

A Metric Instrument for the Games with Cultural Heritage

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Abstract

This paper reviews existing research within two fields; game studies and cultural heritage, discovering inadequacies in current digital means of cultural heritage preservation. It is not unheard of that commercial games have been utilized to showcase them, but they tend to get glossed over in favor of serious games. Therefore, this study details two new tools that can further identify and assess the level of cultural heritage content in commercial games which will benefit not just their digital preservation, but also game developers and game design researchers.

A unique conceptual framework was developed for analysing video game content specifically on four elements of cultural heritage and five elements of game components in both tangible and intangible forms. Exploratory tables of metrics were also created to quantify said content with the help of the existing Goal Question and Metric (GQM) table. They were then put to the test in two trials; Experiment I analysing 6 game franchises and Experiment II testing 28 games. Both demonstrated the presence of significant amounts of cultural heritage, much more than past works credited. Further research into this area, including adapting said tools for other game studies and commercial games usage will be possible and fruitful.

Keywords Games with Cultural Heritage, Game Analysis, Conceptual Framework, Metric Instrument, Reviewing Games;

1 Introduction

Cultural heritage within games remain an understudied avenue in gaming literature. With what little extant work there has been mostly focused on serious or educational games [1]. Often overlooked, however, are the depth and profundity of commercial games which contain cultural heritage elements. Motivated from this lack of research, the aim then is to map out the elements



of cultural heritage associated with the commercial sector of games in a more accessible and self-evident format, something current means are missing out on [1].

To do that, this study came up with two original conceptual tools that although were meant to aid game design researchers, they are also applicable to game designers for organizing, gauging and including cultural heritage elements in their works. As such, predominantly instances of commercial games will be cited in this article. The present research is uninterested in the question of whether or not commercial games can be used for cultural heritage preservation, as that has already been answered time and time again, but rather that more of them should be [2] [3].

1.1 Serious Games Supporting Cultural Heritage

Serious games have been used in diverse subjects, including Science, Healthcare, Social Enterprise, and History [4]. There have been some recorded successful examples of said games supporting cultural heritage, such as in history teaching and learning, or for enhancing museum visits [5]. However, there is still room for improvement with regards to public usage.

Edutainment is the term coined for the fusing of traditional means of education like lectures, lessons, courses, and workshops with entertainment, the medium of enjoyment including games, movies, animation and music [6]. Edutainment has proved popular in public places such as museums and galleries, with games commonly being integrated for exhibition spaces [7]. The subjects of these games are typically related to the artefacts or art pieces on display in the museum, providing another dimension to their viewing experience and enhancing the interactive feel to the museum. The most important takeaway is that games, be they serious or commercial, can also take the form of “museums” in and of themselves, showcasing different categories of cultural heritage.

1.2 Cultural Heritage in Commercial Games

So why should more commercial games have elements of cultural heritage? Not only will they act as means of preserving them in digital forms, of which the sheer demand and market for commercial games are already unmistakeable boons to that cause. More crucially, it is also in line with one of the key initiatives to “building back better” after COVID-19, making full use of approaches spurred on by the transformation to more virtual learning [8]. And thus with there currently not being many meaningful tools to gauge on cultural heritage content or commercial games developed primarily for that end, such a direction is thus far from unnecessary, in fact it is only fitting and logical [9].

When it comes down to the actual cultural heritage content, anthropological studies have divided them into the tangible and intangible. According to the United Nations Educational, Scientific and Cultural Organization Convention (UNESCO) in 2019, intangible heritage was subdivided into five domains. These consist of oral traditions and expressions, performing arts, social practices, rituals and festive events, knowledge and practices concerning nature and the universe, and traditional craftsmanship [10]. The tangible aspects then refer to music, dances, works of art, artefacts, languages, festivities, ceremonies, knowledge, and skills [11].

The relationship between the tangible and intangible heritage is not so clear cut for they can sometimes intertwine as shown in **Table 1**. Intangible heritage could therefore be considered the larger framework within which tangible heritage can also take on shape and significance [12] [13]. However, for the sake of argument, the former would be treated as the beliefs and meanings behind festivities or ceremonies whereas the latter is more so on how they are performed and represented.

Initial undertakings such as the study by Balela and Mundy (2015), which reviewed and dissected the dimensions of cultural heritage in **Table 1**, served to provide a new lens to inspect video games and to better understand their methodical approaches to representation. They applied

the four stated dimensions from a number of different perspectives; culture, history and commercial game studies.

However, the study was essentially qualitative in nature and restricted in the sense that there were only two games exemplified, namely 'Assassin's Creed I' and 'Unearthed: Trail of Ibn Battuta' [11]. Besides, there have been arguably many more commercial games that showcase exhilarating examples of cultural heritage content but they tend to get overlooked by researchers (see **Table 2**) and so the present study addresses that through branching out on and deepening the analyses.

Table 1. Elements of Cultural Heritage

| Dimensions | Tangible Dimensions | Intangible Dimensions |
|---------------------------|--|--|
| Arts and Artefacts | Architecture, Sculpture, Visual Images, Documents and Writing, Performance Arts, Clothes, Design Ethos and Other Arts. | Language, music, and folklore. |
| Environment | Places of Scenic Interest and Landscape. | Climate. |
| People | Tribes and villages. | Behaviour. |
| History | Historic Sites, Historic Artefacts, and Historic People. | Religion, customs, time, and the ages. |

Table 2. Games with Content related to Cultural Heritage

| Games | Description | Genres of Games | Platform | Publish Year | Reference |
|---------------------------------|---|---------------------------|---|--------------|---|
| Assassin's Creed II | The game takes place at the height of the Renaissance in Italy. With several of the heritage sites listed by UNESCO such as Florence Cathedral also prominently featured. | Action-adventure, stealth | PlayStation 3, PC, Xbox 360 | 2009 | Ruch, 2010[14]; Compagno, 2015[15] |
| A Plague Tale: Innocence | This game is set in France during the Hundred Years' War and focuses on the history of the Black Death. Players experience rituals and events of that time. | Action-adventure, stealth | PlayStation 4, PC, Xbox One | 2019 | Pippia, 2021[16] |
| Shogun: Total War | The game is set in feudal Japan. Players can witness the "Warring States" period and understand the history of different Japanese clans during that period. | Strategy Game | PC | 2000 | Ghita and Andrikopoulos, 2009[17]; Spring, 2015[18] |
| Valiant Hearts | This game is based on true historical events from the WWI era. It contains pictures and descriptions for players to better understand this defining conflict. | Puzzle Adventure Game | Android, iOS, PlayStation 3, PC, Xbox 360 | 2014 | Hanes and Stone, 2019[19]; Cole, 2019[20] |

1.3 Components of Video Game Design

The later framework incorporates the following basic components from the hierarchy first proposed by Werbach and Hunter, who stated that game elements consist of components, mechanics, and dynamics [21]. Mechanics cover any of the processes that propel an action forward in order to engage with players. Dynamics is the big picture of the gamified system that has to be managed. Components are inclusive of the former two, referring to the manner in which mechanics and dynamics get produced. It is these three components that are then applied to gamification technology to make them work. However, since this research takes those specific

aspects of game components to be tied specifically to the field of game design ,they will be more widely broken down into gameplay, narrative, acting, art/design, music/sound, and more [22] [23].

Gameplay component is made up of all the interactive mechanics and systems within a game. It is how players input and control the characters as well as interact with all the game objects, non-playable characters, and the environment. The narrative to the game is inclusive of all the text related to the story, character dialogue and not to mention the background lore. The art direction for a game includes UI design, character design, environment design, lighting design, and more. The music would refer to the composed score, sound effects which also include the panorama of post-production such as their timing, volume, and positioning. Originally acting was taken to broadly mean voice acting, but with the introduction of motion capture technology, acting now covers full body motion capture and advanced facial expressions animation capture.

In the research method and analysis sections to come, the contents of each game will be reflected on, all while taking into consideration of the players' experiences in the game environment. Fully aware of the fact that game design can be inherently complex to follow, the following video game design components were developed as the best way to structure the games, having been based on recurring issues found largely within the first stage of game design [23].

2 Development of the Conceptual Framework

The following three-step framework has been generated for the sake of this paper, which include 1. A summarisation of the elements of cultural heritage in **Figure 1**. 2. Listing of the game components in **Figure 2**. 3. Grouping these elements into meaningful categories resulted in the construction of the framework (as given in **Table 4** and **Table 5**).

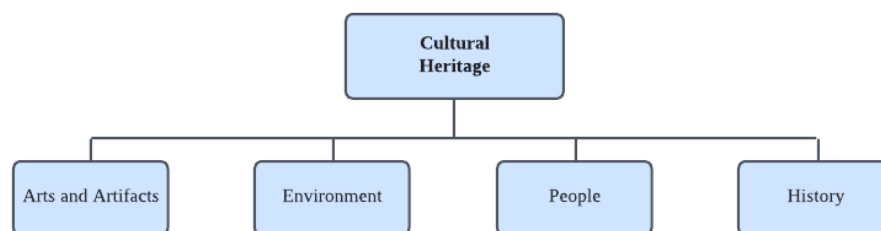


Figure 1. *The Four elements of Cultural Heritage*

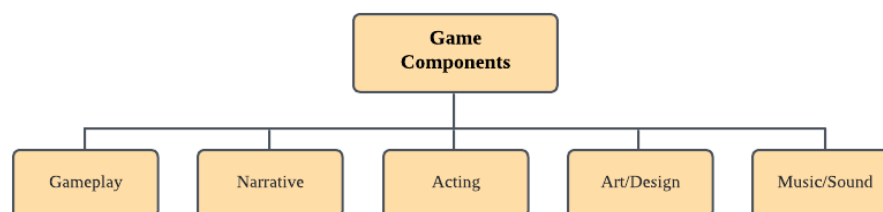


Figure 2. *The Five Elements of Game Components*

The elements presented in **Table 3** and **Table 4** were derived by examining the existing gaming literature across various research areas, including those of cultural heritage, serious games, educational technology, and game design. By deconstructing a game into different components for analysis in the table, it would be easier to pinpoint the cultures related to each subcomponent and make for easier comprehension by game designers who can implement cultural heritage more thematically consistent in their works.

As such, the relevant elements were classified into two groups. The first being cultural heritage: tangible and intangible elements involved with Arts and Artefacts, Environment, People, and History (see **Figure 1**). The second group is for the game components: Gameplay, Narrative, Acting, Art/Design, and Music/Sound (**Figure 2**).

Table 3. Elements of the Framework: Cultural Heritage

| Elements | Existing Gaming Literature | Reference |
|---------------------------|--|--|
| Arts and Artefacts | Art is the format and artefact is any object made or shaped by a human. A cultural heritage game therefore may exhibit both of them. | Koch et al, 2020[20]; Schou and Løvlie, 2020[24] |
| Environment | Places and landscapes of scenic interest. The game environment can also paint a picture of climate change, for example; water scarcity, severe fires, flooding, melting polar ice caps, catastrophic storms, and declining biodiversity. | Van Grieken, 1998[25] Bloom,2016[26] |
| People | Represent people such as tribes and villages or emulate their behavior. | Hasibuan et al., 2011[27]; Mortara et al., 2014[28] |
| History | For learning history—especially for a serious game that tries to educate the players. | Mortara et al., 2014[28]; Anderson et al., 2009[1]; Hanes and Stone, 2019[19]; Ghita and Andrikopoulos, 2009 [17] |

Table 4. Elements of the Framework: Game Components

| Elements | Existing Gaming Literature | Reference |
|--------------------|---|--|
| Gameplay | The player is able to control the character so as to experiment with cultural heritage through game mechanics such as attending a ritual in-game. | Barbara, 2020[29]; Flynn, 2005[30] |
| Narrative | The background story and lore discuss the themes related to cultural heritage. It is often used in serious games to get a point across to players. | Bloom, 2016[26]; Ciccoricco, 2010[31] |
| Acting | Acting encompasses those of motion capture and facial expression animation capture allowing actors to recreate historical figures more realistically and humanlike. | Bloom, 2016[26]; Daniel and Garry, 2018[32] |
| Art/Design | Game art and design can display cultural heritage including character designs, environment designs, visual designs, and many more. | Hanes and Stone, 2019[19]; Raptis et al, 2019[33] |
| Music/Sound | Music and sound effects build up the atmosphere through use of traditional music or instruments. | Kato et al., 2007[34]; Nnam and Nmadu, 2020[35] |

Outlined in **Figure 3**, the aim here is to construct a framework with cultural heritage games at its center, making use of linking words to connect elements of cultural heritage within the games.

The link words for the cultural heritage aspect are to help evaluate the games' elements of cultural heritage and they comprise of **exhibit**, **experience**, **represent** and **record**[36]. These have been found to be in accordance with the purpose behind museums, which is to support visitors so that they can have a more vibrant and meaningful time. For instance 1.) Museum

exhibits their designs to engage with visitors[37]. 2.) Enhances the visitors' museum **experience**[38]. 3.) Global resources are **represented** through the museum [39]. 4.) The museum **record** the history [40].

Link words in cultural heritage include:

- **Exhibit:** Evaluates how a cultural heritage game can showcase the art and artefacts. These could materialize as game objects or settings.
- **Experience:** Evaluates how a cultural heritage game can let the player experience the environment. The environment usually involves a place of scenic interest or landscape that serves as a game scene that players could immerse themselves in.
- **Represent:** Evaluates how a cultural heritage game portrays people. For instance, tribes and their rituals could be the theme or topic of a game.
- **Record:** Evaluates how a cultural heritage game records history. The cultural heritage history could be involved with the narrative, script, dialogue or text in the game.

The link words for the game component aspects are to help evaluate how each one pertains to cultural heritage, with particular attention to words like **interact**, **relate**, **perform**, **display** and **inspire**. These link words were refined from the five dimensions of interactive design namely words, visual representation, physical objects/space, time, and behavior [41]. Words refer to button labels, which help users get the right and **related** information. Visual representations refer to the graphical elements, including the visual **display**. Physical objects/spaces act as the medium in which users **interact** with the product or service. Time is related to media that change over time, and could consist of animations, videos and sound, all of which **inspire** users. Behaviour discusses how users can **perform** corresponding actions [41].

