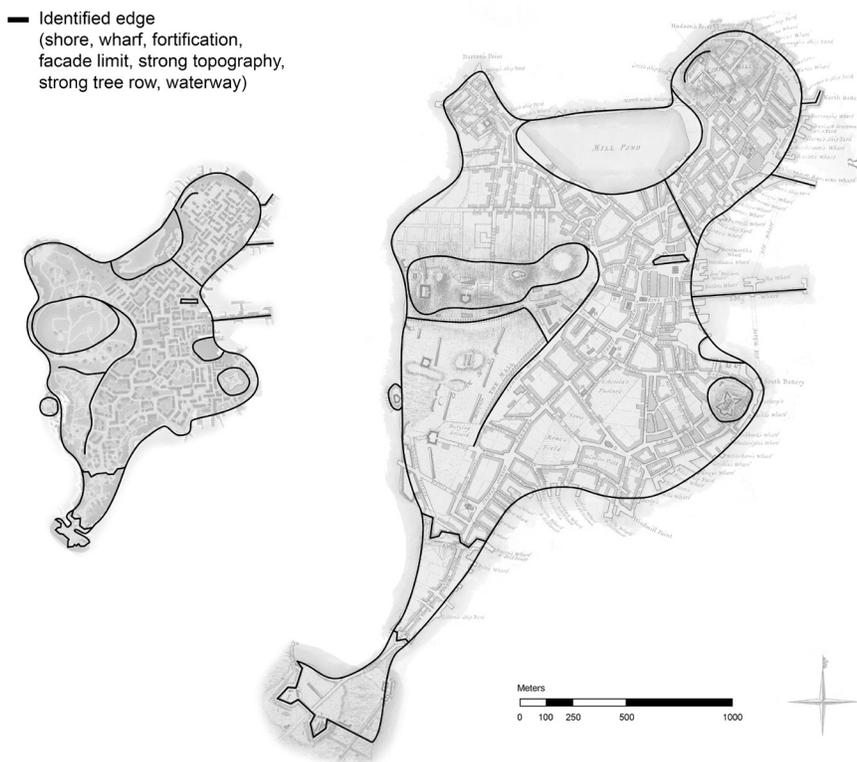
Among the edges observed, some followed paths, such as Common Street with its tree rows. Given their size and function, these often served as primary edges within the city. Interestingly enough, following the comparison, every main edge present in-game could also be found on the 1775 map (FIG. 10). Although their sizes and shapes might vary, their location and role as spatial dividers remained accurate. Thus, all cases have been judged as accurate (1) in the qualitative comparative analysis table.

## DISTRICTS

We have so far considered punctual (landmarks and nodes) and linear (edges and paths) elements of the city image, however, we have yet to mention its surface elements. Lynch spoke of districts when considering this aspect of a city's image, and they comprised areas he characterized as exhibiting a certain degree of homogeneity. As he wrote: "Districts are the medium-to-large sections of the city, conceived of as having two-dimensional extent, which the observer mentally enters 'inside of,' and which are recognizable as having some common, identifying character."<sup>28</sup> Such areas may thus typically be recognizable through a sense of uniform architectural style and typology. But they may also be determined by the common social origin of their inhabitants, or they may be identified by specific functions, colors, or even atmosphere.

As such, districts represented a substantial hurdle to our qualitative analysis of Boston's imageability, since there was no easy way to arrive at an accurate comparison of qualitative factors between districts in the RGM and in historic Boston. In fact, such a comparison would require knowledge of how Ubisoft proceeded when designing each separate common element of a city (windows, sidewalks, building materials, clothing, etc.). Many of these characteristics are hard to guess from archival documents only. Nonetheless, the city

**FIGURE 10.** Comparison of edges between the RGM and the historical map. Left: RGM map. Right: historical map. The maps are represented at the same scale.



appears to be quite homogenous to the average player thanks to the use of concept art — pictures used to establish the atmosphere of a place even before a design team begins to generate a 3D model.

