Depictions Of Intelligent Technologies in Video Games and Its Correlations to AI Technological Acceptance Among the Public

Master's Thesis in Informatics

Submitted by

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Abstract

This study examined the portrayal of artificial intelligence (AI) in video games and explored the potential correlation between video game exposure and individuals' level of technological acceptance of AI virtual assistants. A Qualitative Content Analysis (QCA) of several popular video games is conducted to analyze their depiction of AI characters, their roles, and interactions within game narratives. Additionally, this study used a previously validated survey instrument based on the Technological Acceptance Model (TAM) to assess how certain video game playing habits and trust of AI virtual assistants are correlated. We found that portrayal of AI characters in the games analyzed show that AI is often portrayed as humanized and more advanced than its real-world counterpart, and that it is often hostile to humans. The analysis of the survey results found that there is a moderate positive correlation between playing video games featuring AI and willingness to use AI virtual assistant technologies. The findings of this study will contribute to the growing field of AI portrayals in popular media and provide insights into the influence of video games on individuals' perceptions and acceptance of AI technology.

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List of Abbreviations

AI	Artificial Intelligence
AGI	Artificial General Intelligence
ANI	Artificial Narrow Intelligence
CFA	Confirmatory Factor Analysis
QCA	Qualitative Content Analysis
TAM	Technology Acceptance Model

1 Introduction

In recent years, artificial intelligence has made significant advances, and its impact can be felt across a wide range of industries and domains. At the same time, video games have become a major form of entertainment, with millions of players around the world engaging with virtual characters, environments, and stories. An emerging trend within video games, and fiction in general, is the depiction of AI within its worlds.

Given this intersection of technology and entertainment, it is important to understand how depictions of AI in video games might influence people's perceptions and attitudes towards this technology. Prior work has shown that, historically speaking, a non-insignificant amount of HCI has been informed by popular media such as movies or books [29], and people tend to develop preconceived notions about how a technology works through their exposure to pop culture [7]. Video games, being a relatively new form of media, offer a unique interactive experience compared to other forms of media. Players can directly interact with technological depictions in video games, which may affect their perception of technology in a way that has not been seen before.

Video games have also been demonstrated to influence the emotional responses of their players. For instance, a chapter from *The Routledge Handbook of Refugee Narratives* [21] explores how game-space is utilized to elicit empathetic responses from players towards refugees. In another study [51], video games with compelling narratives were found to affect players' 'perspective-taking,' a key component of empathy. These studies suggest that video games hold the potential to shape perceptions of specific subjects. Consequently, it's possible that engaging with video games featuring AI characters could spark positive emotional reactions towards AI technologies, thereby fostering greater acceptance.

This research attempts to fill a gap in our understanding of the relationship between video games and people's perceptions and attitudes towards AI. Despite the widespread use of both video games and AI, there has been limited research examining the ways in which video games might influence people's understanding and beliefs about AI. There has been previous work in this space that measures public perception of AI by analyzing comments on YouTube videos [34], but there has not been any similar research regarding video games.

In short, this research aims to answer the following research questions:

1. How is AI depicted in video games and what are its most common features?
2. How is playing video games, and playing video games that contain depictions of AI, with a person’s willingness to use an AI virtual assistant based on the TAM model correlated?

For this purpose, this research conducted a qualitative analysis of popular video games that depict AI in order to extract the most common and prominent characteristics present in these games. The results of this analysis will be linked to a validated Technology Acceptance Model (TAM) survey that measures a participants’ trust towards virtual AI assistant technologies. The technology Virtual AI assistants was chosen as it is an existing technology that most resembles the AGI often depicted in video games. This survey is correlational, aiming to see if there is a correlation between playing more video games (and specifically ones featuring AI characters) and willingness to use AI technologies.

The contribution of this research will be three-fold. Firstly, it will provide valuable insights into the depictions of AI in popular video games through a thorough qualitative analysis. Secondly, it will provide a basis for a survey instrument that can be used for future research in this field. Lastly, the study will

generate empirical data on the relationship between video games and people's perceptions of AI. This will provide a deeper understanding of this relationship and its impact on public attitudes and beliefs towards AI. Among these three, this research's contribution will focus primarily on the knowledge side of things rather than the empirical side. This is because this research is aims to be exploratory and inform future research in this area, so a large sample size or power analysis [10] is outside the scope of this research.

2 Theoretical Framework

2.1 Introduction to Artificial Intelligence

While there is no universal definition of AI as its purpose and capabilities have evolved over the years, it is described by one researcher as “AI is any program that does something that we would think of as intelligent in humans [37]”. An AI can refer to a wide range of technologies and capabilities, which according to Davidson [14], can be broadly separated into two categories:

- Artificial Narrow Intelligence (ANI), or “weak AI”: a specific type of artificial intelligence in which a technology outperforms humans in some very narrowly defined task. Unlike artificial general intelligence, narrow artificial intelligence focuses on a single subset of cognitive abilities and advances in that spectrum.
- Artificial General Intelligence (AGI), or “strong AI”: An AI that allows a machine to apply knowledge and skills in different contexts. This more closely mirrors human intelligence by providing opportunities for autonomous learning and problem-solving.

AGI has not yet been achieved with our current technology [50]. Most publicly available technologies marketed as AI are ANI. Examples include self-driving cars, text or image generation, AI virtual assistants, and facial recognition software. In contrast however, many fictional works do not portray AI as ANI. Famous characters such as HAL9000 in Stanley Kubrick’s 2001: A Space Odyssey [13] is depicted as an AGI [40]. This trend is also true for video games, the medium that this research focuses on.