The link words related to game components include:

- **Interact:** Evaluates how the player interacts with cultural heritage through gameplay. For example, players could interact with the artefacts or people in the game.
- **Relate:** Evaluates how game narrative relates to cultural heritage, which usually adopts the historical aspect of cultural heritage into the story in some manner.
- **Perform:** Evaluates how game acting performs cultural heritage. Which could take the form of dances, stage performances or rituals.
- **Display:** Evaluates how the game art/design displays cultural heritage. Including art style, character design, UI design and all the visual elements in the game.
- **Inspire:** Evaluates how the game music/sound was inspired by cultural heritage. Whether they were inspired by traditional music worldwide.

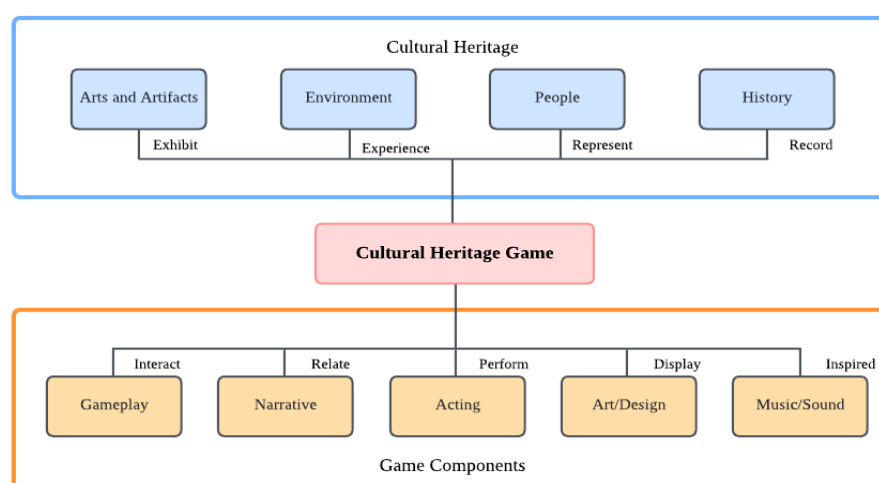


Figure 3. *Conceptual Framework*

3 Game Methodology — Game Analysis

3.1 Development of the Metric Table Instrument

The metric instruments devised for use in this work were similarly developed from, as well as with the framework elements in mind and are presented in full across two tables in **Appendix A**. As a result, a metric table was developed from the framework elements (cultural heritage and game components), and from them, a Goal Question-Metrics (GQM) table was then further derived using the GQM method for designing software metrics.

The Goal Question Metric approach is made up of three levels namely the Conceptual Level, Operation Level and Quantitative Level (see **Figure 4**)[42]. The Conceptual Level refers to measurement “Goals” which are set up by matching one cultural heritage element with one game element. An example of a goal then is: To evaluate how the game retells History through the game Narrative.

Operation Level would refer to the “Questions”, which try to characterize the objects of measurement. For example: How to use the game Narrative in order to relate it to History? Lastly, the Quantitative Level uses “Metrics” to help provide quantitative answers to each “Question”.

The metric expresses hypothetical features of the game that the evaluator can assess between a score from 1 to 4 according to the level of evidence in support of that particular feature in a game (see **Table 5**). Prior research has validated this method of evidence ranking[42]. For the example of evaluating how History is recorded through game Narrative, see T_H2 and I_H1 in **Appendix A**.

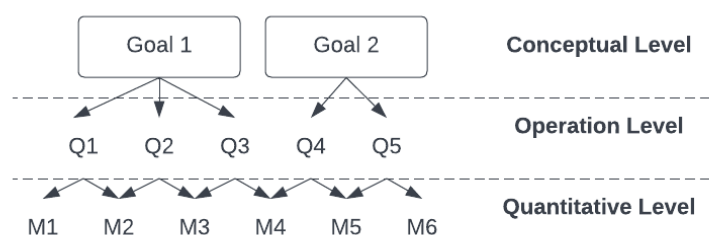


Figure 4. The Goal Question Metric Approach

Table 5. Levels of Evidence

| SCORE | LEVEL | CRITERIA |
|-------|-----------------------|---|
| 1 | No Evidence | The item is non-existent in the game. |
| 2 | Limited Evidence | The item is shown only a little in the game, with limited related items to support. |
| 3 | Satisfactory Evidence | The item is shown at a satisfactory level in the game. |
| 4 | Significant Evidence | The item is shown at a significant level in the game. |

From the Goal Question Metrics in **Appendix A**, a ‘Goal’ was set up by four cultural heritage elements (Arts and Artefacts, Environment, People and History), each to be connected with five game elements (Gameplay, Narrative, Acting, Art/design and Music/ Sound), thus, amounting to twenty goals in total. Each ‘Question’ was subsequently developed so that in order to fulfill a goal, they must first meet the criteria set by the questions, of which there were twenty overall.

Each ‘Question’ will have one to two ‘Metrics’ to answer the ‘Questions’, and there are 56 metrics altogether (see **Appendix A.**)

Using the 56-item scale, Experiment I seeks to quantify the game quality and value of six well-known games series comprising of 12 games. Experiment II evaluates the framework elements by using the same 56-item scale on a total of 28 games.

3.2 *Game Selection*

The selected games measure the degree of efforts in which commercial games preserve cultural heritage. There are two groups of games; 6 game series (12 games) whose entries have in common a continuous story (games spawning sequels or prequels with the same protagonist or universe) and 28 games that are not related to one another in any way (see **Appendix B.**)

Experiment I was designed to be an in-depth review of 6 game series, working with the hypothesis that the continuity of a game series might yield stronger connections to cultural heritage. Moreover, the games were chosen due to their impact on the audience, having been based on their popularity (sales), critic reviews, user reviews, and the number of entries in the series which hint at their demand. Several influences outside the game were also crucial such as the prevalence of fan base communities, tendency to cosplay or host contests, and so on.

The game selection here was mostly informed by Metacritic, which aggregated reviews of video games with critic scores (100-point scale) which were only submitted after much deliberation. The Metacritic critic scores are represented using a colour bar distribution system and range between positive (green), mixed (orange), and negative (red). If a critic gives a score of more than 90, then it signifies that the game in question is a “must-play”, in other words, it has been highly recommended.

3.3 *Statistics*

In order to assess the significance behind each item metric across all games, a simulated null hypothesis distribution (Null = 2.5) was created for each item by taking the average between ‘Limited Evidence = 2’ and ‘Satisfactory Evidence = 3’. The null hypothesis and alternative hypothesis being investigated were: H₀: The mean ranking of each item is not different from its corresponding null value and H₁: The mean ranking of each item is different from its corresponding null value.

The true sample population average responses for each item were thus compared relative to the simulated null hypothesis distribution. Each independent group consists of a different number of questions that will impact the mean rank value. This resulted in a total of 280 statistical tests split between Experiment I (168 statistical tests) & II (112 statistical tests). Tests of normality, that is, to determine whether the data exhibit a normal distribution of the scale items were carried out using the Kolmogorov–Smirnov test and Shapiro–Wilk test.

The hypothesis being tested was whether cultural heritage themes were significant factors in the aforementioned games and that there were no between-group differences in the degree of cultural heritage content per item. Experiment I performed tests relative to the null on each item and assessed the differences between games, whereas Experiment II performed tests only relative to the null for each item. Experiment I made use of the Man Whitney U and Kruskal-Wallis tests for checking the differences between outcome items among the 6 game franchises (Assassin’s Creed, BioShock, God of War, Red Dead Redemption, Tomb Raider, Uncharted). Experiment II subjected the Man Whitney U test on 28 games.

4 Results

4.1 Experiment I

The data as demonstrated by the normality tests were shown to not be normally distributed ($p < 0.05$, see **Appendix C**). Each of the 56 items, with the exception of four items, was found to significantly contribute to the heritage game content included in Experiment I ($U \leq 36$, $p < 0.05$, for full details of each test see Appendix C). Additionally, only three items did not significantly contribute to the games, they were the game sound, the environment ('T_E7': Places of Scenic Interest and Landscape) and the playable character interacting with Historic Sites, Historic Artefacts, and Historic People (T_H3).

On the one hand, sound effects (T_E7) serve to attract the player's attention to important consequences of player decisions/actions. For instance, when the player picks up or equips an item, or presses a button. Ultimately, this may not be a sufficiently robust item to integrate cultural heritage content. On the other hand, it is important to stress that the games' music genres have a significant impact. One partial explanation for there being null results in the item T_H3 (where the playable character interacts with people, tribes, and villages) may be that it is an item that rests profoundly on the targeted mood of the game, which again is traced back to the conveyed story.

When analysing the intangible dimension, all items apart from five were significant ($U \leq 36$, $p < 0.05$, for full detail of each test see **Appendix C**). The five items that were not significant mainly pertained to the games' music and sound (I_A7, I_E3, I_E7, I_P4, I_H4). For example, items to do with art and artefacts, environment, or people's behavior, simply may not have been easy to be worked in or serve as inspiration. The results also show that the games' stories did not, to a large degree, incorporate elements from the environment, such as the climate. In addition, the acting in the game between playable characters and their interactions with people's behavior may depend on the thought out plot and subject matter of the game itself.

According to the Kruskal-Wallis test, Assassin's Creed has been consistently observed to be the highest ranked heritage-themed game among the five other games mentioned. The items T_E7, I_H7, I_E7 were also observed overall to have low mean rank values.

4.2 Experiment II

There are 14 items in the comparisons between groups (games) on tangible items that were not significant. These items primarily included game components on music (T_A7, T_E7, T_P7, I_E7, I_P7, and I_H7) and sound (T_P6, I_E6). The intangible dimensions to do with the environments demonstrated null results in the items I_E2, I_E3, I_E4, I_E6 and I_E7. In addition, game components centered on acting (T_A4 and I_p4) for non-playable characters performing tangible heritage art and people's behaviours were shown to have lower mean rank values overall relative to the other items that illustrated more heritage content (for full details of each test, see **Appendix D**).

4.3 Goal Question Metric in Action

This section highlights two examples of games to demonstrate the Goal Question Metric in action. The highlighted examples include Assassin's Creed II from Experiment I and Zuma's Revenge! from Experiment II. It is important to note that Assassin's Creed is a game series where the entries are usually fashioned after actual time periods and introduce many key historical figures. So, it is only fitting that they have deep connections to cultural heritage across all of their game components (see **Table 6** for further details).

Table 6. Assassin’s Creed series

| Components | Description |
|--------------------|---|
| Gameplay | Assassin’s Creed is an open world action-adventure game with an emphasis on the stealth elements in its gameplay. More elements and systems were added in the later entries to give off the feeling of an RPG. Besides the silent assassinations, there are also interactions with different inventions and transportation modes such as Gondolas in Venice or the flying machines designed by Leonardo da Vinci. |
| Narrative | The plot of Assassin’s Creed is that humans could experience their ancestors’ memories with the aid of technology. So each game in the series is set during and based on a specific age or period in history, including the Italian Renaissance in Assassin’s Creed II, French Revolution in Assassin’s Creed Unity, American Revolution in Assassin’s Creed III and many more. The games also introduce historical figures such as, among others, Leonardo da Vinci, George Washington, Benjamin Franklin. |
| Acting | Assassin’s Creed contains voice acting and motion capture of hundreds of characters. The actors will mimic the accent of each country for better immersion. For example, the protagonist of Assassin’s Creed II will speak with an Italian dialect. |
| Art/Design | Investigation teams were employed by the developer to recreate historic architecture, tools, weapons, and clothing in their games. For instance, the Notre-Dame de Paris was modeled with the exact specifications in real life for Assassin’s Creed Unity. |
| Music/Sound | The music and sound design in the Assassin’s Creed series were also influenced by each game’s background. The most famous example of this being the pirate’s song in Assassin’s Creed IV Black Flag which captured the feeling of the Golden Age of Piracy. |

Using Assassin’s Creed II as a representative for the series, **Table 7** provides a demonstration of the Goal Question Metrics (as shown in **Appendix A**) in measuring a game on its potential cultural heritage content. A score of 1-4 was given to each question (metric) according to the level of evidence in cultural heritage elements (as shown in **Table 5**). Given that Assassin’s Creed II was based off of historical events and real locations, the metrics relating to **Art and Artefacts**, **Environment** and **History** received especially high scores except for Intangible Environment as climate is a topic rarely accurately depicted in games. The introduction of historical figures in the game also gave it a high score on the metrics related to **People** elements.

Table 7. Measuring Assassin’s Creed II with Goal Question Metrics

| Game | Tangible | | | | | | | | | | | | | |
|---------------------|-------------------|-------|-------|-------|-------|-------|-------|-------------|-------|-------|-------|-------|-------|-------|
| | Art and Artefacts | | | | | | | Environment | | | | | | |
| Assassin’s Creed II | T_A 1 | T_A 2 | T_A 3 | T_A 4 | T_A 5 | T_A 6 | T_A 7 | T_E 1 | T_E 2 | T_E 3 | T_E 4 | T_E 5 | T_E 6 | T_E 7 |
| | | 4 | 3 | 4 | 3 | 4 | 3 | 2 | 4 | 3 | 4 | 4 | 4 | 3 |
| Assassin’s Creed II | People | | | | | | | History | | | | | | |
| | T_P 1 | T_P 2 | T_P 3 | T_P 4 | T_P 5 | T_P 6 | T_P 7 | T_H 1 | T_H 2 | T_H 3 | T_H 4 | T_H 5 | T_H 6 | T_H 7 |
| | 4 | 4 | 3 | 4 | 4 | 3 | 2 | 4 | 4 | 3 | 4 | 4 | 3 | 3 |
| Assassin’s Creed II | Intangible | | | | | | | | | | | | | |
| | Art and Artefacts | | | | | | | Environment | | | | | | |
| Assassin’s Creed II | I_A 1 | I_A 2 | I_A 3 | I_A 4 | I_A 5 | I_A 6 | I_A 7 | I_E 1 | I_E 2 | I_E 3 | I_E 4 | I_E 5 | I_E 6 | I_E 7 |
| | | 4 | 3 | 4 | 3 | 4 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 |
| Assassin’s Creed II | People | | | | | | | History | | | | | | |
| | I_P1 | I_P2 | I_P3 | I_P4 | I_P5 | I_P6 | I_P7 | I_H 1 | I_H 2 | I_H 3 | I_H 4 | I_H 5 | I_H 6 | I_H 7 |
| | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 4 | 3 | 4 | 4 | 4 | 3 | 2 |

As for Zuma’ Revenge! (**Table 8**), however, since it is a casual game without any obvious storyline. Measuring this game with the Goal Question Metrics will evidently produce vastly different results compared to Assassin’s Creed II. Metrics relating to game components of Gameplay, Narrative and Acting therefore have relatively low scores. Despite that, the game did take strong inspiration from Maya civilization particularly for its art and sound design. As such,



the metrics concerning the game components of Art/Design and Music/Sound resulted in stronger evidence of cultural heritage elements.