While examining alternate examples of such material could aid in our analysis of atmospheric quality, it would require bringing in new historical material as a point of comparison that we cannot be sure Ubisoft actually used during the design process. Thus, we preferred to devise a quantitative method to analyze the urban fabric to assess the verisimilitude of in-game districts to their historic counterparts. For the purpose of the study, this involved quantifying the percentage rate of land use in each district — a factor which would certainly affect imageability. Such a measurement might seem too broad to fully account for the many qualities described by Lynch, but it would provide a good initial indicator of the accuracy of the game environment.

We already knew that urban density is an important component of historical reconstruction for designers at Ubisoft, since they often employ techniques such as radial scaling to seamlessly distort the urban fabric without compromising the illusion of walking about a historic city.<sup>29</sup> We thus decided to base our comparison between the RGM and the historical condition on measurements of urban density, which we decided to calculate as a ratio of built to unbuilt surface area within each district. The first step was to scale the RGM appropriately for comparison. The 1775 map included a help-

ful graphic scale in yards at the bottom, which allowed us to gather information pertaining to the distance between landmarks. With this, we were able to calculate a scaling factor by determining the distance between these same elements in the RGM. We thus found the in-game model to be approximately 2.3 times smaller than the actual extent of Boston at the time (as visible in previous figures). In order to obtain the built percentage rate for each district, we digitized the RGM map and the historical map inside CAD software to extract comparable surface areas (FIG. 11). We then computed the difference between the game rate and the 1775 map rate to assess the accuracy for each district to fill in the QCA table.

The percentage difference rate indicates to what extent the RGM's density per area differed from its historical equivalent. In other words, we sought to discover how dense (or less dense) each area in the RGM was compared to its historical referent. We assumed that any level of difference lower than +/-10 percent would not likely be perceptible by a player, and thus would be experienced as accurate (allowing us to enter a value of 1 in the QCA table). Here, the situation in Z1 proved to be striking: while the difference in absolute density was low (-2.27 percent), the percentage difference between densities (-40.20 percent) was high. This indicated that although the density was low in both cases, the perceived difference between the modeled and the actual environments was large. Although less evident in Z2, a percentage difference of 18.59 indicated that the RGM also differed substantially from con-

CASES	GAME MAP			HISTORICAL MAP			% DIFF.	% DIFF RATE	QCA VALUE
	BUILT (sq. m.)	GLOBAL (sq. m.)	BUILT%	BUILT (sq. m.)	GLOBAL (sq. m.)	BUILT %			
<b>X</b>	56,805	230,612	<b>24.63</b>	108,728	402,778	<b>26.99</b>	<b>2.36</b>	<b>8.75</b>	<b>1</b>
<b>Y1</b>	49,229	178,871	<b>27.52</b>	98,715	380,689	<b>25.93</b>	<b>1.59</b>	<b>6.14</b>	<b>1</b>
<b>Y2</b>	76,168	289,543	<b>26.31</b>	164,050	598,038	<b>27.43</b>	<b>-1.13</b>	<b>-4.10</b>	<b>1</b>
<b>Z1</b>	13,034	386,546	<b>3.37</b>	58 270	1,033,459	<b>5.64</b>	<b>-2.27</b>	<b>-40.20</b>	<b>0</b>
<b>Z2</b>	45,315	237,641	<b>19.07</b>	103,364	642,849	<b>16.08</b>	<b>2.99</b>	<b>18.59</b>	<b>0</b>
<b>GLOBAL</b>	240,550	1,323,213	<b>18.18</b>	533,128	3,057,813	<b>17.43</b>	<b>0.74</b>	<b>4.27</b>	<b>-</b>

FIGURE 11. The built and unbuilt surface area per case.

ditions for this area of the historical map. The differences in these two areas was significant enough to warrant an accuracy value of 0.

According to these examples, we decided that percentage difference rate would be a fairer assessment of district accuracy than absolute density, since it considered the impact of buildings on the overall character of each area. In the game we thus noticed that a higher rate of percentage difference often corresponded to less dense areas. Indeed, a single missing building in a sparse area might have a higher impact on its image than a single missing building in a denser area. We also noticed that the percentage difference rate for the overall city was impressively accurate (less than 5 percent) — which could hint at the method used by Ubisoft to generate the game. In order to confirm this last hypothesis, further interviews with Ubisoft developers would be necessary, however.