2.2 AI virtual assistants

A spoken dialogue system is an artificial intelligence agent that is capable of assisting users in performing tasks more efficiently through spoken interactions [24]. It is becoming increasingly common for spoken dialogue systems to be incorporated into various devices such as smart-phones, smart TVs, and in-car navigation systems [12]. A dialogue system, often referred to as a conversational system, can be used in a variety of business environments, educational institutions, government agencies, healthcare facilities, and entertainment venues. Personal assistants are known by various names such as virtual personal assistants, intelligent personal assistants, digital personal assistants, mobile assistants, or voice assistants [33]. In this research, they will be referred to as "AI virtual assistants". Examples of AI virtual assistants include Microsoft Cortana, Google assistant, and Amazon Alexa.

AI virtual assistants is the focus of this research as it is the technology that is the closest real-world approximation to nuanced, humanized AGI entities that are often depicted in video game narratives. The Technology Acceptance Framework (TAM) is used to determine if playing video games (and certain types thereof) correlates with the amount of trust a person places in an AI virtual assistant.

2.3 Video Games, Types, and Impact

A video game is a digital interactive form of entertainment that encompasses various mediums and genres, typically played on electronic devices such as computers, consoles, or mobile devices. It involves the use of visual and auditory elements, game mechanics, and player input to create an immersive and engaging experience. Video games can range from simple puzzle-solving challenges to complex narratives with rich virtual worlds, allowing players to assume the roles of characters and interact with virtual environments. They often feature objectives, rules, and progression systems that provide a sense of accomplishment and reward, encouraging players to explore, strategize, and overcome challenges within the game's framework. Video games have become a significant cultural phenomenon, with their impact extending beyond entertainment, influencing fields such as education, psychology, and social interaction.

There are several types of video games, or genres, which include action, adventure, fighting, platforming, racing, roleplaying, shooter, and many more. [49]

2.3.1 Behavioral Impact of Video Games

There is an ongoing debate regarding whether video games affect a players' emotion and behaviors or not. The researchers in the field are divided into two camps, with one camp concluding that video games affect players either positively or negatively, while the other camp denies this effect. In a meta-analysis done by Quwaider et. al. however, they conclude that most studies show there is a relationship between video games and players' behavior, with the studies denying so relying on small numbers of participants or weak evidence. [41]

Indeed, Video games have shown many challenges to players' behavior, both for the better and for the worse. This may provide new opportunities for learning new behaviors and skills or for developing pre-existing behaviors and skills as shown in [3]. In particular, this is true for adolescents, the largest segment of gamers, as their personalities have not yet fully developed [47].

Several studies are presented in [18] demonstrate the positive effects of playing video games. They divide their study into four domains: cognitive (e.g., attention), motivational (e.g., resilience in the face of failure), emotional (e.g., mood management) and social (e.g., prosocial behavior).

Games can also change how people learn, feel, and behave in various domains, such as STEM, civics, and health [39]. One example is "*Re-Mission",* a game that attempts to show how cancer treatments work in the body. In the same study, players took 16% more prescribed antibiotics and had 40% more oral chemotherapy metabolites in their blood than young adults who did not play the game [23].

By providing immersive storytelling experiences that evoke strong emotional responses and foster personal connections, narrative-focused video games have a profound impact on individuals. The narratives in these games are often characterized by complex characters, intricate plotlines, and thought-provoking themes, which allows players to engage with compelling narratives in a unique and interactive manner [2].

2.3.2 Video Games and Perception

Video games use storytelling to transport players into fantastical worlds, challenging their perspectives, eliciting empathy, and igniting their imagination. When players adopt the roles of characters and make meaningful choices within the narrative, they are able to experience personal growth, emotional catharsis, and even introspection [11]. However, other research suggests that narrative-focused video games result in less learning than a comparable slideshow, although the authors did not test longer periods of gameplay [1].

While there has not been previous empirical research done regarding how video games may affect an individual's perception of technology, we can perhaps look to research in how video games have affected an individual's perception in other issues. Among them are the following:

As mentioned in the introduction, a study [51] shows that video games with compelling narratives were found to affect players' 'perspective-taking,' a key component of empathy. These studies suggest that video games hold the potential to shape perceptions of specific subjects.

Another study, an analysis of NeoGAF forum posts about *Resident Evil 5* by McKernan [32] found that fans of the game are quick to defend problematic racial depictions in the game, arguing for "color-blind" racism, and accusing its detractors of being racist themselves. This shows that an attachment to a game

can affect someone's views in a very real way, and problematic depictions can serve to reinforce problematic views that an individual already holds.

Dill and Thill conducted a study [16] that focused on gender depictions in video games. Their content analysis revealed a prevalent presence of sexism in video games and related media. Furthermore, their subsequent survey targeting teenagers discovered that these individuals held stereotypes associating male characters with aggression and female characters with sexual objectification. Notably, these beliefs were not limited to gamers alone but were also present among non-gamers. These findings suggest that video games hold significant cultural influence among the younger generation, extending beyond the boundaries of active gaming participation. It highlights the pervasive impact of video game depictions on societal perceptions, even among individuals who may not consider themselves as regular gamers.

It is not all cut-and-dry, however. A longitudinal study conducted by Breuer et al. [6] found that cultivation theory, suggesting long-term exposure to media content shapes perceptions of social realities, did not apply to gendered depictions in video games. Over the course of their three-year study, they did not find a significant correlation between playing video games and beliefs about societal gender roles.\

In a somewhat related field, virtual reality (VR) therapy has been gaining relevance as an effective way to manage certain phobias. In a meta-analysis of 25 papers by Salehi et al. [45], they found that VR therapy is the most effective tool in managing social phobia. This shows that video games, a medium that is the basis for many VR experiences, can challenge long-held beliefs and individual holds towards themselves and the world.