Table 8. *Measuring Zuma's Revenge! with Goal Question Metrics*

| Game | Tangible | | | | | | | | | | | | | |
|---------------------|-------------------|------|------|------|------|------|------|-------------|------|------|------|------|------|------|
| Assassin's Creed II | Art and Artefacts | | | | | | | Environment | | | | | | |
| | T_A1 | T_A2 | T_A3 | T_A4 | T_A5 | T_A6 | T_A7 | T_E1 | T_E2 | T_E3 | T_E4 | T_E5 | T_E6 | T_E7 |
| | 1 | 1 | 1 | 1 | 1 | 4 | 3 | 3 | 1 | 1 | 1 | 4 | 2 | 2 |
| | People | | | | | | | History | | | | | | |
| | T_P1 | T_P2 | T_P3 | T_P4 | T_P5 | T_P6 | T_P7 | T_H1 | T_H2 | T_H3 | T_H4 | T_H5 | T_H6 | T_H7 |
| | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 4 |
| | Intangible | | | | | | | | | | | | | |
| | Art and Artefacts | | | | | | | Environment | | | | | | |
| | I_A1 | I_A2 | I_A3 | I_A4 | I_A5 | I_A6 | I_A7 | I_E1 | I_E2 | I_E3 | I_E4 | I_E5 | I_E6 | I_E7 |
| | 1 | 1 | 1 | 1 | 4 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| | People | | | | | | | History | | | | | | |
| | I_P1 | I_P2 | I_P3 | I_P4 | I_P5 | I_P6 | I_P7 | I_H1 | I_H2 | I_H3 | I_H4 | I_H5 | I_H6 | I_H7 |
| | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 1 | 1 | 3 | 3 | 4 | 4 | 2 |

5 Discussion and Future Work

This exploratory study aimed to inform new research on the understudied topic of cultural heritage themes in commercial gaming. One key finding is that there is still a limited number of research efforts into this area as well as commercial games whose main goal is to present or preserve cultural heritage. This study revealed that 28 of the surveyed games that were deemed widely popular contained and exhibited strong elements of cultural heritage.

The results from Experiment I and II both show that the conceptual framework and tables of item metrics are indeed valid and reliable measures of cultural heritage in games. Future works may wish to develop them further or broaden the dimensions of cultural heritage which are being looked at, perhaps even focus exclusively on them as research objectives.

The limitations of the study included the paucity of resources in terms of the available literature, thereby stressing on the imperative knowledge gap which prompted the research. Personal bias that may have arisen when giving the scores and the selection of games which were reliant on the subjectivity of the critics. Lastly, it is important to note that while there is a means of quantifying the cultural heritage content, most of said aspects rest on the assumption of and decision of the developer for instance. And as such are qualitative in that sense, so whether or not to include aspects like historically accurate stories or cultural artefacts to begin with is a matter of subjectivity. These pointed out issues will inevitably affect the results.

5.1 Research Implication

Two main contributions came out of this paper and they are the conceptual framework and the metric instruments. The former was developed for theoretically mapping out elements of cultural heritage, which then complemented the latter instruments, created as tools for measuring the levels of cultural heritage present within games. This paper also pondered on the theoretical

ramifications and practical implications that could support game design so as to help them deliver specific and strategic results in their projects by first having a strong knowledge background and support from relevant literature.

As this paper is concerned with and discussed more on how to better measure games on their cultural heritage content, as opposed to questioning whether games can be used to display and preserve them. This research has the potential of opening up a revamped field of research into cultural heritage games. Game researchers could apply the proposed instruments in this paper to gauge the cultural heritage elements in their games or they could repurpose the framework and instruments to look into different aspects of cultural heritage games. The metric instruments have been shown to be dependable tools for measuring cultural heritage within games, which could prove useful for game designers in coming up with more cultural heritage games according to the elements outlined in the framework.

5.2 *Future Works*

The hope is that this may inform future research having to do with human-computer interactions and user research to also factor in all that were discussed and perhaps even go into game design themselves. On top of further supporting game designers and stimulating others to develop more heritage-based games, the concept and methodology developed in this study can be applied in a diverse panoply of research topics, ranging from museum studies to commercial games as covered in this study, and even beyond such as towards digital art, which employ similar concepts and technology to video games. The conceptual framework and metrics proposed in this paper could be redesigned to measure the efficacy of cultural heritage content in games or they could even be modified to look into content that go beyond cultural heritage, such as those related to sexual and gender diversity, for one.

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Appendix A: Metric Instruments

(1) Metric Table

| Components | | Gameplay | Narrative | Acting | Art/Design | Music/Sound |
|-------------------|--------------------|---|---|---|--|---|
| Dimensions | | | | | | |
| Tangible | Arts and Artefacts | The gameplay interacts with the art and artefacts (Architecture, Sculpture, Visual Images, Documents, Clothes, and other Arts). | The narrative is related to art and artefacts (Architecture, Sculpture, Visual Images, Documents, Clothes, and other Arts). | The acting performs art and artefacts (Architecture, Sculpture, Visual Images, Documents, Clothes, and other Arts). | The game art/design displays art and artefacts (Architecture, Sculpture, Visual Images, Documents, Clothes, and other Arts). | The game music/sound is inspired by art and artefacts (Architecture, Sculpture, Visual Images, Documents, Clothes, and other Arts). |
| | Environment | The gameplay interacts with the environment (Places of Scenic Interest and Landscape etc.). | The game narrative is related to the environment (Places of Scenic Interest and Landscape etc.). | The acting takes place in the environment (Places of Scenic Interest and Landscape etc.). | The game art/design displays the environment (Places of Scenic Interest and Landscape etc.). | The game music/sound is inspired by the environment (Places of Scenic Interest and Landscape etc.). |
| | People | The gameplay interacts with the people in the tribes and villages etc. | The game narrative is related to people in the tribes and villages etc. | The acting portrays and interacts with people from the tribes and villages etc. | The game art/design displays people in the tribe and village etc. | The game music/sound is inspired by people in the tribes and villages etc. |
| | History | The gameplay interacts with Historic Sites, Historic Artefacts, and Historic People. | The game narrative is related to Historic Sites, Historic Artefacts, and Historic People | The game acting performs to Historic Sites, Historic Artefacts, and Historic People | The game art/design displays Historic Sites, Historic Artefacts, and Historic People | The game music/sound is inspired by Historic Sites, Historic Artefacts, and Historic People |
| Intangible | Arts and Artefacts | The gameplay interacts with art and artefacts (language, Music, Folklore, etc.). | The game narrative is related to art and artefacts (language, Music, Folklore, etc.). | The acting performs art and artefacts (language, Music, Folklore, etc.) | The game art/design displays art and artefacts (language, Music, Folklore, etc.) | The game music/sound is inspired by art and artefacts (language, Music, Folklore, etc.) |
| | Environment | The gameplay interacts with the environment (Climate). | The game narrative is related to the environment (Climate). | The acting takes place in the environment (Climate). | The game art/design displays the environment (Climate). | The game music/sound is inspired by the environment (Climate). |

| | | | | | | |
|--|---------|--|---|---|---|--|
| | People | The gameplay interacts with people's behaviour. | The game narrative is related to people's behaviour. | The acting portrays the people's behaviour. | The game art/design displays people's behaviour. | The game music/sound is inspired by people's behaviour. |
| | History | The gameplay interacts with Religion, Customs, Time, and Ages. | The game narrative is related to Religion, Customs, Time, and Ages. | The game acting performs Religion, Customs, Time, and Ages. | The game art/design displays Religion, Customs, Time, and Ages. | The game music/sound is inspired by Religion, Customs, Time, and Ages. |

(2) Goal Questions Metrics

| Goal | | Questions | Metrics | |
|---|--------------------|--|---|---|
| | | | T : Metric applied to the Tangible Heritage | I : Metric applied to the Intangible Heritage |
| Arts and Artefacts: To evaluate how the cultural heritage game can exhibit the art and artefacts | Gameplay | How does gameplay interact with art and artefacts? | T_A1:The gameplay interacts with tangible heritage art and artefacts (Architecture, Sculpture, Visual Images, Documents, Clothes, and other Arts) | I_A1:The gameplay interacts with intangible heritage art and artefacts (language, Music, Folklore etc.) |
| | Narrative | How to use the game narrative to relate to heritage art and artefacts? | T_A2:The narrative is related to heritage art and artefacts (Architecture, Sculpture, Visual Images, Documents, Clothes, and other Arts) | I_A2:The narrative is related to intangible heritage art and artefacts (language, Music, Folklore etc.) |
| | Acting | How does the game acting perform heritage art and artefacts? | T_A3:The playable character performs tangible heritage art and artefacts (Architecture, Sculpture, Visual Images, Documents, Clothes, and other Arts) | I_A3:The playable character performs intangible heritage art and artefacts (language, Music, Folklore etc.) |
| | | | T_A4:The non-playable character performs tangible heritage art and artefacts (Architecture, Sculpture, Visual Images, Documents, Clothes, and other Arts) | I_A4:The non-playable character performs intangible heritage art and artefacts (language, Music, Folklore etc.) |
| | Art/Design | How does the game art/design display art and artefacts? | T_A5:The game art/design displays tangible heritage art and artefacts (Architecture, Sculpture, Visual Images, Documents, Clothes, and other Arts) | I_A5:The game art/design displays intangible heritage art and artefacts (language, Music, Folklore etc.) |
| | Music/Sound | How is the game music/sound inspired by art and artefacts? | T_A6:The game music inspired tangible heritage art and artefacts (Architecture, Sculpture, Visual Images, Documents, Clothes, and other Arts) | I_A6:The game music is inspired by intangible heritage art and artefacts (language, Music, Folklore etc.) |
| T_A7:The game sound inspired tangible heritage art and artefacts (Architecture, Sculpture, Visual Images, Documents, Clothes, and other Arts) | | | I_A7:The game sound is inspired by intangible heritage art and artefacts (language, Music, Folklore etc.) | |
| Environment: To evaluate how the cultural heritage game can experience the environment. | Gameplay | How does gameplay interact with environment? | T_E1:The gameplay interacts with an environment (Places of Scenic Interest and Landscape etc). | I_E1:The gameplay interacts with an environment (Climate). |
| | Narrative | How to use the game narrative and relate it to the environment? | T_E2:The game narrative is related to the environment (Places of Scenic Interest and Landscape etc). | I_Ev2:The game narrative is related to the environment (Climate). |

| | | | | |
|--|--|--|---|---|
| | Acting | How does the game's acting perform in the environment? | T_E3:The playable character performs the environment (Places of Scenic Interest and Landscape etc). | I_E3:The playable character performs the environment (Climate). |
| | | | T_E4:The non-playable character performs the environment (Places of Scenic Interest and Landscape etc). | I_E4:The non-playable character performs the environment (Climate). |
| | Art/Design | How does the game art/design display environment? | T_E5:The game art/design displays the environment (Places of Scenic Interest and Landscape etc). | I_E5:The game art/design displays the environment (Climate). |
| | Music/Sound | How is the game music/sound inspired by the environment? | T_E6:The game music is inspired by the environment (Places of Scenic Interest and Landscape etc). | I_E6:The game music is inspired by the environment (Climate). |
| | | | T_E7:The game sound is inspired by the environment (Places of Scenic Interest and Landscape etc). | I_E7:The game sound is inspired by the environment (Climate). |
| | People: To evaluate how the cultural heritage game represents people | Gameplay | How does gameplay interact with people? | T_P1:The gameplay interacts with people in the tribe and village etc. |
| Narrative | | How to use the game narrative to relate to people? | T_P2:The game narrative is related to people in the tribe and village etc. | I_P2:The game narrative is related to people's behaviour. |
| Acting | | How does the game's acting portray people? | T_P3:The playable character performs with people in the tribe and village etc. | I_P3:The playable character performs with people's behaviour. |
| | | | T_P4:The non-playable character performs with people in the tribe and village etc. | I_P4:The non-playable character performs with people's behaviour. |
| Art/Design | | How does the game art/design display people? | T_P5:The game art/design displays people in the tribe and village etc. | I_P5:The game art/design displays people's behaviour. |
| Music/Sound | | How is the game music/sound inspired by people? | T_P6:The game music is inspired by people in the tribe and village etc. | I_P6:The game music is inspired by people's behaviour. |
| | T_P7:The game sound is inspired by people in the tribe and village etc. | | I_P7:The game sound is inspired by people's behaviour. | |
| History: To evaluate how the | Gameplay | How does gameplay interact with history? | T_H1:The gameplay interacts with Historic Sites, Historic Artefacts, and Historic People. | I_H1:The gameplay interacts with Religion, Customs, Time, and Ages. |

| | | | | |
|---|--------------------|---|---|--|
| cultural heritage game record the history | Narrative | How to use the game narrative to relate to history? | T_H2:The game narrative is related to Historic Sites, Historic Artefacts, and Historic People | I_H2:The game narrative is related to Religion, Customs, Time, and Ages. |
| | Acting | How does the game acting perform history? | T_H3:The playable character performs with Historic Sites, Historic Artefacts, and Historic People | I_H3:The playable character performs with Religion, Customs, Time, and Ages. |
| | | | T_H4:The non-playable character performs with Historic Sites, Historic Artefacts, and Historic People | I_H4:The non-playable character performs with Religion, Customs, Time, and Ages. |
| | Art/Design | How does the game art/design display history? | T_H5:The game art/design displays Historic Sites, Historic Artefacts, and Historic People | I_H5:The game art/design displays Religion, Customs, Time, and Ages. |
| | Music/Sound | How is the game music/sound inspired by history? | T_H6:The game music is inspired by Historic Sites, Historic Artefacts, and Historic People | I_H6:The game music is inspired by Religion, Customs, Time, and Ages. |
| | | | T_H7:The game sound is inspired by Historic Sites, Historic Artefacts, and Historic People | I_H7:The game sound is inspired by Religion, Customs, Time, and Ages. |