#### ON THE VERISIMILITUDE OF VIRTUAL BOSTON

We summarized the verisimilitude of areas as an outcome of five conditions (A,B,C,D,E) representing each of Lynch's elements for a city's imageability: landmarks, paths, nodes, edges and districts. A value of 1 indicated the accuracy of that given condition for each of the five areas of Boston, while a 0 value indicated the inaccuracy of the same given condition. Since we chose the RGM for its acclaimed historical likelihood, we also made the early hypothesis that the RGM would yield an overall value of accurate in each of its component areas. The QCA table shows this assumption by featuring a "1" in each cell of the outcome column (V) (FIG. 12).

Each case studied, however, showed differing accuracy with regard to certain elements. Thus, X was accurate throughout, while Y1, Y2, Z1 and Z2 had between three and

CASES	CONDITIONS					OUTCOME
Areas of Boston	A	B	C	D	E	Area's Verisimilitude (V)
<b>X</b>	1	1	1	1	1	1
<b>Y1</b>	1	0	0	1	1	1
<b>Y2</b>	1	1	0	1	1	1
<b>Z1</b>	1	0	1	1	0	1
<b>Z2</b>	0	1	1	1	0	1

FIGURE 12. Qualitative comparative analysis (QCA). A) landmarks, B) paths, C) nodes, D) edges, E) districts.

four accurate elements each. If we assumed each element to have comparable importance in producing the feeling of verisimilitude, we could also rank the five areas of virtual Boston according to the number of elements assessed as accurate with reference to the archival map. X would be the most accurate, with five elements; then Y<sub>2</sub>, with four; and then Y<sub>1</sub>, Z<sub>1</sub> and Z<sub>2</sub>, with three elements each — making them comparably accurate even though the elements creating this situation differed.

In addition, it became possible to extrapolate the character of an area of the RGM during the model's creation according to its combinations of causes, especially in areas with fewer accurate conditions. Indeed, in such cases the absence of accuracy for certain elements might indicate favored conditions by game designers when creating such areas. For instance, Z<sub>2</sub> was deemed to be inaccurate at the level of landmarks and districts; however, all three other conditions held true. We hypothesize that this area's verisimilitude was based around mobility (paths, nodes, edges), which corresponds with its urban function as the entrance into the old city.

By contrast, Y<sub>1</sub> served traditionally as Boston's downtown, famous for its monuments and bars. Thus the RGM is accurate in terms of district (the downtown atmosphere), edges, and landmarks to produce the sense of verisimilitude. But it ignored paths and nodes, which were judged unnecessary to convey its character.

Finally, while area Z<sub>2</sub> appeared to prioritize linearity and mobility, the modeled area Z<sub>1</sub> placed greater emphasis on elements Lynch characterized as punctual (landmarks and nodes). The inaccuracy of paths here could be explained by Ubisoft's desire to create an area where the player might free-roam from one punctual element to the next, rather than following a predetermined path. This might have been intended to better suit its sparsely settled and untamed historic quality (FIG. 13).

## A BOOLEAN UNDERSTANDING OF RECONSTRUCTIVE GAME MODELS

As per Ragin's QCA method, which relies on Boolean algebra, the final table can also be expressed as a theoretical equation showing the causal factors which determine a particular outcome — in this case the feeling of verisimilitude.<sup>30</sup> Conditions for which we found accuracy (labeled 1) are written in capital letters (A, B, C, D, E), while conditions demonstrating the absence of accuracy (labeled 0) are lowercase (a, b, c, d, e). For example, in the case Y<sub>1</sub>, we found A, D and E to be accurate (thus labeled "A," "D," and "E"), while we found B and C were not (labeled "b" and "c"). For this area we could thus argue that the sense of verisimilitude (V) was caused by the following combination of factors:  $AbcDE$ . By combining all case equations together, we were able to arrive at an equation summarizing the conditions affecting the sense of perceived verisimilitude of the entire RGM:

$$ABCDE+AbcDE+ABcDE+AbCDE+aBCDe = V$$

We then reduced the causal combination by factoring. This led to the following equation, which separates out edges (D) as a necessary cause because it is accurate throughout (there is a capital D in every term of the previous equation):

$$D(ABCE+AbcE+ABcE+AbCe+aBCe) = V$$

According to Ragin, in Boolean analysis, the absence of a specific condition can itself be considered a cause.<sup>31</sup> In terms of our study, this might mean that an inaccurate city element might be *required* to produce a feeling of verisimilitude. However, we know this to be improbable since the absence of accuracy for one of Lynch's elements might be trivial, but it