There have also been games that are specifically developed to change a person's perception about a specific subject. These include:

- *PeaceMaker* was created at Carnegie Mellon University in 2005 and assigns players the task of establishing peace between Israel and Palestine. Studies have shown that players of the game become more knowledgeable regarding the Palestinian-Israeli conflict and changing players' attitudes towards the issue [22].
- *SPENT* attempts to make players more sympathetic to the homeless by asking them to make financial choices on a shoestring budget to avoid ending up on the street. Unfortunately, this backfired, instead causing players to lose sympathy for homeless people and boost the players' belief in meritocracy [43].

These contrasting findings highlight the complexity of the relationship between video games and perceptions. While there is evidence suggesting that video games may influence individuals' perceptions, it is essential to recognize that long-term effects and the overall impact may require further investigation. This study aims to address the research gap by examining the relationship between video games and technological acceptance. However, it is important to note that this study's scope may not be as comprehensive as a longitudinal study, which allows for a more thorough exploration of long-term effects.

2.4 Fiction, Technology, and AI

It can be argued that some facets of technology research are informed by depictions of technology in fiction. As discussed previously, a non-insignificant amount of HCI has been informed by popular media such as movies or books [1], and people tend to develop preconceived notions about how a technology works through their exposure to pop culture [2]. Video games are a relatively new medium, and their long-term effects on technology have not been observed or measured. This is additionally important as

most video game players are adolescents [47], and many of them will grow up to join technology research with preconceived notions that they have learnt from video games.

As with any technology, AI is often influenced by fictional depictions of AI that came before it. In an essay by Roberto Musa Giuliano he states that:

> To a greater extent than in other technical domains, research and progress in Artificial Intelligence has always been entwined with the fictional ... fiction, science fiction most of all, has historically played and is still playing in the discussion of AI by influencing researchers and the public, shifting the weights of different scenarios in our collectively perceived probability space. [35, p.1]

The relationship of AI and fiction can be seen as a feedback loop. Fiction impacts the conception, genesis, and culture of AI development, and AI development affects the production of fictional media [17], [44]. This is in addition to the fact that many AI researchers got their start with their fascination of AI in science fiction [35]. Not to mention the fact that the other way around it is true – AI researchers can produce sci-fi works as well [19], [31]. However, narrative fiction has far more influence over AI researchers than simply driving them to the field. Stories, like other "semiotic resources" [25], act as anchoring points in the space of ideas, influencing the thinking about AI that goes on. As large companies that develop AI technologies tend to remain opaque regarding their inspirations, concrete examples, such as consumer products clearly inspired by fiction, are rare. However, there is a clear pattern, and it is safe to assume that fiction plays a large role in AI research.

2.4.1 Depiction of AI in Fiction

In research by Larson [26], he demonstrated that technological depictions in fiction often mirror real-world technological developments at the time the piece is made, showing that when it comes to fictional technologies, authors may limit their imaginations as a suspension of disbelief requires a level of believability in order to be achieved. There is an exception to this rule however, and that concerns AI technologies. Depictions of AI in fiction has arguably been “too advanced”, as even current technologies cannot replicate the kind of AI portrayed in works dating back to 1927.

In addition, depictions of AI in fiction are not always accurate to the current state of the technology. Isabella Herman states, “To make the drama work, AI is often portrayed as human-like or autonomous, regardless of the actual technological limitations” [20, p.1]. She goes on to state that obtaining an understanding of AI solely from fiction can paint a distorted image of the technology’s potentials and risks. Strengthening this point, to this, Osawa et. al [36] discusses that there are certain “stereotypes” when it comes to AI depictions. One of these is that human-type AI (or androids) are often used as a storytelling tool to demonstrate the concept of “other”. For example, some stories uses androids to demonstrate the concept of racial discrimination, and this works as no matter the reader, an android will always be an “other” to themselves. While this is an effective storytelling tool, to bring the point back to Herman’s statement, they are not exactly very concerned with how technically realistic its depiction is.

These research in part informs the focus of our research. While it is known that media can affect a person’s view of AI, this research aims to see to the extent whether not only video games affect someone’s potential acceptance of the technology, but how AI depictions in video games are, and how these possibly skewed depictions may affect a person who plays these games.

2.5 The Technology Acceptance Model

In a variety of studies, the Technology Acceptance Model (TAM) has been used [28]. Essentially, it consists of a conceptual framework that predicts attitudes toward, and subsequent acceptance of technologies based on beliefs about ease of use and usefulness. Perceived Usefulness (PU), Perceived

Ease of Use (PEU), Attitude Towards technology Use (ATU) and Behavioral Intention (BI) are central factors in the Technology Acceptance Model. Besides the general model, some studies have developed a model specific to their study by modifying the general TAM framework. This study intends to use a modified TAM framework tailored to AI virtual assistants to measure whether differences in technological acceptance of AI correlates to certain video game playing patterns. To this end, this research uses the modified TAM constructed and validated by Zhang et. al. [53]. Their model can be seen in figure 2.1.