Appendix B: Game Selection

(1) Games sequels or prequels with the same protagonist

| Series | Games | Description | Genres of Games | Platform | Publish Year | Metacritic Critic Score |
|----------------------------|-------------------------------------|---|-----------------|------------|--------------|-------------------------|
| Assassin's Creed | Assassin's Creed II | The game took place in the era of the Renaissance in Italy. | Adventure | Console/PC | 2009 | 90 |
| | Assassin's Creed: Origin | The game unfolds against the backdrop of ancient Egypt. Introduces many Egyptian relics and architecture. | Adventure | Console/PC | 2017 | 84 |
| BioShock | BioShock | The game's art and music were highly influenced by 1960's Art Deco style. | Shooter | Console | 2007 | 96 |
| | BioShock Infinite | The game's theme and style were influenced by 1920 America. | Shooter | Console | 2013 | 84 |
| God of War | God of War (2005) | Set in ancient Greece. Its story was based on Greek mythology. | Action | Console | 2005 | 94 |
| | God of War (2018) | Sequel to the God of War series. Changed the setting from Greek to Norse mythology. | Action | Console | 2018 | 94 |
| Red Dead Redemption | Red Dead Redemption | The game was set during the American Old West era. | Adventure | Console | 2010 | 95 |
| | Red Dead Redemption 2 | The game depicts the America Old West era. | Adventure | Console | 2013 | 84 |
| Tomb Raider | Shadow of the Tomb Raider | The latest entry in the Tomb Raider series introduces ancient Maya mythology. | Action | Console/PC | 2018 | 82 |
| | Lara Croft and the Temple of Osiris | Sequel to Lara Croft and the Guardian of Light. It was involved with ancient Egyptian civilization. | Action | Console | 2014 | 74 |
| Uncharted | Uncharted 2 | Sequel to Uncharted: Drake's Fortune and it | Adventure | Console | 2009 | 96 |

| | | | | | |
|----------------------------|--|-----------|---------|------|----|
| | took the protagonist to many ancient archaeological sites. It also referenced actual Tibetan-Buddhist lore and beliefs.. | | | | |
| Uncharted: The Lost Legacy | The latest sequel in the Uncharted series. Showcased many ancient Indian temples and relics. | Adventure | Console | 2017 | 84 |



(2) Games that did not have a sequel or they had sequels but without obvious story tie-ins.

| Games | Description | Genres of Games | Platform | Publish Year | Metacritic Critic Score |
|--|--|-----------------|------------|--------------|-------------------------|
| Age of Empires II: The Age of Kings | Features several campaigns including medieval Europe and Mongol conquest. | Strategy | PC | 1999 | 92 |
| Amnesia: Rebirth | A psychological horror game set in an ancient ruin in Algeria. | Adventure | Console/PC | 2020 | 80 |
| A Plague Tale: Innocence | Depicted the Black Death originating from 14th century Europe. | Adventure | Console/PC | 2019 | 83 |
| Battlefield 1 | The first game in the Battlefield series took place in the WWI period. | Shooter | Console/PC | 2016 | 89 |
| Bloodborne | Bloodborne was inspired by the Victorian era and Cthulhu mythology. | RPG | Console | 2015 | 92 |
| Call of Duty: WWII | One of the most popular game series in the world. This one was set in the WWII period. | Shooter | Console/PC | 2017 | 79 |
| Crusader Kings III | A strategy game about the conflicts in Middle Age Europe. | Strategy | Console | 2022 | 88 |
| Darkest Dungeon | A game inspired by the Victorian Era and Cthulhu mythology. | RPG | PC | 2016 | 84 |
| Dark Souls | A fantasy RPG inspired from the Middle Ages and Norse mythology. | RPG | Console/PC | 2011 | 89 |
| Detention | The story discussed the history of 1960s Taiwan under martial law. | Adventure | Console/PC | 2017 | 83 |
| Devotion | The game was related to Taiwanese culture, religion and beliefs. | Adventure | PC | 2019 | 86 |
| Ghost of Tsushima | Depicted 13th century Japan, specifically about the Mongol invasion. | Adventure | Console | 2020 | 83 |
| Hellblade: Senua's Sacrifice | The story was steeped in Celtic and Norse mythologies. | Adventure | Console/PC | 2018 | 88 |

| | | | | | |
|---|--|-----------|------------|------|----|
| ICO | Envisioned and motivated by a number of lost civilizations. | Adventure | Console | 2001 | 90 |
| Nioh | Took place in the Sengoku period and was inspired by Japanese mythology. | Action | Console | 2017 | 88 |
| Nobunaga's Ambition: Sphere of Influence | The latest entry in the Nobunaga's Ambition series. It told a war-torn story in Japan's Sengoku period. | Strategy | PC | 2015 | 80 |
| Mafia | The game is set in the 1930s and about the underbelly of America. | Adventure | PC | 2002 | 88 |
| Mount & Blade: Warband | An action game about the war in Middle Age Europe. | Action | Console | 2010 | 78 |
| Muramasa: The Demon Blade | A 2D action game that took inspiration from Japanese mythology and Yōkai. | Action | Console | 2009 | 81 |
| Odin Sphere | A 2D scrolling action RPG inspired by Norse mythology. | Action | Console | 2007 | 83 |
| Ōkami | An action-adventure game that incorporated Japanese mythology which served as its story backdrop. | Action | Console/PC | 2006 | 93 |
| Romance of the Three Kingdoms VIII | A series of games that conveys the conflict during the Chinese Three Kingdoms era. | Strategy | PC | 2003 | 77 |
| Sekiro: Shadows Die Twice | The world of Sekiro was set towards the end of the Japanese Sengoku period. | Action | Console | 2019 | 91 |
| Sid Meier's Civilization VI | A turn-based strategy game that drew inspiration from various cultures across several different eras. | Strategy | Console/PC | 2016 | 88 |
| Taiko Drum Master | A rhythm game that utilized the "Taiko" Japanese traditional drum instrument as its main gameplay gimmick. | Rhythm | Console | 2005 | 77 |
| Total War Saga: Thrones of Britannia | A game about the feud between Britain and Vikings in the 9th century | Strategy | PC | 2018 | 75 |

| | | | | | |
|-------------------------------------|---|--------|----------------|------|----|
| Valiant Heart: The Great War | Taking place in the WWI era, it made use of pictures and text derived from real-life correspondence to give historical snapshots. | Puzzle | Console/P C | 2014 | 87 |
| Zuma's Revenge! | A puzzle game whose theme and art-style were inspired from Maya civilization. | Puzzle | Console/P C | 2012 | 76 |

Appendix C: Experiment I

(1) Tests of Normality

| | Kolmogorov-Smirnov ^a | | | Shapiro-Wilk | | |
|------|---------------------------------|----|------|--------------|----|------|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| T_A1 | .499 | 12 | .000 | .465 | 12 | .000 |
| T_A2 | .385 | 12 | .000 | .627 | 12 | .000 |
| T_A3 | .401 | 12 | .000 | .662 | 12 | .000 |
| T_A4 | .499 | 12 | .000 | .465 | 12 | .000 |
| T_A5 | .499 | 12 | .000 | .465 | 12 | .000 |
| T_A6 | .258 | 12 | .026 | .818 | 12 | .015 |
| T_A7 | .257 | 12 | .028 | .807 | 12 | .011 |
| T_E1 | .250 | 12 | .037 | .807 | 12 | .011 |
| T_E2 | .375 | 12 | .000 | .706 | 12 | .001 |
| T_E3 | .385 | 12 | .000 | .627 | 12 | .000 |
| T_E4 | .385 | 12 | .000 | .627 | 12 | .000 |
| T_E5 | .400 | 12 | .000 | .674 | 12 | .000 |
| T_E6 | .460 | 12 | .000 | .552 | 12 | .000 |
| T_E7 | .374 | 12 | .000 | .640 | 12 | .000 |
| T_P1 | .450 | 12 | .000 | .575 | 12 | .000 |
| T_P2 | .450 | 12 | .000 | .575 | 12 | .000 |
| T_P3 | .388 | 12 | .000 | .668 | 12 | .000 |
| T_P4 | .450 | 12 | .000 | .575 | 12 | .000 |
| T_P5 | .499 | 12 | .000 | .465 | 12 | .000 |
| T_P6 | .367 | 12 | .000 | .757 | 12 | .003 |
| T_P7 | .404 | 12 | .000 | .721 | 12 | .001 |
| T_H1 | .250 | 12 | .037 | .828 | 12 | .020 |
| T_H2 | .300 | 12 | .004 | .809 | 12 | .012 |
| T_H3 | .460 | 12 | .000 | .552 | 12 | .000 |

| | | | | | | |
|------|------|----|-------|------|----|------|
| T_H4 | .300 | 12 | .004 | .809 | 12 | .012 |
| T_H5 | .331 | 12 | .001 | .650 | 12 | .000 |
| T_H6 | .530 | 12 | .000 | .327 | 12 | .000 |
| T_H7 | .417 | 12 | .000 | .608 | 12 | .000 |
| I_A1 | .323 | 12 | .001 | .780 | 12 | .006 |
| I_A2 | .400 | 12 | .000 | .674 | 12 | .000 |
| I_A3 | .354 | 12 | .000 | .732 | 12 | .002 |
| I_A4 | .417 | 12 | .000 | .608 | 12 | .000 |
| I_A5 | .499 | 12 | .000 | .465 | 12 | .000 |
| I_A6 | .364 | 12 | .000 | .753 | 12 | .003 |
| I_A7 | .417 | 12 | .000 | .608 | 12 | .000 |
| I_E1 | .281 | 12 | .009 | .778 | 12 | .005 |
| I_E2 | .200 | 12 | .200* | .877 | 12 | .080 |
| I_E3 | .441 | 12 | .000 | .587 | 12 | .000 |
| I_E4 | .480 | 12 | .000 | .450 | 12 | .000 |
| I_E5 | .480 | 12 | .000 | .450 | 12 | .000 |
| I_E6 | .374 | 12 | .000 | .640 | 12 | .000 |
| I_E7 | .331 | 12 | .001 | .650 | 12 | .000 |
| I_P1 | .374 | 12 | .000 | .640 | 12 | .000 |
| I_P2 | .398 | 12 | .000 | .699 | 12 | .001 |
| I_P3 | .293 | 12 | .005 | .867 | 12 | .060 |
| I_P4 | .307 | 12 | .003 | .764 | 12 | .004 |
| I_P5 | .460 | 12 | .000 | .552 | 12 | .000 |
| I_P6 | .460 | 12 | .000 | .552 | 12 | .000 |
| I_P7 | .460 | 12 | .000 | .552 | 12 | .000 |
| I_H1 | .374 | 12 | .000 | .640 | 12 | .000 |
| I_H2 | .460 | 12 | .000 | .552 | 12 | .000 |
| I_H3 | .417 | 12 | .000 | .608 | 12 | .000 |
| I_H4 | .304 | 12 | .003 | .777 | 12 | .005 |



| | | | | | | |
|------|------|----|------|------|----|------|
| I_H5 | .460 | 12 | .000 | .552 | 12 | .000 |
| I_H6 | .374 | 12 | .000 | .640 | 12 | .000 |
| I_H7 | .460 | 12 | .000 | .552 | 12 | .000 |

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction



(2) Mann-Whitney Test

| Ranks | | | | | | | | | | | | | | |
|-------|-------|-----------|--------------|--------|-------|-------|---|-------|--------|-------|-------|---|-------|--------|
| Group | N | Mean Rank | Sum of Ranks | | Null | 1 | 2 | 8.50 | 102.00 | Null | 1 | 2 | 7.50 | 90.00 |
| | | | | Total | | | | | | Total | | | | |
| T_A 1 | Games | 1 | 18.50 | 222.00 | T_A 7 | Games | 1 | 16.50 | 198.00 | T_E 6 | Games | 1 | 15.50 | 186.00 |
| | Null | 1 | 6.50 | 78.00 | | Null | 1 | 8.50 | 102.00 | | Null | 1 | 9.50 | 114.00 |
| | Total | 2 | | | | Total | 2 | | | | Total | 2 | | |
| | | 2 | | | | | 4 | | | | | 4 | | |
| T_A 2 | Games | 1 | 16.50 | 198.00 | T_E 1 | Games | 1 | 15.50 | 186.00 | T_E 7 | Games | 1 | 11.50 | 138.00 |
| | Null | 1 | 8.50 | 102.00 | | Null | 1 | 9.50 | 114.00 | | Null | 1 | 13.50 | 162.00 |
| | Total | 2 | | | | Total | 2 | | | | Total | 2 | | |
| | | 2 | | | | | 4 | | | | | 4 | | |
| T_A 3 | Games | 1 | 16.50 | 198.00 | T_E 2 | Games | 1 | 17.50 | 210.00 | T_P 1 | Games | 1 | 16.50 | 198.00 |
| | Null | 1 | 8.50 | 102.00 | | Null | 1 | 7.50 | 90.00 | | Null | 1 | 8.50 | 102.00 |
| | Total | 2 | | | | Total | 2 | | | | Total | 2 | | |
| | | 2 | | | | | 4 | | | | | 4 | | |
| T_A 4 | Games | 1 | 18.50 | 222.00 | T_E 3 | Games | 1 | 16.50 | 198.00 | T_P 2 | Games | 1 | 16.50 | 198.00 |
| | Null | 1 | 6.50 | 78.00 | | Null | 1 | 8.50 | 102.00 | | Null | 1 | 8.50 | 102.00 |
| | Total | 2 | | | | Total | 2 | | | | Total | 2 | | |
| | | 2 | | | | | 4 | | | | | 4 | | |
| T_A 5 | Games | 1 | 18.50 | 222.00 | T_E 4 | Games | 1 | 16.50 | 198.00 | T_P 3 | Games | 1 | 16.50 | 198.00 |
| | Null | 1 | 6.50 | 78.00 | | Null | 1 | 8.50 | 102.00 | | Null | 1 | 8.50 | 102.00 |
| | Total | 2 | | | | Total | 2 | | | | Total | 2 | | |
| | | 2 | | | | | 4 | | | | | 4 | | |
| T_A 6 | Games | 1 | 16.50 | 198.00 | T_E 5 | Games | 1 | 17.50 | 210.00 | T_P 4 | Games | 1 | 16.50 | 198.00 |
| | Null | 1 | 8.50 | 102.00 | | Null | 1 | 7.50 | 90.00 | | Null | 1 | 8.50 | 102.00 |
| | Total | 2 | | | | Total | 2 | | | | Total | 2 | | |
| | | 2 | | | | | 4 | | | | | 4 | | |