FIGURE 13. Screenshot of the game taken by the authors. View from the foot of Beacon Hill (Y<sub>1</sub>). Source: Assassin's Creed III, Ubisoft, 2012.

would not be required to create a verisimilar RGM. For this reason every absence of a given cause (lowercase letters) was removed, resulting in the following equation:

$$D(ABCE+AE+ABE+AC+BC) = V$$

Additionally, Ragin's method relies on the Boolean concept of implication, which states that "a Boolean expression is said to imply another if the membership of the second term is a subset of the membership of the first."<sup>32</sup> In other words, we may remove any term implied by a superset. Applied here, we could thus argue that "AE" implies both "ABCE" and "ABE." Because the two terms are subsets of "AE" they may thus be removed, leading to the following equation:

$$D(AE+AC+BC) = V$$

This simplified equation summarizes the possible causal factors that we observed, and that we assume are sufficient to obtain the feeling of verisimilitude (V) in the RGM.

Essentially, for there to be a general sense of verisimilitude, an area might be accurate regarding its edges (D) in addition to at least one of the three following pairs of elements: landmarks and districts (AE), landmarks and nodes (AC), or paths and nodes (BC). In other words, an area which has accurate edges as well as any combination of AE, AC, or BC can achieve a desired feeling of verisimilitude.

We further observed that all five of Lynch's elements are present in at least one of the different combinations of causes. This condition confirms that all five components of Lynch's theory of urban imageability are relevant to shaping the feeling of verisimilitude within an RGM. The equation thus demonstrates that it is possible to create a case (area) in any Boston-like RGM where ACE, for example, is a sufficient condition to produce verisimilitude.

Considering that all combinations of causes are composed of three conditions including edges (D), further assumptions can be made regarding our simplified equation. We might also propose a following general law for RGM areas that all sets of causes sufficient to produce a feeling of verisimilitude are composed of D plus two other accurate conditions among A,B,C,E. Mathematically, this may be written as:

$$D(AB+AC+AE+BC+BE+CE)=V$$

formalized as follows:  $D[P_k(\{A,B,C,E\})]=V$ ,  
where P is an algebraic normal form of the set of causes  
and  $k=2$

However, such an assumption has yet to be proven, since no cases in our RGM were observed that revealed the causes D(AB), D(BE), or D(CE) as sufficient to imply the feeling of verisimilitude. Also, one should note that assumptions made here are probably linked to the scale of cases studied. Thus, since our study examined the feeling of verisimilitude in an

RGM that was subdivided into areas, its findings should not be generalized to studies that examine cases of a different nature, such as those that might consider an entire RGM. In order to assess the transferability of our results, further studies with a different corpus would be required.

## THE TRUTH ON USEFUL LIES

This article has shown that the city of Boston modeled in the game *Assassins Creed III* is dissimilar to what the historical city looked like. Indeed, we were able to discover numerous differences in the urban fabric as well as in terms of scale that allow us to state that the game model is an imperfect historic reconstruction. Yet, in terms of user perception, it is faithful enough to convey a feeling of verisimilitude. Thus, since "useful lies" may be needed in game development to increase playability, their consequences on the perceived verisimilitude of a city model are contingent on there being a sufficient number of urban elements, as described by Lynch, being historically accurate. Such conclusions support what Maxime Durand has said about the process used to design the RGM of *AC III*:

*We did a lot of research precisely on the story of different key buildings of 18th century Boston, such as the Old State House. However, we also had to understand the different architecture styles which would be used to re-create more generic buildings. With these, we respected the different wards in the city and the general layout, but we didn't go in as much details [sic] as with the landmarks.<sup>33</sup>*

This process is partially analogous to our findings. While we found that the model's edges ("general layout") were almost entirely accurate, districts ("wards") and landmarks ("landmarks") were accurate only where such accuracy was needed. Indeed, the faithful representation of certain elements, like landmarks, was dependent on the area to be designed.