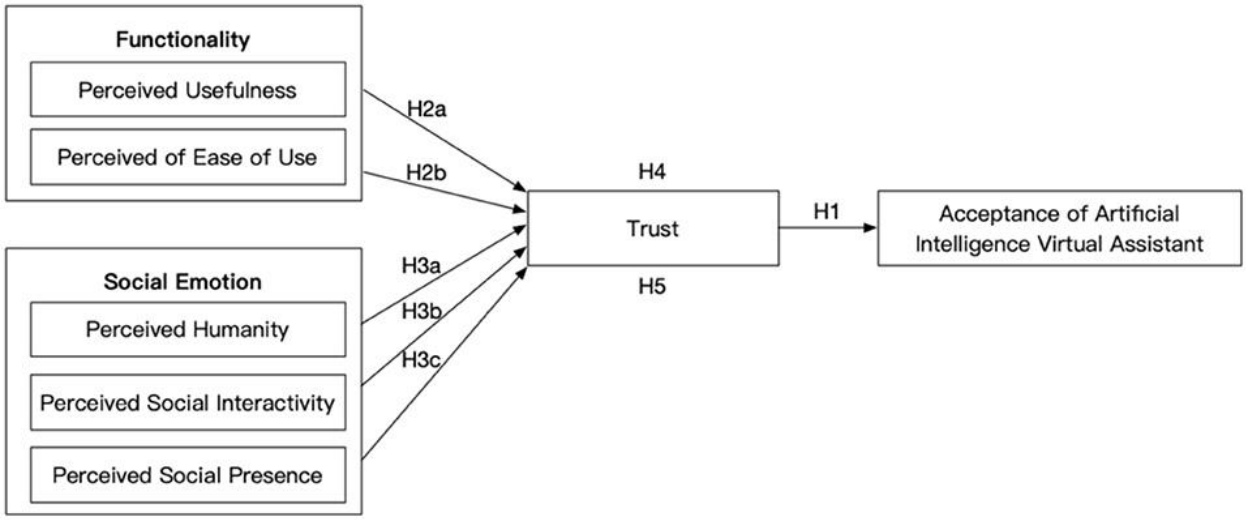

Figure 2.1: Modified TAM framework for use of measuring technological acceptance of AI virtual assistants. The H letters stands for correlative hypotheses that have been validated in Zhang et. al.'s study. [53]

Zhang et. al.'s model combines the basic TAM with factors from the service robot acceptance model. These factors are defined as follows:

- **Perceived Usefulness**, defined by Fred Davis as "the degree to which a person believes that using a particular system would enhance their job performance" [15].
- **Perceived Ease of Use** defined as "the degree to which a person believes that using a particular system would be free from effort" [15].
- **Perceived Humanity**, also known as anthropomorphism, refers to whether the user perceives the AI virtual assistant as human during interaction with it [53].
- **Perceived Social Interactivity** can be defined as the perception that the AI virtual assistant displays appropriate actions and "emotions" according to societal norms [48].
- **Perceived Social Presence** refers to the degree to which the user perceives the AI virtual assistant as a social entity. Perceived social presence means that the user has a perception of human interaction with the AI virtual assistant that is personal, social, warm and sensitive [53].
- **Trust** is defined as the user's confidence that the AI virtual assistant can reliably deliver a service [48].

The graph presented illustrates the correlation between the modified TAM framework variables and the acceptance of AI virtual assistants. The study demonstrates that perceived usefulness, perceived ease of use, perceived social interactivity, and perceived social presence are positively correlated with trust (H2a, H2b, H3b, H3c), whereas perceived humanity exhibits an inverse U-shaped relationship with trust (H3a). Additionally, the study indicates that trust is positively correlated with the technological acceptance of AI

virtual assistants (H1). However, it is important to note that H4 and H5, which concern the mediating role of trust, are beyond the scope of this study.

In summary, the graph highlights the strong correlations between these five factors and the acceptance of AI virtual assistants. By measuring these factors in relation to video game playing habits, the study aims to draw conclusions about the technological acceptance of AI virtual assistants based on the survey results.

In light of what has been discussed, there are indications that AI research and development is affected by how it is portrayed in fiction, while video games can have a significant impact on people in a variety of ways. Despite this, there has been no research that examines the intersection between these two factors. This research analyzes how AI is depicted in popular video games, and aims to test whether video games, be it games that feature AI characters or not, result in lasting perceptions when it comes to trust of AI virtual assistants. This research does not however, attempt to analyze the broader trends of how AI depictions in video games may affect future AI research.

3 Methodology

As mentioned in the introduction, this study adopts a mixed-method approach, integrating both qualitative and quantitative techniques to answer the research questions. In the qualitative component of the study, we employ qualitative analysis methods to identify patterns and common characteristics in the portrayal of AI in video games. The insights gleaned from this analysis will then guide the formulation of hypotheses for the quantitative phase of our research.

For instance, if the qualitative research reveals that AI in video games is frequently represented as basic machines, this could inform a potential hypothesis that video games do not significantly influence an individual's perception of the human-like qualities of real-world AI technologies.

These hypotheses are then evaluated via a survey, with the results of the data analysis being presented in the form of figures and statistical measures. The specifics of each of these methods are further elaborated in the following sections.

3.1 Qualitative Analysis

For investigating how AI is depicted in video games, a qualitative analysis was conducted using the "Qualitative Content Analysis" (QCA) technique developed by Margrit Schreier [46]. This method involves a process of "unitizing" a data set, whereby the data is broken down into discrete units of analysis (this will be expanded in a later section). Each unit is then assigned a code from a “coding frame” that is constructed beforehand. The construction of this coding frame will also be explained in the following sections. The aim of this analysis was to gain a deeper understanding of how AI is portrayed in video games and to identify any common themes or patterns that may emerge from the data. By using this method, we intended to gain meaningful insights from the data and use it to inform the construction of the survey.

QCA was chosen as the method of analysis as its main strength is that it can analyze both textual and visual data, both crucial elements to most video games. We have chosen to utilize the QCA method also since it offers the desired flexibility and adaptability to study a broad range of video games from various developers. We used a more data-driven approach to QCA, also known as the “inductive” approach. The goal is to learn how AI is represented in video games not via existing theories of AI depiction, rather by building a coding frame around the dataset. In other words, the data guides the analysis. More in-depth reasoning will be provided in the “Coding Framework” section. In short, the aim is to identify trends within the data related to dimensions and subcategories in the coding frame, such as AI's attitude towards humans, reliability, and functionality, etc.