| | | | | | | | | | | | | | |
|-----|-------|---|-------|--------|-------|-------|-------|--------|--------|-------|---|-------|--------|
| | Null | 1 | 8.50 | 102.00 | Total | 2 | | | I_A3 | Games | 1 | 17.50 | 210.00 |
| | | 2 | | | | 4 | | | | | 2 | | |
| | Total | 2 | | | T_H | Games | 1 | 16.50 | 198.00 | Null | 1 | 7.50 | 90.00 |
| | | 4 | | | 4 | 2 | | | | | 2 | | |
| T_P | Games | 1 | 18.50 | 222.00 | Null | 1 | 8.50 | 102.00 | Total | 2 | | | |
| 5 | | 2 | | | | 2 | | | | 4 | | | |
| | Null | 1 | 6.50 | 78.00 | Total | 2 | | | I_A4 | Games | 1 | 18.50 | 222.00 |
| | | 2 | | | | 4 | | | | | 2 | | |
| | Total | 2 | | | T_H | Games | 1 | 18.50 | 222.00 | Null | 1 | 6.50 | 78.00 |
| | | 4 | | | 5 | 2 | | | | | 2 | | |
| T_P | Games | 1 | 16.50 | 198.00 | Null | 1 | 6.50 | 78.00 | Total | 2 | | | |
| 6 | | 2 | | | | 2 | | | | 4 | | | |
| | Null | 1 | 8.50 | 102.00 | Total | 2 | | | I_A5 | Games | 1 | 18.50 | 222.00 |
| | | 2 | | | | 4 | | | | | 2 | | |
| | Total | 2 | | | T_H | Games | 1 | 17.50 | 210.00 | Null | 1 | 6.50 | 78.00 |
| | | 4 | | | 6 | 2 | | | | | 2 | | |
| T_P | Games | 1 | 16.50 | 198.00 | Null | 1 | 7.50 | 90.00 | Total | 2 | | | |
| 7 | | 2 | | | | 2 | | | | 4 | | | |
| | Null | 1 | 8.50 | 102.00 | Total | 2 | | | I_A6 | Games | 1 | 15.50 | 186.00 |
| | | 2 | | | | 4 | | | | | 2 | | |
| | Total | 2 | | | T_H | Games | 1 | 14.50 | 174.00 | Null | 1 | 9.50 | 114.00 |
| | | 4 | | | 7 | 2 | | | | | 2 | | |
| T_H | Games | 1 | 15.50 | 186.00 | Null | 1 | 10.50 | 126.00 | Total | 2 | | | |
| 1 | | 2 | | | | 2 | | | | 4 | | | |
| | Null | 1 | 9.50 | 114.00 | Total | 2 | | | I_A7 | Games | 1 | 10.50 | 126.00 |
| | | 2 | | | | 4 | | | | | 2 | | |
| | Total | 2 | | | I_A1 | Games | 1 | 17.50 | 210.00 | Null | 1 | 14.50 | 174.00 |
| | | 4 | | | | 2 | | | | | 2 | | |
| T_H | Games | 1 | 15.50 | 186.00 | Null | 1 | 7.50 | 90.00 | Total | 2 | | | |
| 2 | | 2 | | | | 2 | | | | 4 | | | |
| | Null | 1 | 9.50 | 114.00 | Total | 2 | | | I_E1 | Games | 1 | 16.50 | 198.00 |
| | | 2 | | | | 4 | | | | | 2 | | |
| | Total | 2 | | | I_A2 | Games | 1 | 17.50 | 210.00 | Null | 1 | 8.50 | 102.00 |
| | | 4 | | | | 2 | | | | | 2 | | |
| T_H | Games | 1 | 9.50 | 114.00 | Null | 1 | 7.50 | 90.00 | Total | 2 | | | |
| 3 | | 2 | | | | 2 | | | | 4 | | | |
| | Null | 1 | 15.50 | 186.00 | Total | 2 | | | I_E2 | Games | 1 | 10.50 | 126.00 |
| | | 2 | | | | 4 | | | | | 2 | | |

| | | | | | | | | | | | | |
|------------|-------|---|-------|--------|------------|---|-------|--------|------------|---|-------|--------|
| | Null | 1 | 14.50 | 174.00 | Total | 2 | | | I_H1 Games | 1 | 18.50 | 222.00 |
| | | 2 | | | | 4 | | | | 2 | | |
| | Total | 2 | | | I_P2 Games | 1 | 16.50 | 198.00 | Null | 1 | 6.50 | 78.00 |
| | | 4 | | | | 2 | | | | 2 | | |
| I_E3 Games | | 1 | 16.50 | 198.00 | Null | 1 | 8.50 | 102.00 | Total | 2 | | |
| | | 2 | | | | 2 | | | | 4 | | |
| | Null | 1 | 8.50 | 102.00 | Total | 2 | | | I_H2 Games | 1 | 15.50 | 186.00 |
| | | 2 | | | | 4 | | | | 2 | | |
| | Total | 2 | | | I_P3 Games | 1 | 11.50 | 138.00 | Null | 1 | 9.50 | 114.00 |
| | | 4 | | | | 2 | | | | 2 | | |
| I_E4 Games | | 1 | 17.50 | 210.00 | Null | 1 | 13.50 | 162.00 | Total | 2 | | |
| | | 2 | | | | 2 | | | | 4 | | |
| | Null | 1 | 7.50 | 90.00 | Total | 2 | | | I_H3 Games | 1 | 18.50 | 222.00 |
| | | 2 | | | | 4 | | | | 2 | | |
| | Total | 2 | | | I_P4 Games | 1 | 12.50 | 150.00 | Null | 1 | 6.50 | 78.00 |
| | | 4 | | | | 2 | | | | 2 | | |
| I_E5 Games | | 1 | 17.50 | 210.00 | Null | 1 | 12.50 | 150.00 | Total | 2 | | |
| | | 2 | | | | 2 | | | | 4 | | |
| | Null | 1 | 7.50 | 90.00 | Total | 2 | | | I_H4 Games | 1 | 12.50 | 150.00 |
| | | 2 | | | | 4 | | | | 2 | | |
| | Total | 2 | | | I_P5 Games | 1 | 6.50 | 78.00 | Null | 1 | 12.50 | 150.00 |
| | | 4 | | | | 2 | | | | 2 | | |
| I_E6 Games | | 1 | 6.50 | 78.00 | Null | 1 | 18.50 | 222.00 | Total | 2 | | |
| | | 2 | | | | 2 | | | | 4 | | |
| | Null | 1 | 18.50 | 222.00 | Total | 2 | | | I_H5 Games | 1 | 18.50 | 222.00 |
| | | 2 | | | | 4 | | | | 2 | | |
| | Total | 2 | | | I_P6 Games | 1 | 6.50 | 78.00 | Null | 1 | 6.50 | 78.00 |
| | | 4 | | | | 2 | | | | 2 | | |
| I_E7 Games | | 1 | 12.50 | 150.00 | Null | 1 | 18.50 | 222.00 | Total | 2 | | |
| | | 2 | | | | 2 | | | | 4 | | |
| | Null | 1 | 12.50 | 150.00 | Total | 2 | | | I_H6 Games | 1 | 18.50 | 222.00 |
| | | 2 | | | | 4 | | | | 2 | | |
| | Total | 2 | | | I_P7 Games | 1 | 6.50 | 78.00 | Null | 1 | 6.50 | 78.00 |
| | | 4 | | | | 2 | | | | 2 | | |
| I_P1 Games | | 1 | 18.50 | 222.00 | Null | 1 | 18.50 | 222.00 | Total | 2 | | |
| | | 2 | | | | 2 | | | | 4 | | |
| | Null | 1 | 6.50 | 78.00 | Total | 2 | | | I_H7 Games | 1 | 15.50 | 186.00 |
| | | 2 | | | | 4 | | | | 2 | | |

| | | | | | | | |
|------|---|------|--------|-------|---|--|--|
| Null | 1 | 9.50 | 114.00 | Total | 2 | | |
| | 2 | | | | 4 | | |

| | T_A1 | T_A2 | T_A3 | T_A4 | T_A5 | T_A6 | T_A7 | T_E1 | T_E2 | T_E3 | T_E4 | T_E5 | T_E6 | T_E7 |
|--------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Mann-Whitney U | .000 | 24.000 | 24.000 | .000 | .000 | 24.000 | 24.000 | 36.000 | 12.000 | 24.000 | 24.000 | 12.000 | 36.000 | 60.000 |
| Wilcoxon W | 78.000 | 102.000 | 102.000 | 78.000 | 78.000 | 102.000 | 102.000 | 114.000 | 90.000 | 102.000 | 102.000 | 90.000 | 114.000 | 138.000 |
| Z | -4.638 | -3.027 | -3.027 | -4.638 | -4.638 | -2.996 | -2.992 | -2.238 | -3.786 | -3.027 | -3.027 | -3.786 | -2.293 | -.755 |
| Asymp. Sig. (2-tailed) | .000 | .002 | .002 | .000 | .000 | .003 | .003 | .025 | .000 | .002 | .002 | .000 | .022 | .450 |
| Exact Sig. [2*(1-tailed Sig.)] | .000 ^b | .005 ^b | .005 ^b | .000 ^b | .000 ^b | .005 ^b | .005 ^b | .039 ^b | .000 ^b | .005 ^b | .005 ^b | .000 ^b | .039 ^b | .514 ^b |

| | T_P1 | T_P2 | T_P3 | T_P4 | T_P5 | T_P6 | T_P7 | T_H1 | T_H2 | T_H3 | T_H4 | T_H5 | T_H6 | T_H7 |
|--------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Mann-Whitney U | 24.000 | 24.000 | 24.000 | 24.000 | .000 | 24.000 | 24.000 | 36.000 | 36.000 | 36.000 | 24.000 | .000 | 12.000 | 48.000 |
| Wilcoxon W | 102.000 | 102.000 | 102.000 | 102.000 | 78.000 | 102.000 | 102.000 | 114.000 | 114.000 | 114.000 | 102.000 | 78.000 | 90.000 | 126.000 |
| Z | -3.055 | -3.055 | -3.026 | -3.055 | -4.638 | -3.007 | -3.027 | -2.245 | -2.256 | -2.293 | -3.007 | -4.522 | -3.922 | -1.517 |
| Asymp. Sig. (2-tailed) | .002 | .002 | .002 | .002 | .000 | .003 | .002 | .025 | .024 | .022 | .003 | .000 | .000 | .129 |
| Exact Sig. [2*(1-tailed Sig.)] | .005 ^b | .005 ^b | .005 ^b | .005 ^b | .000 ^b | .005 ^b | .005 ^b | .039 ^b | .039 ^b | .039 ^b | .005 ^b | .000 ^b | .000 ^b | .178 ^b |

| | I_A1 | I_A2 | I_A3 | I_A4 | I_A5 | I_A6 | I_A7 | I_E1 | I_E2 | I_E3 | I_E4 | I_E5 | I_E6 | I_E7 |
|--------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------------|
| Mann-Whitney U | 12.000 | 12.000 | 12.000 | .000 | .000 | 36.000 | 48.000 | 24.000 | 48.000 | 24.000 | 12.000 | 12.000 | .000 | 72.000 |
| Wilcoxon W | 90.000 | 90.000 | 90.000 | 78.000 | 78.000 | 114.000 | 126.000 | 102.000 | 126.000 | 102.000 | 90.000 | 90.000 | 78.000 | 150.000 |
| Z | -3.764 | -3.786 | -3.764 | -4.550 | -4.638 | -2.271 | -1.517 | -2.995 | -1.490 | -3.054 | -3.864 | -3.864 | -4.529 | .000 |
| Asymp. Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | .023 | .129 | .003 | .136 | .002 | .000 | .000 | .000 | 1.000 |
| Exact Sig. [2*(1-tailed Sig.)] | .000 ^b | .000 ^b | .000 ^b | .000 ^b | .000 ^b | .039 ^b | .178 ^b | .005 ^b | .178 ^b | .005 ^b | .000 ^b | .000 ^b | .000 ^b | 1.000 ^b |

| | I_P1 | I_P2 | I_P3 | I_P4 | I_P5 | I_P6 | I_P7 | I_H1 | I_H2 | I_H3 | I_H4 | I_H5 | I_H6 | I_H7 |
|----------------|------|--------|--------|--------|------|------|------|------|--------|------|--------|------|------|--------|
| Mann-Whitney U | .000 | 24.000 | 60.000 | 72.000 | .000 | .000 | .000 | .000 | 36.000 | .000 | 72.000 | .000 | .000 | 36.000 |

| | | | | | | | | | | | | | | |
|--------------------------------|-------------------|-------------------|-------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------------|-------------------|-------------------|-------------------|
| Wilcoxon W | 78.000 | 102.000 | 138.000 | 150.000 | 78.000 | 78.000 | 78.000 | 78.000 | 114.000 | 78.000 | 150.000 | 78.000 | 78.000 | 114.000 |
| Z | -4.529 | -3.055 | -.748 | .000 | -4.586 | -4.586 | -4.586 | -4.529 | -2.293 | -4.550 | .000 | -4.586 | -4.529 | -2.293 |
| Asymp. Sig. (2-tailed) | .000 | .002 | .455 | 1.000 | .000 | .000 | .000 | .000 | .022 | .000 | 1.000 | .000 | .000 | .022 |
| Exact Sig. [2*(1-tailed Sig.)] | .000 ^b | .005 ^b | .514 ^b | 1.000 ^b | .000 ^b | .000 ^b | .000 ^b | .000 ^b | .039 ^b | .000 ^b | 1.000 ^b | .000 ^b | .000 ^b | .039 ^b |

- a. Grouping Variable: Group
- b. Not corrected for ties.