To summarize, we can describe the differences we noticed between the RGM of Boston and the historic condition of the city as expressions of all three "forms of translation" in the "history game framework" described by Vincenzo Cassone and Mattia Thibault.<sup>34</sup> The "perspectival form," which involves actualization of the past, was exemplified by the game's focus on landmarks, some of which were not considered to be as significant by mapmakers in the eighteenth century. The "digital form," understood as a translation from one medium to another, was evident in terms of limitations intrinsic to digital modeling techniques being observable in the game. We noted, for example, that the RGM of *AC III* represents only the island of Boston, ignoring Charlestown to the north of the city, which is visible in the historical map (REFER TO FIG. 2).

Finally, the “ludic form” seems to describe the major issues that lead developers to choose the extent to which “historical accuracy and plausibility are bent (or not) in order to work with the gameplay and to translate it in an enjoyable game.”<sup>35</sup> Indeed, for the studio, playability and visual appearance are given primordial status. According to Nicolas Guerin, the design director of *AC Unity*, “we have to build a game playground first, and on top of that make a cool city that’s visually striking and historically accurate as well.”<sup>36</sup>

This comment can also explain the scale disparity we observed in *AC III* (the 2.3 times ratio between the RGM and the historical map). Ubisoft’s objective was probably to limit travel time between locations and missions in-game as a way to reduce the use of its fast-travel option (a process of teleporting from one location to the next) — a mechanism that disrupts the narrative as well as the illusion of presence.<sup>37</sup> After *AC III*, this process of choosing which elements should be distorted without compromising the feeling of verisimilitude became characteristic of Ubisoft RGMs.

This article, grounded in Lynch’s theory of urban imageability, has proposed a new method for assessing the verisimilitude of RGMs by comparing them with historical data in general, and archival maps in particular. As a way to extend this work, examples exist in which the identification of Lynch’s city elements have been automated through algorithmic processes applied on maps.<sup>38</sup> We believe that such technology could improve both the level of accuracy of the type of comparison we have proposed and the number of cases that may be treated. We likewise presume that the use of such techniques could drastically reduce researcher bias in the creation of maps for comparative analysis.

In addition, we believe that the study should be replicated at different scales of the same RGM, as well as with other RGMs from comparable games, as a way to improve this method. And further collaboration with sociologists and an-

thropologists could allow the consideration of factors responsible for shaping a city’s imageability beyond those explored here. This might produce a more in-depth understanding of what makes a city recognizable to individuals, and strengthen the accuracy of city images, including intangible metrics.

On another note, in terms of educational value, *Assassin’s Creed* is designed to activate a model of “tangential learning,” according to which some players can be expected to self-educate through the introduction of topics in an exciting and engaging context. Tangential learning relies on a user actively seeking historical clarification following a play session, rather than simply expecting to be presented with a promise of historical accuracy. Many studies have shown that learning is increased when someone is excited or stimulated by the presented material.<sup>39</sup> However, this model also presents difficulties since any potential for learning will occur without direction or feedback. In games like *Assassin’s Creed*, where historical accuracy is touted, it may be difficult to separate truth from fiction. While the factual historic information provided may be accurate, many of the architectural and urban elements are distorted or intentionally dissimilar to the way they would have appeared in reality.

Typically, the layperson has no chance of identifying these distortions. As such, RGMs recall the observation by Vittorio Gregotti that both “the literal description and the reproduction of landscape as an aesthetic object give an ‘improper’ understanding of the landscape and, in doing so, mask and deflect all the while unveiling.”<sup>40</sup>

Sometimes considered the creator of quasi-educational games, Ubisoft, therefore, has a certain responsibility to portray an adequate-enough level of historical accuracy in RGMs for those who will not research this issue independently. *AC III*, for some, could be the first, or only exposure they will have with the theme of the American Revolution or the form of the old city of Boston.

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