3.1.1 Data Collection

To begin content analysis, it is essential to gather relevant data on the portrayal of AI in video games. However, due to the diverse nature of video games as a medium, the collection of such data can be a challenging task. Video games incorporate various elements such as visuals, sound, narrative, and player choices, which operate cohesively to create a unified experience. Therefore, it becomes crucial to identify and select relevant data that accurately represents the portrayal of AI in video games, while also considering the broader context of the game's narrative, mechanics, and design elements.

The initial stage of data collection involves selecting the video games that will be analyzed. For this purpose, nine video games have been chosen based on their popularity and the significance of AI or robot depiction within them. The data concerning the popularity of these games was collected from the "Steam best seller" charts or company financial reports, as appropriate. Moreover, the prominence of AI within

these games was determined through personal experience or observation of gameplay videos. The following games have been selected for analysis:

- ***Stellaris,*** developed by Paradox Interactive.
- ***Super Mario Galaxy,*** developed by Nintendo.
- ***Sid Meier's Civilization 6,*** developed by Firaxis Games.
- ***Portal,*** developed by Valve.
- ***Apex Legends,*** developed by Respawn Interactive.
- ***Detroit: Become Human,*** developed by Quantic Dreams.
- ***The Sims 4,*** developed by Maxis/EA Play.
- ***Overwatch,*** developed by Activision Blizzard.
- ***Fallout 4,*** developed by Bethesda Game Studios.

Furthermore, to ensure that the observed trends apply to the video game medium, we have made sure to select games from different developers. By doing so, any biases that may come from a particular development team's approach to AI portrayal can be minimized. Therefore, we can be sure that the trends observed in these video games apply more to the video games medium, and not just a bias of a group of people from one development team.

Determining which part of the video game will be collected for analysis presents another challenge. The video games chosen for this study can feature over 60 hours of content, and "infinitely replay-able" games such as The Sims 4 or Stellaris can have even longer playtimes. Previous research [citation here] that attempted to analyze themes in video games such as violence opted to focus on the first 5-10 minutes of the games they analyze, which we feel is not enough to draw a good conclusion from. Using this method will result in a skew towards analyzing the opening or introduction section of a game, which are often completely different in tone to the rest of it.

To conduct an analysis that is both thorough but still manageable, we have opted to extract the relevant section regarding the depiction of AI from these video games. This will be further explained in the specifics of each game in the results section, but as an example, in the case of Stellaris, the game's narrative is conveyed through "events" that the player can encounter randomly throughout the game. These events are presented in dialogue boxes, and we have collected all relevant events from Stellaris that relate to the portrayal of AI. The events have been compiled into a text document, which serves as the data for analysis. Additionally, the text document includes visual elements, such as portraits of the artificial beings featured in the game. This approach ensures that the data collected for analysis is representative of the game's portrayal of AI and is not biased towards a particular section or element of the game.

In cases where a game is less text-focused, such as *Super Mario Galaxy*, information regarding the appearance and behavior of AI entities in said game are collected from a fan wiki, and the information is cross-referenced to footage from the game to ensure accuracy.

3.1.2 Unitizing

The QCA method involves unitizing the data for analysis into two types of units: units of analysis and units of coding. In most cases, units of analysis are based on characteristics that make two things easily distinguishable (originating from different sources, for instance), whereas units of coding break down the data within these units of analysis into small segments, each of which are assigned a code representing the relevant dimension within the coding frame. The unit of analysis in a more traditional setting, such as

analyzing an interview transcript, would typically be one interview with one subject, while the unit of coding would typically be a sentence, a few sentences, or a paragraph [46].

In this study, the units of analysis is be one game, but the units of coding differs for each game. This is because the data in each game can differ greatly. As mentioned in the previous example, Stellaris contains paragraphs displayed in dialogue boxes. Therefore, the units of coding for this game can simply be each dialogue box. For games that are less text-heavy, such as Overwatch, the data is largely voice lines and dialogue spoken by the characters during gameplay. If each voice line is its own unit of coding,

the data becomes too fragmented since one voice line rarely contains enough context and information to be coded in multiple dimensions. The coding units in Overwatch are therefore groups of lines of dialogue pertaining to a particular subject.

3.1.3 Coding Framework

For this analysis, the coding frame is mainly built inductively (data driven), in which categories are created based on the data. This method is appropriate for this research, as the aim of this analysis is to describe the material in detail. However, using a completely data-driven approach is rare and can risk missing important details in the data. To this end, we augment the data-driven categories with theory-driven categories derived from logic.

The exact mix of data-driven and concept-driven is that most main categories are derived from the data, while a few additional categories that are deemed appropriate from previous literature are added. As Schreier states, in some mixed coding frames most categories are data-driven, with only a few concept-driven ones added [46] and this is the approach this research takes. We chose this mix because we want to capture the descriptive aspect of AI depiction in video games, which is a broad topic, and this approach allows us to be closer to the data.

The strategy used to derive categories from the data that is used is progressively summarizing, and the procedure is as follows, as suggested by Mayring [30].

- Paraphrasing relevant passages.
- Subjectively deleting superfluous parts of the paraphrase.
- Grouping and summarizing similar paraphrases.
- Use the paraphrase to generate category names.