(3) Kruskal-Wallis Test

| Ranks | | | |
|---------------------|---------------------|------------------|------|
| Group | N | Mean Rank | |
| T_A1 | Assassin's Creed | 2 | 7.50 |
| | BioShock | 2 | 1.50 |
| | God of War | 2 | 7.50 |
| | Red Dead Redemption | 2 | 7.50 |
| | Tomb Raider | 2 | 7.50 |
| | Uncharted | 2 | 7.50 |
| | Total | 12 | |
| | T_A2 | Assassin's Creed | 2 |
| BioShock | | 2 | 1.50 |
| God of War | | 2 | 3.50 |
| Red Dead Redemption | | 2 | 8.50 |
| Tomb Raider | | 2 | 8.50 |
| Uncharted | | 2 | 8.50 |
| Total | | 12 | |
| T_A3 | | Assassin's Creed | 2 |
| | BioShock | 2 | 1.50 |
| | God of War | 2 | 3.50 |
| | Red Dead Redemption | 2 | 8.50 |
| | Tomb Raider | 2 | 8.50 |
| | Uncharted | 2 | 8.50 |
| | Total | 12 | |
| | T_A4 | Assassin's Creed | 2 |
| BioShock | | 2 | 1.50 |
| Total | | 12 | |

| | | | |
|---------------------|---------------------|------------------|-------|
| God of War | 2 | 7.50 | |
| Red Dead Redemption | 2 | 7.50 | |
| Tomb Raider | 2 | 7.50 | |
| Uncharted | 2 | 7.50 | |
| Total | 12 | | |
| T_A5 | Assassin's Creed | 2 | 7.50 |
| | BioShock | 2 | 1.50 |
| | God of War | 2 | 7.50 |
| | Red Dead Redemption | 2 | 7.50 |
| | Tomb Raider | 2 | 7.50 |
| | Uncharted | 2 | 7.50 |
| | Total | 12 | |
| | T_A6 | Assassin's Creed | 2 |
| BioShock | | 2 | 8.00 |
| God of War | | 2 | 10.50 |
| Red Dead Redemption | | 2 | 8.00 |
| Tomb Raider | | 2 | 1.50 |
| Uncharted | | 2 | 5.50 |
| Total | | 12 | |
| T_A7 | | Assassin's Creed | 2 |
| | BioShock | 2 | 1.50 |
| | God of War | 2 | 7.50 |
| | Red Dead Redemption | 2 | 10.00 |
| | Tomb Raider | 2 | 5.00 |
| | Uncharted | 2 | 10.00 |
| | Total | 12 | |

| | | | |
|---------------------|---------------------|------------------|-------|
| Total | 12 | | |
| T_E1 | Assassin's Creed | 2 | 10.00 |
| | BioShock | 2 | 1.50 |
| | God of War | 2 | 5.50 |
| | Red Dead Redemption | 2 | 7.75 |
| | Tomb Raider | 2 | 4.25 |
| | Uncharted | 2 | 10.00 |
| | Total | 12 | |
| | T_E2 | Assassin's Creed | 2 |
| BioShock | | 2 | 3.25 |
| God of War | | 2 | 5.50 |
| Red Dead Redemption | | 2 | 5.50 |
| Tomb Raider | | 2 | 5.50 |
| Uncharted | | 2 | 8.25 |
| Total | | 12 | |
| T_E3 | | Assassin's Creed | 2 |
| | BioShock | 2 | 1.50 |
| | God of War | 2 | 3.50 |
| | Red Dead Redemption | 2 | 8.50 |
| | Tomb Raider | 2 | 8.50 |
| | Uncharted | 2 | 8.50 |
| | Total | 12 | |
| | T_E4 | Assassin's Creed | 2 |
| BioShock | | 2 | 1.50 |
| God of War | | 2 | 3.50 |

| | | | |
|------|---------------------|----|-------|
| | Red Dead Redemption | 2 | 8.50 |
| | Tomb Raider | 2 | 8.50 |
| | Uncharted | 2 | 8.50 |
| | Total | 12 | |
| T_E5 | Assassin's Creed | 2 | 8.50 |
| | BioShock | 2 | 4.75 |
| | God of War | 2 | 5.75 |
| | Red Dead Redemption | 2 | 3.00 |
| | Tomb Raider | 2 | 8.50 |
| | Uncharted | 2 | 8.50 |
| | Total | 12 | |
| T_E6 | Assassin's Creed | 2 | 8.00 |
| | BioShock | 2 | 8.00 |
| | God of War | 2 | 5.00 |
| | Red Dead Redemption | 2 | 8.00 |
| | Tomb Raider | 2 | 2.00 |
| | Uncharted | 2 | 8.00 |
| | Total | 12 | |
| T_E7 | Assassin's Creed | 2 | 4.00 |
| | BioShock | 2 | 4.00 |
| | God of War | 2 | 7.00 |
| | Red Dead Redemption | 2 | 7.00 |
| | Tomb Raider | 2 | 10.00 |
| | Uncharted | 2 | 7.00 |
| | Total | 12 | |

| | | | |
|------|---------------------|----|------|
| T_P1 | Assassin's Creed | 2 | 8.00 |
| | BioShock | 2 | 1.50 |
| | God of War | 2 | 8.00 |
| | Red Dead Redemption | 2 | 8.00 |
| | Tomb Raider | 2 | 5.50 |
| | Uncharted | 2 | 8.00 |
| | Total | 12 | |
| T_P2 | Assassin's Creed | 2 | 8.00 |
| | BioShock | 2 | 1.50 |
| | God of War | 2 | 5.50 |
| | Red Dead Redemption | 2 | 8.00 |
| | Tomb Raider | 2 | 8.00 |
| | Uncharted | 2 | 8.00 |
| | Total | 12 | |
| T_P3 | Assassin's Creed | 2 | 8.50 |
| | BioShock | 2 | 1.50 |
| | God of War | 2 | 8.50 |
| | Red Dead Redemption | 2 | 8.50 |
| | Tomb Raider | 2 | 3.50 |
| | Uncharted | 2 | 8.50 |
| | Total | 12 | |
| T_P4 | Assassin's Creed | 2 | 8.00 |
| | BioShock | 2 | 1.50 |
| | God of War | 2 | 8.00 |
| | Red Dead Redemption | 2 | 8.00 |

| | | | |
|------|---------------------|----|-------|
| | Tomb Raider | 2 | 5.50 |
| | Uncharted | 2 | 8.00 |
| | Total | 12 | |
| T_P5 | Assassin's Creed | 2 | 7.50 |
| | BioShock | 2 | 1.50 |
| | God of War | 2 | 7.50 |
| | Red Dead Redemption | 2 | 7.50 |
| | Tomb Raider | 2 | 7.50 |
| | Uncharted | 2 | 7.50 |
| | Total | 12 | |
| T_P6 | Assassin's Creed | 2 | 6.00 |
| | BioShock | 2 | 1.50 |
| | God of War | 2 | 8.50 |
| | Red Dead Redemption | 2 | 8.50 |
| | Tomb Raider | 2 | 6.00 |
| | Uncharted | 2 | 8.50 |
| | Total | 12 | |
| T_P7 | Assassin's Creed | 2 | 6.50 |
| | BioShock | 2 | 1.50 |
| | God of War | 2 | 6.50 |
| | Red Dead Redemption | 2 | 11.50 |
| | Tomb Raider | 2 | 6.50 |
| | Uncharted | 2 | 6.50 |
| | Total | 12 | |
| T_H1 | Assassin's Creed | 2 | 11.00 |
| | BioShock | 2 | 4.25 |

| | | | |
|------|---------------------|----|-------|
| | God of War | 2 | 6.50 |
| | Red Dead Redemption | 2 | 8.75 |
| | Tomb Raider | 2 | 2.00 |
| | Uncharted | 2 | 6.50 |
| | Total | 12 | |
| T_H2 | Assassin's Creed | 2 | 9.25 |
| | BioShock | 2 | 2.00 |
| | God of War | 2 | 7.00 |
| | Red Dead Redemption | 2 | 7.00 |
| | Tomb Raider | 2 | 4.50 |
| | Uncharted | 2 | 9.25 |
| | Total | 12 | |
| T_H3 | Assassin's Creed | 2 | 11.00 |
| | BioShock | 2 | 5.00 |
| | God of War | 2 | 8.00 |
| | Red Dead Redemption | 2 | 5.00 |
| | Tomb Raider | 2 | 5.00 |
| | Uncharted | 2 | 5.00 |
| | Total | 12 | |
| T_H4 | Assassin's Creed | 2 | 11.00 |
| | BioShock | 2 | 6.00 |
| | God of War | 2 | 6.00 |
| | Red Dead Redemption | 2 | 8.50 |
| | Tomb Raider | 2 | 1.50 |
| | Uncharted | 2 | 6.00 |
| | Total | 12 | |

| | | | |
|------|---------------------|----|-------|
| T_H5 | Assassin's Creed | 2 | 9.50 |
| | BioShock | 2 | 3.50 |
| | God of War | 2 | 6.50 |
| | Red Dead Redemption | 2 | 6.50 |
| | Tomb Raider | 2 | 6.50 |
| | Uncharted | 2 | 6.50 |
| | Total | 12 | |
| T_H6 | Assassin's Creed | 2 | 7.00 |
| | BioShock | 2 | 7.00 |
| | God of War | 2 | 7.00 |
| | Red Dead Redemption | 2 | 7.00 |
| | Tomb Raider | 2 | 4.00 |
| | Uncharted | 2 | 7.00 |
| | Total | 12 | |
| T_H7 | Assassin's Creed | 2 | 8.50 |
| | BioShock | 2 | 8.50 |
| | God of War | 2 | 2.50 |
| | Red Dead Redemption | 2 | 8.50 |
| | Tomb Raider | 2 | 2.50 |
| | Uncharted | 2 | 8.50 |
| | Total | 12 | |
| I_A1 | Assassin's Creed | 2 | 10.50 |
| | BioShock | 2 | 3.00 |
| | God of War | 2 | 5.00 |
| | Red Dead Redemption | 2 | 5.00 |
| | Tomb Raider | 2 | 5.00 |

| | | | |
|------|---------------------|----|-------|
| | Uncharted | 2 | 10.50 |
| | Total | 12 | |
| I_A2 | Assassin's Creed | 2 | 8.50 |
| | BioShock | 2 | 2.00 |
| | God of War | 2 | 8.50 |
| | Red Dead Redemption | 2 | 8.50 |
| | Tomb Raider | 2 | 5.75 |
| | Uncharted | 2 | 5.75 |
| | Total | 12 | |
| I_A3 | Assassin's Creed | 2 | 9.00 |
| | BioShock | 2 | 5.00 |
| | God of War | 2 | 9.00 |
| | Red Dead Redemption | 2 | 9.00 |
| | Tomb Raider | 2 | 3.50 |
| | Uncharted | 2 | 3.50 |
| | Total | 12 | |
| I_A4 | Assassin's Creed | 2 | 8.50 |
| | BioShock | 2 | 5.50 |
| | God of War | 2 | 8.50 |
| | Red Dead Redemption | 2 | 8.50 |
| | Tomb Raider | 2 | 2.50 |
| | Uncharted | 2 | 5.50 |
| | Total | 12 | |
| I_A5 | Assassin's Creed | 2 | 7.50 |
| | BioShock | 2 | 1.50 |
| | God of War | 2 | 7.50 |

| | | | |
|------|---------------------|----|-------|
| | Red Dead Redemption | 2 | 7.50 |
| | Tomb Raider | 2 | 7.50 |
| | Uncharted | 2 | 7.50 |
| | Total | 12 | |
| I_A6 | Assassin's Creed | 2 | 7.50 |
| | BioShock | 2 | 9.75 |
| | God of War | 2 | 4.75 |
| | Red Dead Redemption | 2 | 7.50 |
| | Tomb Raider | 2 | 4.75 |
| | Uncharted | 2 | 4.75 |
| | Total | 12 | |
| I_A7 | Assassin's Creed | 2 | 4.50 |
| | BioShock | 2 | 7.50 |
| | God of War | 2 | 10.50 |
| | Red Dead Redemption | 2 | 7.50 |
| | Tomb Raider | 2 | 4.50 |
| | Uncharted | 2 | 4.50 |
| | Total | 12 | |
| I_E1 | Assassin's Creed | 2 | 7.00 |
| | BioShock | 2 | 5.25 |
| | God of War | 2 | 7.00 |
| | Red Dead Redemption | 2 | 7.00 |
| | Tomb Raider | 2 | 5.75 |
| | Uncharted | 2 | 7.00 |
| | Total | 12 | |

| | | | |
|------|---------------------|----|------|
| I_E2 | Assassin's Creed | 2 | 8.25 |
| | BioShock | 2 | 2.50 |
| | God of War | 2 | 6.25 |
| | Red Dead Redemption | 2 | 4.50 |
| | Tomb Raider | 2 | 9.25 |
| | Uncharted | 2 | 8.25 |
| | Total | 12 | |
| I_E3 | Assassin's Creed | 2 | 8.00 |
| | BioShock | 2 | 4.50 |
| | God of War | 2 | 8.00 |
| | Red Dead Redemption | 2 | 8.00 |
| | Tomb Raider | 2 | 8.00 |
| | Uncharted | 2 | 2.50 |
| | Total | 12 | |
| I_E4 | Assassin's Creed | 2 | 7.50 |
| | BioShock | 2 | 4.25 |
| | God of War | 2 | 7.50 |
| | Red Dead Redemption | 2 | 7.50 |
| | Tomb Raider | 2 | 7.50 |
| | Uncharted | 2 | 4.75 |
| | Total | 12 | |
| I_E5 | Assassin's Creed | 2 | 7.50 |
| | BioShock | 2 | 4.25 |
| | God of War | 2 | 7.50 |
| | Red Dead Redemption | 2 | 7.50 |

| | | | |
|------|---------------------|----|-------|
| | Tomb Raider | 2 | 7.50 |
| | Uncharted | 2 | 4.75 |
| | Total | 12 | |
| I_E6 | Assassin's Creed | 2 | 7.00 |
| | BioShock | 2 | 7.00 |
| | God of War | 2 | 7.00 |
| | Red Dead Redemption | 2 | 4.00 |
| | Tomb Raider | 2 | 7.00 |
| | Uncharted | 2 | 7.00 |
| | Total | 12 | |
| I_E7 | Assassin's Creed | 2 | 3.50 |
| | BioShock | 2 | 6.50 |
| | God of War | 2 | 6.50 |
| | Red Dead Redemption | 2 | 9.50 |
| | Tomb Raider | 2 | 6.50 |
| | Uncharted | 2 | 6.50 |
| | Total | 12 | |
| I_P1 | Assassin's Creed | 2 | 10.00 |
| | BioShock | 2 | 4.00 |
| | God of War | 2 | 7.00 |
| | Red Dead Redemption | 2 | 7.00 |
| | Tomb Raider | 2 | 7.00 |
| | Uncharted | 2 | 4.00 |
| | Total | 12 | |
| I_P2 | Assassin's Creed | 2 | 7.00 |
| | BioShock | 2 | 7.00 |

| | | | |
|------|---------------------|----|-------|
| | God of War | 2 | 4.25 |
| | Red Dead Redemption | 2 | 9.50 |
| | Tomb Raider | 2 | 4.25 |
| | Uncharted | 2 | 7.00 |
| | Total | 12 | |
| I_P3 | Assassin's Creed | 2 | 11.50 |
| | BioShock | 2 | 5.00 |
| | God of War | 2 | 6.75 |
| | Red Dead Redemption | 2 | 6.75 |
| | Tomb Raider | 2 | 4.50 |
| | Uncharted | 2 | 4.50 |
| | Total | 12 | |
| I_P4 | Assassin's Creed | 2 | 11.00 |
| | BioShock | 2 | 9.50 |
| | God of War | 2 | 3.50 |
| | Red Dead Redemption | 2 | 5.75 |
| | Tomb Raider | 2 | 3.50 |
| | Uncharted | 2 | 5.75 |
| | Total | 12 | |
| I_P5 | Assassin's Creed | 2 | 5.00 |
| | BioShock | 2 | 8.00 |
| | God of War | 2 | 8.00 |
| | Red Dead Redemption | 2 | 8.00 |
| | Tomb Raider | 2 | 5.00 |
| | Uncharted | 2 | 5.00 |
| | Total | 12 | |

| | | | |
|------|---------------------|----|-------|
| I_P6 | Assassin's Creed | 2 | 5.00 |
| | BioShock | 2 | 11.00 |
| | God of War | 2 | 5.00 |
| | Red Dead Redemption | 2 | 8.00 |
| | Tomb Raider | 2 | 5.00 |
| | Uncharted | 2 | 5.00 |
| | Total | 12 | |
| I_P7 | Assassin's Creed | 2 | 5.00 |
| | BioShock | 2 | 11.00 |
| | God of War | 2 | 8.00 |
| | Red Dead Redemption | 2 | 5.00 |
| | Tomb Raider | 2 | 5.00 |
| | Uncharted | 2 | 5.00 |
| | Total | 12 | |
| I_H1 | Assassin's Creed | 2 | 10.00 |
| | BioShock | 2 | 4.00 |
| | God of War | 2 | 7.00 |
| | Red Dead Redemption | 2 | 7.00 |
| | Tomb Raider | 2 | 7.00 |
| | Uncharted | 2 | 4.00 |
| | Total | 12 | |
| I_H2 | Assassin's Creed | 2 | 8.00 |
| | BioShock | 2 | 5.00 |
| | God of War | 2 | 5.00 |
| | Red Dead Redemption | 2 | 8.00 |
| | Tomb Raider | 2 | 5.00 |

| | | | |
|------|---------------------|----|-------|
| | Uncharted | 2 | 8.00 |
| | Total | 12 | |
| I_H3 | Assassin's Creed | 2 | 10.50 |
| | BioShock | 2 | 4.50 |
| | God of War | 2 | 4.50 |
| | Red Dead Redemption | 2 | 10.50 |
| | Tomb Raider | 2 | 4.50 |
| | Uncharted | 2 | 4.50 |
| | Total | 12 | |
| I_H4 | Assassin's Creed | 2 | 11.50 |
| | BioShock | 2 | 6.00 |
| | God of War | 2 | 6.00 |
| | Red Dead Redemption | 2 | 8.50 |
| | Tomb Raider | 2 | 3.50 |
| | Uncharted | 2 | 3.50 |
| | Total | 12 | |
| I_H5 | Assassin's Creed | 2 | 11.00 |
| | BioShock | 2 | 5.00 |
| | God of War | 2 | 8.00 |
| | Red Dead Redemption | 2 | 5.00 |
| | Tomb Raider | 2 | 5.00 |
| | Uncharted | 2 | 5.00 |
| | Total | 12 | |
| I_H6 | Assassin's Creed | 2 | 4.00 |
| | BioShock | 2 | 4.00 |
| | God of War | 2 | 7.00 |

| | | |
|---------------------|----|-------|
| Red Dead Redemption | 2 | 10.00 |
| Tomb Raider | 2 | 7.00 |
| Uncharted | 2 | 7.00 |
| Total | 12 | |

| | | | |
|------|------------------|---|------|
| I_H7 | Assassin's Creed | 2 | 2.00 |
| | BioShock | 2 | 8.00 |
| | God of War | 2 | 8.00 |

| | | |
|---------------------|----|------|
| Red Dead Redemption | 2 | 8.00 |
| Tomb Raider | 2 | 8.00 |
| Uncharted | 2 | 5.00 |
| Total | 12 | |

| | T_A1 | T_A2 | T_A3 | T_A4 | T_A5 | T_A6 | T_A7 | T_E1 | T_E2 | T_E3 | T_E4 | T_E5 | T_E6 | T_E7 | T_P1 | T_P2 | T_P3 | T_P4 | T_P5 | T_P6 | T_P7 |
|------------------|--------|--------|--------|--------|--------|-------|-------|-------|-------|--------|--------|-------|-------|-------|-------|-------|--------|-------|--------|-------|--------|
| Kruskal-Wallis H | 11.000 | 11.000 | 11.000 | 11.000 | 11.000 | 8.708 | 9.878 | 9.857 | 8.194 | 11.000 | 11.000 | 6.194 | 8.556 | 5.343 | 9.333 | 9.333 | 10.945 | 9.333 | 11.000 | 7.333 | 11.000 |
| df | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Asymp. Sig. | .051 | .051 | .051 | .051 | .051 | .121 | .079 | .079 | .146 | .051 | .051 | .288 | .128 | .375 | .096 | .096 | .052 | .096 | .051 | .197 | .051 |

| | T_H1 | T_H2 | T_H3 | T_H4 | T_H5 | T_H6 | T_H7 | I_A1 | I_A2 | I_A3 | I_A4 | I_A5 | I_A6 | I_A7 | I_E1 | I_E2 | I_E3 | I_E4 | I_E5 | I_E6 | I_E7 |
|------------------|-------|-------|-------|-------|-------|-------|--------|--------|-------|-------|-------|--------|-------|-------|------|-------|-------|-------|-------|-------|-------|
| Kruskal-Wallis H | 9.167 | 7.798 | 8.556 | 9.778 | 3.667 | 5.000 | 11.000 | 10.200 | 7.417 | 7.800 | 6.875 | 11.000 | 4.833 | 6.875 | .571 | 5.668 | 7.687 | 4.409 | 4.409 | 1.571 | 3.667 |
| df | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Asymp. Sig. | .103 | .168 | .128 | .082 | .598 | .416 | .051 | .070 | .191 | .168 | .230 | .051 | .437 | .230 | .989 | .340 | .174 | .492 | .492 | .905 | .598 |

| | I_P1 | I_P2 | I_P3 | I_P4 | I_P5 | I_P6 | I_P7 | I_H1 | I_H2 | I_H3 | I_H4 | I_H5 | I_H6 | I_H7 |
|------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|
| Kruskal-Wallis H | 5.343 | 5.300 | 6.327 | 8.759 | 3.667 | 8.556 | 8.556 | 5.343 | 3.667 | 11.000 | 8.708 | 8.556 | 5.343 | 8.556 |
| df | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Asymp. Sig. | .375 | .380 | .276 | .119 | .598 | .128 | .128 | .375 | .598 | .051 | .121 | .128 | .375 | .128 |

a. Kruskal Wallis Test



Appendix D: Experiment II

(1) Tests of Normality

| Tests of Normality | | | | | | |
|--------------------|---------------------------------|----|------|--------------|----|------|
| | Kolmogorov-Smirnov ^a | | | Shapiro-Wilk | | |
| | Statistic | df | Sig. | Statistic | df | Sig. |
| T_A1 | .499 | 12 | .000 | .465 | 12 | .000 |
| T_A2 | .385 | 12 | .000 | .627 | 12 | .000 |
| T_A3 | .401 | 12 | .000 | .662 | 12 | .000 |
| T_A4 | .499 | 12 | .000 | .465 | 12 | .000 |
| T_A5 | .499 | 12 | .000 | .465 | 12 | .000 |
| T_A6 | .258 | 12 | .026 | .818 | 12 | .015 |
| T_A7 | .257 | 12 | .028 | .807 | 12 | .011 |
| T_E1 | .250 | 12 | .037 | .807 | 12 | .011 |
| T_E2 | .375 | 12 | .000 | .706 | 12 | .001 |
| T_E3 | .385 | 12 | .000 | .627 | 12 | .000 |
| T_E4 | .385 | 12 | .000 | .627 | 12 | .000 |
| T_E5 | .400 | 12 | .000 | .674 | 12 | .000 |
| T_E6 | .460 | 12 | .000 | .552 | 12 | .000 |
| T_E7 | .374 | 12 | .000 | .640 | 12 | .000 |
| T_P1 | .450 | 12 | .000 | .575 | 12 | .000 |
| T_P2 | .450 | 12 | .000 | .575 | 12 | .000 |
| T_P3 | .388 | 12 | .000 | .668 | 12 | .000 |
| T_P4 | .450 | 12 | .000 | .575 | 12 | .000 |
| T_P5 | .499 | 12 | .000 | .465 | 12 | .000 |
| T_P6 | .367 | 12 | .000 | .757 | 12 | .003 |
| T_P7 | .404 | 12 | .000 | .721 | 12 | .001 |
| T_H1 | .250 | 12 | .037 | .828 | 12 | .020 |

| | | | | | | |
|------|------|----|-------|------|----|------|
| T_H2 | .300 | 12 | .004 | .809 | 12 | .012 |
| T_H3 | .460 | 12 | .000 | .552 | 12 | .000 |
| T_H4 | .300 | 12 | .004 | .809 | 12 | .012 |
| T_H5 | .331 | 12 | .001 | .650 | 12 | .000 |
| T_H6 | .530 | 12 | .000 | .327 | 12 | .000 |
| T_H7 | .417 | 12 | .000 | .608 | 12 | .000 |
| I_A1 | .323 | 12 | .001 | .780 | 12 | .006 |
| I_A2 | .400 | 12 | .000 | .674 | 12 | .000 |
| I_A3 | .354 | 12 | .000 | .732 | 12 | .002 |
| I_A4 | .417 | 12 | .000 | .608 | 12 | .000 |
| I_A5 | .499 | 12 | .000 | .465 | 12 | .000 |
| I_A6 | .364 | 12 | .000 | .753 | 12 | .003 |
| I_A7 | .417 | 12 | .000 | .608 | 12 | .000 |
| I_E1 | .281 | 12 | .009 | .778 | 12 | .005 |
| I_E2 | .200 | 12 | .200* | .877 | 12 | .080 |
| I_E3 | .441 | 12 | .000 | .587 | 12 | .000 |
| I_E4 | .480 | 12 | .000 | .450 | 12 | .000 |
| I_E5 | .480 | 12 | .000 | .450 | 12 | .000 |
| I_E6 | .374 | 12 | .000 | .640 | 12 | .000 |
| I_E7 | .331 | 12 | .001 | .650 | 12 | .000 |
| I_P1 | .374 | 12 | .000 | .640 | 12 | .000 |
| I_P2 | .398 | 12 | .000 | .699 | 12 | .001 |
| I_P3 | .293 | 12 | .005 | .867 | 12 | .060 |
| I_P4 | .307 | 12 | .003 | .764 | 12 | .004 |
| I_P5 | .460 | 12 | .000 | .552 | 12 | .000 |
| I_P6 | .460 | 12 | .000 | .552 | 12 | .000 |

| | | | | | | |
|------|------|----|------|------|----|------|
| I_P7 | .460 | 12 | .000 | .552 | 12 | .000 |
| I_H1 | .374 | 12 | .000 | .640 | 12 | .000 |
| I_H2 | .460 | 12 | .000 | .552 | 12 | .000 |
| I_H3 | .417 | 12 | .000 | .608 | 12 | .000 |
| I_H4 | .304 | 12 | .003 | .777 | 12 | .005 |

| | | | | | | |
|------|------|----|------|------|----|------|
| I_H5 | .460 | 12 | .000 | .552 | 12 | .000 |
| I_H6 | .374 | 12 | .000 | .640 | 12 | .000 |
| I_H7 | .460 | 12 | .000 | .552 | 12 | .000 |