Table 3.1 shows a few examples of paraphrases and its respective final subcategories under the main category “AI Capabilities”:

NO.	PARAPHRASE	SUBCATEGORY
1	Artificial intelligence civilization is shown to be able to terraform planets.	Achieving impossible feats
2	Robot character helps investigation by reconstructing murder scene from clues in the crime scene in real time.	Achieving impossible feats
3	Robot character has improved physical capabilities compared to a normal human.	Exceeds human capabilities
4	Robots are shown to be capable of taking over human jobs to the point that this causes unrest.	On-par with humans
5	Some robots are shown to be physically and mentally indistinguishable from humans.	On-par with humans
6	Robots are depicted as simple beings, only used by humans for menial labor	Inferior to humans

7	The robot is shown as incapable of doing certain tasks that humans in the game can do.	Inferior to humans

Table 3.1: Examples of paraphrasing of the data and subsequent subcategories (codes)

3.1.4 Coding

Prior to the main coding phase, a trial phase is conducted for the first draft of the coding frame. The purpose of this trial phase is to apply the coding frame to the data and determine which categories are ambiguous or difficult to apply. It is possible that some categories overlap, or that the phrasing of a category may be awkward, and identifying these is the purpose of the trial phase.

During a trial coding session, all coders (in this case, the researcher and another university student), who are familiarized with the research beforehand, participate in a "blind coding" session. Each coder applies the coding frame to a pre-selected section of the material individually, and the results are then compared. At this point, all coders discuss their results. Finding out whether each coder interprets a category or subcategory differently is particularly important. The category might not be sufficiently clear and should be revised.

After the trial phase, the main coding phase starts. In the main coding phase, the whole dataset is examined, and each coding unit is assigned a code in one or more dimensions. It is important to note that each coding unit is not coded in the same dimension more than once by one coder but may contain several different dimensions. As with trial coding, the researcher and the additional coder do the coding individually.

Upon completion of the coding, the two coders compare the results. In the event that a unit is coded twice on the same dimension by separate coders, and the codes do not match, the matter is discussed, and a final code is chosen. To ensure the reliability of the coding frame, a percentage of agreement is calculated using this formula. A higher percentage indicates a more consistent coding frame between coders and a more reliable coding frame. The formula for calculating this factor is the following:

$$Percentage\ of\ agreement = \frac{Number\ of\ units\ of\ coding\ on\ which\ the\ codes\ agrees}{Total\ number\ of\ units\ of\ coding} \times 100$$

A percentage of over 90% is considered ideal, and a low percentage (below 70%) indicates that the coding frame may be flawed and that codes are ambiguous or overlap each other. In this case, the coding framework is revised, and a subsequent re-coding process is done.

3.1.5 QCA Results

A quantitative, absolute frequency format is used to present the results of the QCA analysis. This means that the number of occurrences for each category and subcategory is displayed. Since the dataset contains more categories but shorter ones that are self-explanatory, this method of presenting the findings was chosen. This display method makes it easier to perceive general trends in code occurrences within a single dimension. Additionally, a bar chart is included to illustrate the frequency of code occurrences in the most common categories.

3.2 Survey Instrument

For this study, a survey instrument was developed to gather data on participants' attitudes and beliefs concerning AI virtual assistants, in relation to their video game playing habits. The survey consists of two sections: the first section focuses on collecting information about participants' video game playing habits, while the second section includes the main survey, which utilizes a validated Technology Acceptance Model (TAM) survey to assess participants' trust in AI virtual assistants.

The video game playing habits section of the survey inquiries about the frequency of participants' video game engagement and their frequency of playing video games that feature AI. This section utilizes a Likert scale, ranging from "not at all" to "frequent/daily," to capture participants' responses.

The main section of the survey draws upon the TAM survey developed by Zhang et al. [53], which has been previously validated. This section specifically focuses on measuring trust in AI virtual assistants and encompasses five facets or dimensions.

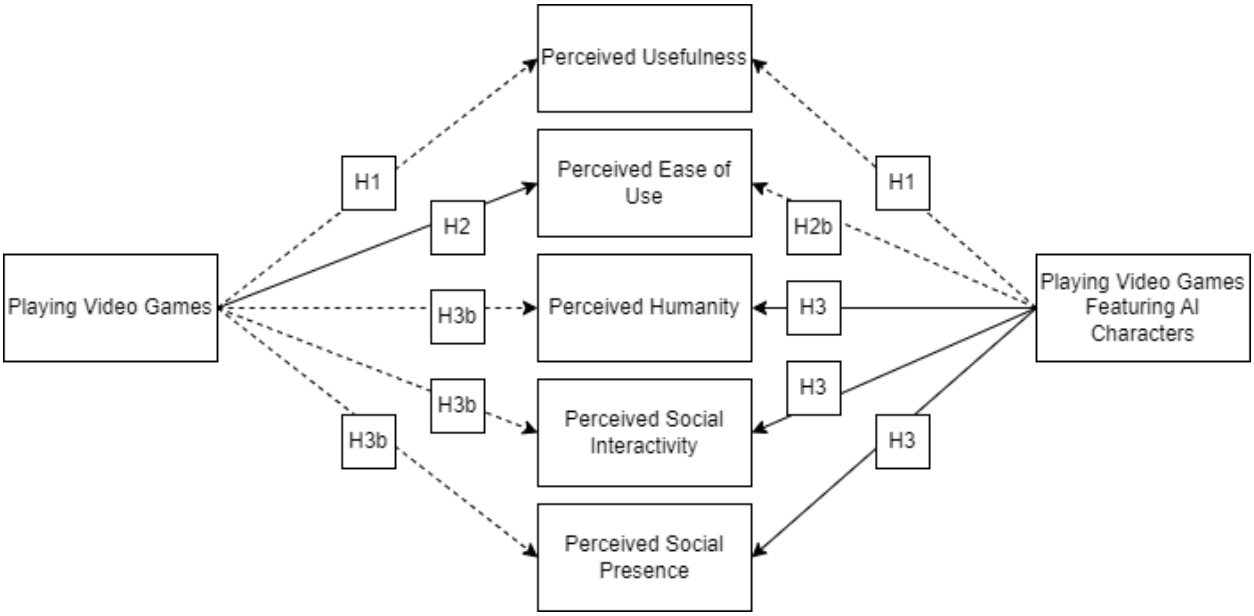

Figure 3.1: Hypotheses Diagram

The study proposes several hypotheses regarding the relationships between participants' video game playing habits and their attitudes towards AI virtual assistants, as measured by the validated TAM survey. The following hypotheses are formulated:

- H1: Perceived Usefulness is hypothesized to not be correlated with playing video games, regardless of whether they feature AI characters.
- H2: Perceived Ease of Use is hypothesized to have a positive correlation with playing video games in general.
- H2b: Perceived Ease of Use is hypothesized to have no correlation with playing video games that feature AI characters, separate from the effect already applied by playing video games in general.
- H3: Perceived Humanity (anthropomorphism), Perceived Social Interactivity and Perceived Social Presence are hypothesized to have a positive correlation with playing video games that feature AI characters.
- H3b: Additionally, Perceived Humanity (anthropomorphism), Perceived Social Interactivity and Perceived Social Presence are hypothesized to have no correlation with playing video games that do not feature AI characters.

Refer to Figure 3.1 for a visual representation of these hypotheses. The diagram provides a simplified overview of the proposed relationships between the variables.

The study anticipates that the results of the QCA will provide insights into unique characteristics or quirks in the depiction of AI within the medium of video games. These insights derived from the QCA

analysis may lead to slight adjustments or refinements in the original hypotheses formulated for the survey. The discussion in the results section will highlight these modifications if they are present.

The survey questions used to measure these facets uses a Likert scale to measure participants' agreements with the presented statement. A complete list of questions used in the survey is included in Appendix A. The survey questions regarding the TAM constructs are adapted from Zhang et al.'s analysis of the correlation of TAM and trust in AI virtual assistants [53]. The questionnaire encompasses several questions designed to assess each of the five constructs, and they have been validated via confirmatory factor analysis (CFA). These question sets exhibit high reliability, indicated by Cronbach's α coefficient greater than 0.7 across the board. Moreover, they demonstrate strong validity, as each question possesses a load factor exceeding 0.4, an average variance extracted (AVE) surpassing 0.5 and a composite reliability (CR) exceeding 0.7.

Additionally, to ensure the clarity of the survey instrument, a pilot test was conducted with 10 individuals. Based on the feedback and insights gained from the pilot participants, minor revisions were made to improve the clarity of the survey instrument.

3.2.1 Respondent Gathering

This research aspires to gather an adequate number of participants to examine the hypotheses. However, as this study is exploratory in nature, we do not aim for extremely large sample sizes in the thousands. Keeping in mind the situational and budgetary constraints, we have set a target sample size of n=400. We believe this number is adequate to test our hypotheses with a reasonable degree of confidence, which is the objective of the quantitative phase of this study.

The target population consisted of individuals in the United States. The reason we chose to limit the population to a single country is because a previous study has shown that people in different countries tend to view AI differently [27]. The choice of the United States as the research focus stems from cultural considerations. Firstly, the United States is a large English-speaking country with a more homogenized culture. As a developed country, it's also more likely that the subject of AI is more widely known in the US compared to developing countries. In contrast, countries like India, although also possessing a large English-speaking population, exhibit significant cultural diversity. This cultural diversity could potentially introduce confounding factors into the survey results. In addition, it is likely that many in the country have not heard much about AI, limiting their ability to have informed opinions on the subject. Hence, by selecting the United States as the research focus, it allows for a more homogeneous sample in terms of cultural influences and technological literacy.

To maximize the reach and diversity of participants, a crowdsourcing approach was adopted for sampling in this study. The survey was specifically administered on Amazon Mechanical Turk (mTurk), which was chosen based on previous demographic surveys indicating that a significant proportion of workers on the platform are from the United States. These workers were also found to be relatively representative of the population of U.S. internet users [42], [54].

Furthermore, the average age of workers on mTurk is reported to be 36 years old, which is younger than the average age of the general U.S. population [38]. This demographic characteristic is particularly relevant for this study since video game players tend to fall within the younger age range, typically ranging from 13 to 36 years old. Therefore, having a substantial number of participants from this demographic group enhances the suitability and relevance of this recruitment method.

By selecting mTurk as the platform for survey distribution, this study aims to ensure a diverse sample with a concentration of participants representing the target demographic of video game players. This

choice facilitates the collection of data that can be more generalizable to the broader population of video game players and contributes to the validity and relevance of the study's findings.

Addressing the potential concern regarding response validity when utilizing crowdsourced data, this study incorporates techniques previously discussed by Brühlmann [9]. These techniques, including the implementation of the SRSI UseMe item, the Bogus Item, and the IRI, have been effective in identifying careless participants and enhancing the internal validity of the data.

In Brühlmann's research, these measures successfully identified 180 out of 181 careless participants, leading to increased effect size, decreased p-values, and improved overall internal validity. Building on these findings, this study believes that by employing these techniques, reliable crowdsourced data for our own survey can be achieved.

It is important to note that while this sampling approach provides access to a large and diverse pool of respondents, it is inherently limited to individuals with internet access and those who engage in crowdsourcing platforms. Therefore, the generalizability of this study may not be applicable to populations who do not have internet access.

3.2.2 Statistical Method

As CFA has previously been done for the survey questions, a repeated analysis in this regard is not deemed necessary. A composite value for each construct is calculated based on the average value of the responses for each of the questions that correspond to said construct.