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction



(2) Mann-Whitney Test

| Ranks | | | | | | | | | | | | | | |
|-------|-------|-----------|--------------|-------|-------|--------|--------|--------|--------|--------|-------|--------|-------|--------|
| Group | N | Mean Rank | Sum of Ranks | | | | | | | | | | | |
| T_A1 | Games | 1 2 | 18.50 | 222.0 | Null | 1 2 | 8.50 | 102.00 | Null | 1 2 | 7.50 | 90.00 | | |
| | Null | 1 2 | 6.50 | 78.0 | Total | 2 4 | | | Total | 2 4 | | | | |
| | Total | 2 4 | | | | | | | | | | | | |
| T_A2 | Games | 1 2 | 16.50 | 198.0 | T_A7 | Games | 1 2 | 16.50 | 198.00 | T_E6 | Games | 1 2 | 15.50 | 186.00 |
| | Null | 1 2 | 8.50 | 102.0 | Null | 1 2 | 8.50 | 102.00 | Null | 1 2 | 9.50 | 114.00 | | |
| | Total | 2 4 | | | Total | 2 4 | | | Total | 2 4 | | | | |
| T_A3 | Games | 1 2 | 16.50 | 198.0 | T_E1 | Games | 1 2 | 15.50 | 186.00 | T_E7 | Games | 1 2 | 11.50 | 138.00 |
| | Null | 1 2 | 8.50 | 102.0 | Null | 1 2 | 9.50 | 114.00 | Null | 1 2 | 13.50 | 162.00 | | |
| | Total | 2 4 | | | Total | 2 4 | | | Total | 2 4 | | | | |
| T_A4 | Games | 1 2 | 16.50 | 198.0 | T_E2 | Games | 1 2 | 17.50 | 210.00 | T_P1 | Games | 1 2 | 16.50 | 198.00 |
| | Null | 1 2 | 8.50 | 102.0 | Null | 1 2 | 7.50 | 90.00 | Null | 1 2 | 8.50 | 102.00 | | |
| | Total | 2 4 | | | Total | 2 4 | | | Total | 2 4 | | | | |
| T_A5 | Games | 1 2 | 18.50 | 222.0 | T_E3 | Games | 1 2 | 16.50 | 198.00 | T_P2 | Games | 1 2 | 16.50 | 198.00 |
| | Null | 1 2 | 6.50 | 78.0 | Null | 1 2 | 8.50 | 102.00 | Null | 1 2 | 8.50 | 102.00 | | |
| | Total | 2 4 | | | Total | 2 4 | | | Total | 2 4 | | | | |
| T_A6 | Games | 1 2 | 16.50 | 198.0 | T_E4 | Games | 1 2 | 16.50 | 198.00 | T_P3 | Games | 1 2 | 16.50 | 198.00 |
| | Null | 1 2 | 6.50 | 78.0 | Null | 1 2 | 8.50 | 102.00 | Null | 1 2 | 8.50 | 102.00 | | |
| | Total | 2 4 | | | Total | 2 4 | | | Total | 2 4 | | | | |
| | Games | 1 2 | 16.50 | 198.0 | T_E5 | Games | 1 2 | 17.50 | 210.00 | T_P4 | Games | 1 2 | 16.50 | 198.00 |



| | | | | | | | | | | | | | |
|------|-------|--------|-------|-------|-------|--------|--------|--------|--------|--------|--------|-------|--------|
| | Null | 1 2 | 8.50 | 102.0 | Total | 2 4 | | | I_A3 | Games | 1 2 | 17.50 | 210.00 |
| | Total | 2 4 | | | T_H4 | Games | 1 2 | 16.50 | 198.00 | Null | 1 2 | 7.50 | 90.00 |
| T_P5 | Games | 1 2 | 18.50 | 222.0 | Null | 1 2 | 8.50 | 102.00 | Total | 2 4 | | | |
| | Null | 1 2 | 6.50 | 78.0 | Total | 2 4 | | | I_A4 | Games | 1 2 | 18.50 | 222.00 |
| | Total | 2 4 | | | T_H5 | Games | 1 2 | 18.50 | 222.00 | Null | 1 2 | 6.50 | 78.00 |
| T_P6 | Games | 1 2 | 16.50 | 198.0 | Null | 1 2 | 6.50 | 78.00 | Total | 2 4 | | | |
| | Null | 1 2 | 8.50 | 102.0 | Total | 2 4 | | | I_A5 | Games | 1 2 | 18.50 | 222.00 |
| | Total | 2 4 | | | T_H6 | Games | 1 2 | 17.50 | 210.00 | Null | 1 2 | 6.50 | 78.00 |
| T_P7 | Games | 1 2 | 16.50 | 198.0 | Null | 1 2 | 7.50 | 90.00 | Total | 2 4 | | | |
| | Null | 1 2 | 8.50 | 102.0 | Total | 2 4 | | | I_A6 | Games | 1 2 | 15.50 | 186.00 |
| | Total | 2 4 | | | T_H7 | Games | 1 2 | 14.50 | 174.00 | Null | 1 2 | 9.50 | 114.00 |
| T_H1 | Games | 1 2 | 15.50 | 186.0 | Null | 1 2 | 10.50 | 126.00 | Total | 2 4 | | | |
| | Null | 1 2 | 9.50 | 114.0 | Total | 2 4 | | | I_A7 | Games | 1 2 | 10.50 | 126.00 |
| | Total | 2 4 | | | I_A1 | Games | 1 2 | 17.50 | 210.00 | Null | 1 2 | 14.50 | 174.00 |
| T_H2 | Games | 1 2 | 15.50 | 186.0 | Null | 1 2 | 7.50 | 90.00 | Total | 2 4 | | | |
| | Null | 1 2 | 9.50 | 114.0 | Total | 2 4 | | | I_E1 | Games | 1 2 | 16.50 | 198.00 |
| | Total | 2 4 | | | I_A2 | Games | 1 2 | 17.50 | 210.00 | Null | 1 2 | 8.50 | 102.00 |
| T_H3 | Games | 1 2 | 9.50 | 114.0 | Null | 1 2 | 7.50 | 90.00 | Total | 2 4 | | | |
| | Null | 1 2 | 15.50 | 186.0 | Total | 2 4 | | | I_E2 | Games | 1 2 | 10.50 | 126.00 |

| | | | | | | | | | | | | | | |
|------|-------|---|-------|-------|------|-------|---|-------|--------|------|-------|---|-------|--------|
| | Null | 1 | 14.50 | 174.0 | | Total | 2 | | | I_H1 | Games | 1 | 18.50 | 222.00 |
| | | 2 | | | | | 4 | | | | | 2 | | |
| | Total | 2 | | | I_P2 | Games | 1 | 16.50 | 198.00 | | Null | 1 | 6.50 | 78.00 |
| | | 4 | | | | | 2 | | | | | 2 | | |
| I_E3 | Games | 1 | 16.50 | 198.0 | | Null | 1 | 8.50 | 102.00 | | Total | 2 | | |
| | | 2 | | | | | 2 | | | | | 4 | | |
| | Null | 1 | 8.50 | 102.0 | | Total | 2 | | | I_H2 | Games | 1 | 15.50 | 186.00 |
| | | 2 | | | | | 4 | | | | | 2 | | |
| | Total | 2 | | | I_P3 | Games | 1 | 11.50 | 138.00 | | Null | 1 | 9.50 | 114.00 |
| | | 4 | | | | | 2 | | | | | 2 | | |
| I_E4 | Games | 1 | 17.50 | 210.0 | | Null | 1 | 13.50 | 162.00 | | Total | 2 | | |
| | | 2 | | | | | 2 | | | | | 4 | | |
| | Null | 1 | 7.50 | 90.0 | | Total | 2 | | | I_H3 | Games | 1 | 18.50 | 222.00 |
| | | 2 | | | | | 4 | | | | | 2 | | |
| | Total | 2 | | | I_P4 | Games | 1 | 12.50 | 150.00 | | Null | 1 | 6.50 | 78.00 |
| | | 4 | | | | | 2 | | | | | 2 | | |
| I_E5 | Games | 1 | 17.50 | 210.0 | | Null | 1 | 12.50 | 150.00 | | Total | 2 | | |
| | | 2 | | | | | 2 | | | | | 4 | | |
| | Null | 1 | 7.50 | 90.0 | | Total | 2 | | | I_H4 | Games | 1 | 12.50 | 150.00 |
| | | 2 | | | | | 4 | | | | | 2 | | |
| | Total | 2 | | | I_P5 | Games | 1 | 6.50 | 78.00 | | Null | 1 | 12.50 | 150.00 |
| | | 4 | | | | | 2 | | | | | 2 | | |
| I_E6 | Games | 1 | 6.50 | 78.0 | | Null | 1 | 18.50 | 222.00 | | Total | 2 | | |
| | | 2 | | | | | 2 | | | | | 4 | | |
| | Null | 1 | 18.50 | 222.0 | | Total | 2 | | | I_H5 | Games | 1 | 18.50 | 222.00 |
| | | 2 | | | | | 4 | | | | | 2 | | |
| | Total | 2 | | | I_P6 | Games | 1 | 6.50 | 78.00 | | Null | 1 | 6.50 | 78.00 |
| | | 4 | | | | | 2 | | | | | 2 | | |
| I_E7 | Games | 1 | 12.50 | 150.0 | | Null | 1 | 18.50 | 222.00 | | Total | 2 | | |
| | | 2 | | | | | 2 | | | | | 4 | | |
| | Null | 1 | 12.50 | 150.0 | | Total | 2 | | | I_H6 | Games | 1 | 18.50 | 222.00 |
| | | 2 | | | | | 4 | | | | | 2 | | |
| | Total | 2 | | | I_P7 | Games | 1 | 6.50 | 78.00 | | Null | 1 | 6.50 | 78.00 |
| | | 4 | | | | | 2 | | | | | 2 | | |
| I_P1 | Games | 1 | 18.50 | 222.0 | | Null | 1 | 18.50 | 222.00 | | Total | 2 | | |
| | | 2 | | | | | 2 | | | | | 4 | | |
| | Null | 1 | 6.50 | 78.0 | | Total | 2 | | | I_H7 | Games | 1 | 15.50 | 186.00 |
| | | 2 | | | | | 4 | | | | | 2 | | |

| | | | | | | | |
|------|--------|------|-------|-------|--------|--|--|
| Null | 1 2 | 9.50 | 114.0 | Total | 2 4 | | |
|------|--------|------|-------|-------|--------|--|--|

| | T_A1 | T_A2 | T_A3 | T_A4 | T_A5 | T_A6 | T_A7 | T_E1 | T_E2 | T_E3 | T_E4 | T_E5 | T_E6 | T_E7 |
|--------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Mann-Whitney U | .000 | 24.00 0 | 24.00 0 | .000 | .000 | 24.00 0 | 24.00 0 | 36.00 0 | 12.00 0 | 24.00 0 | 24.00 0 | 12.00 0 | 36.00 0 | 60.00 0 |
| Wilcoxon W | 78.000 | 102.0 00 | 102.0 00 | 78.00 0 | 78.00 0 | 102.0 00 | 102.0 00 | 114.0 00 | 90.00 0 | 102.0 00 | 102.0 00 | 90.00 0 | 114.0 00 | 138.0 00 |
| Z | -4.638 | -3.027 | -3.027 | -4.638 | -4.638 | -2.996 | -2.992 | -2.238 | -3.786 | -3.027 | -3.027 | -3.786 | -2.293 | -.755 |
| Asymp. Sig. (2-tailed) | .000 | .002 | .002 | .000 | .000 | .003 | .003 | .025 | .000 | .002 | .002 | .000 | .022 | .450 |
| Exact Sig. [2*(1-tailed Sig.)] | .000 ^b | .005 ^b | .005 ^b | .000 ^b | .000 ^b | .005 ^b | .005 ^b | .039 ^b | .000 ^b | .005 ^b | .005 ^b | .000 ^b | .039 ^b | .514 ^b |

| | T_P1 | T_P2 | T_P3 | T_P4 | T_P5 | T_P6 | T_P7 | T_H1 | T_H2 | T_H3 | T_H4 | T_H5 | T_H6 | T_H7 |
|--------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Mann-Whitney U | 24.000 | 24.000 | 24.000 | 24.000 | .000 | 24.000 | 24.000 | 36.000 | 36.000 | 36.000 | 24.000 | .000 | 12.000 | 48.000 |
| Wilcoxon W | 102.000 | 102.000 | 102.000 | 102.000 | 78.000 | 102.000 | 102.000 | 114.000 | 114.000 | 114.000 | 102.000 | 78.000 | 90.000 | 126.000 |
| Z | -3.055 | -3.055 | -3.026 | -3.055 | -4.638 | -3.007 | -3.027 | -2.245 | -2.256 | -2.293 | -3.007 | -4.522 | -3.922 | -1.517 |
| Asymp. Sig. (2-tailed) | .002 | .002 | .002 | .002 | .000 | .003 | .002 | .025 | .024 | .022 | .003 | .000 | .000 | .129 |
| Exact Sig. [2*(1-tailed Sig.)] | .005 ^b | .005 ^b | .005 ^b | .005 ^b | .000 ^b | .005 ^b | .005 ^b | .039 ^b | .039 ^b | .039 ^b | .005 ^b | .000 ^b | .000 ^b | .178 ^b |

| | I_A1 | I_A2 | I_A3 | I_A4 | I_A5 | I_A6 | I_A7 | I_E1 | I_E2 | I_E3 | I_E4 | I_E5 | I_E6 | I_E7 |
|--------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------------|
| Mann-Whitney U | 12.000 | 12.000 | 12.000 | .000 | .000 | 36.000 | 48.000 | 24.000 | 48.000 | 24.000 | 12.000 | 12.000 | .000 | 72.000 |
| Wilcoxon W | 90.000 | 90.000 | 90.000 | 78.000 | 78.000 | 114.000 | 126.000 | 102.000 | 126.000 | 102.000 | 90.000 | 90.000 | 78.000 | 150.000 |
| Z | -3.764 | -3.786 | -3.764 | -4.550 | -4.638 | -2.271 | -1.517 | -2.995 | -1.490 | -3.054 | -3.864 | -3.864 | -4.529 | .000 |
| Asymp. Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | .023 | .129 | .003 | .136 | .002 | .000 | .000 | .000 | 1.000 |
| Exact Sig. [2*(1-tailed Sig.)] | .000 ^b | .000 ^b | .000 ^b | .000 ^b | .000 ^b | .039 ^b | .178 ^b | .005 ^b | .178 ^b | .005 ^b | .000 ^b | .000 ^b | .000 ^b | 1.000 ^b |

| | I_P1 | I_P2 | I_P3 | I_P4 | I_P5 | I_P6 | I_P7 | I_H1 | I_H2 | I_H3 | I_H4 | I_H5 | I_H6 | I_H7 |
|--------------------------------|-------------------|-------------------|-------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------------|-------------------|-------------------|-------------------|
| Mann-Whitney U | .000 | 24.000 | 60.000 | 72.000 | .000 | .000 | .000 | .000 | 36.000 | .000 | 72.000 | .000 | .000 | 36.000 |
| Wilcoxon W | 78.000 | 102.000 | 138.000 | 150.000 | 78.000 | 78.000 | 78.000 | 78.000 | 114.000 | 78.000 | 150.000 | 78.000 | 78.000 | 114.000 |
| Z | -4.529 | -3.055 | -.748 | .000 | -4.586 | -4.586 | -4.586 | -4.529 | -2.293 | -4.550 | .000 | -4.586 | -4.529 | -2.293 |
| Asymp. Sig. (2-tailed) | .000 | .002 | .455 | 1.000 | .000 | .000 | .000 | .000 | .022 | .000 | 1.000 | .000 | .000 | .022 |
| Exact Sig. [2*(1-tailed Sig.)] | .000 ^b | .005 ^b | .514 ^b | 1.000 ^b | .000 ^b | .000 ^b | .000 ^b | .000 ^b | .039 ^b | .000 ^b | 1.000 ^b | .000 ^b | .000 ^b | .039 ^b |

- a. Grouping Variable: Group
- b. Not corrected for ties.