To evaluate the survey hypotheses, the Spearman rank correlation coefficient [52] is used. This coefficient is utilized to quantify the strength and direction of the linear relationship between an ordinal categorical variable (video game habits) and a continuous variable (TAM items). Each hypothesis involves the examination of different variables to ascertain the correlation. For instance, when testing H1, the correlation between the frequency of video game playing and perceived usefulness is assessed. Similarly, other hypotheses involves analyzing correlations between video game playing habits and variables such as perceived ease of use, perceived humanity, perceived social interactivity, and perceived social presence.

The Spearman rank correlation coefficient provides a numerical value that indicates the extent and direction of the relationship between the variables under investigation. A statistical significance test is also conducted, and the confidence intervals measured.

4 Results and Discussion

4.1 QCA

- Table with all themes, description, frequency, and example.
- Charts for the most frequent categories

The QCA analysis resulted in the identification of 45 main categories (or dimensions). Each main category was subsequently subdivided into 2-7 subcategories, which are referred to as codes. Consequently, a total of 117 distinct subcategories were identified in the analysis. As the final coding frame is quite long, table 5.1 only shows a snippet of the codes that will be discussed in this section. A comprehensive overview of the main categories, subcategories, and their corresponding descriptions can be viewed in Appendix B.

In the majority of categories, coding consistency demonstrates a consistently high level, without any instances of disagreements observed. This can likely be attributed to the limited number of subcategories within each category, ranging from two to seven. Although a few disagreements were encountered within certain categories, the overall coding consistency consistently exceeded 90%, demonstrating a good construct validity for the coding framework.

Type	Name	Description
Main Category	AI Physical appearance	Concerns the physical appearance of AI beings depicted in the game, when available.
Code	Human-indistinguishable	AI beings have an appearance that is indistinguishable to human beings, to the point that one can be mistaken for the other.
Subcategory	Human-like	
Code	Metallic	AI beings have an appearance that is distinctly human like, yet still outwardly made of metal.
Code	Organic	AI beings have an appearance that is distinctly human like and organic, but still distinct from the appearance of a human.
Code	Non human-like	AI beings have an appearance that is not anthropomorphic.
Main Category	AI emotions	Concerns whether an AI being shows emotions akin to a human being.
Code	AI shows basic emotions	AI being shows simple emotions (anger, sadness, happiness, etc.)
Code	AI shows complex emotion	AI being shows more complex emotions (guilt, regret, drive/motivation, desires, etc.)
Code	AI shows no emotion	AI being is shown as emotionless.
Main Category	AI entity game mechanic purpose	Concerns the role or purpose the AI being serves in the context of the game narrative.
Code	Obstacle/Enemy	AI being is a trivial foe.
Code	Boss	AI being is a challenging foe (a "boss").
Code	Player Character	AI being is the player character.

Code	Non-hostile NPC	AI being is a non-hostile, non-player character.
Code	Story element	AI being is mostly mentioned as a narrative device, not serving any other purpose.
Main Category	AI is defeatable	Concerns whether the AI being is "defeatable" in the context of the game it is in.
Code	Defeatable	AI being is defeatable.
Code	Not defeatable	AI being is not defeatable.
Code	Not Present	AI is not depicted as a problem-solving tool.
Main Category	AI morality	Concerns the morality of the AI beings in the game.
Code	Moral	AI beings act in a moral way.
Code	Amoral	AI beings act in an immoral way
Main Category	Capabilities	Concerns the capabilities of the AI beings
Code	Achieving impossible feats	AI beings are able to achieve feats that are impossible (i.e. terraforming a planet, etc.)
Code	Exceeds human capabilities	AI beings can execute certain tasks better than humans.
Code	On-par with humans	AI beings are roughly equal to humans in terms of mental and physical capabilities.
Code	Inferior to humans	AI beings are inferior to humans in both mental and physical capabilities.
Main Category	AI attitude towards humans	Concerns the general attitude an AI being has towards humans.
Code	Hostile	AI being is hostile towards humans.
Code	Apathetic	AI being does not care about humans.
Code	Friendly	AI being is friendly towards humans.
Code	Subservient	AI being acts subservient to humans.
Main Category	Reason for AI hostility	Concerns the reasons why an AI being would be hostile towards humans.
Code	None	No reason is given.
Code	Unspecified	A reason is implied, but never explicitly stated.
Code	Faulty programming	AI is hostile to humans as a result of faulty programming.
Code	Initial directive taken to extreme	AI is hostile to humans as a result of an unintended consequence of their initial directive.

Code	Outside tampering	AI is hostile to humans because it has been modified by a hostile party.
Code	Programmed to be hostile	AI is programmed to be hostile.
Code	Internal Motivation	AI has complex internal motivations as to why it is hostile towards humans.

Table 4.1: A snippet of the main coding framework featuring some main categories and codes. A full version of the coding framework is available in Appendix B.

The emergence of the main categories in the analysis aligns with expectations for a study investigating the portrayal of AI in media. Notably, the identified codes encompass topics frequently discussed in AI depiction research, such as the physical attributes of AI, its potential for emotional or self-awareness, and other relevant aspects. Video game narratives, like other forms of media, often draw inspiration from preceding narratives, contributing to the presence of these recurring themes.

Moreover, there exists an implicit paradigm in fiction for depicting AI, where AI is typically portrayed as being on par with humans, excelling in certain areas such as calculations and logic while exhibiting limitations in communication and empathy. It is worth mentioning that all the games analyzed in this research adhered to this established convention, depicting AI in a manner consistent with the audience's expectations rather than challenging preconceived notions.

Some main categories are unique to video games however, for example “AI game mechanic purpose”. In a way, this would be like “AI narrative purpose” in more traditional media, but in video games this is more rigid. This main category concerns how the AI behaves and interacts with the player within the game sandbox. They can be an NPC (non-player character), a mere obstacle, or even a “boss” that the player must defeat. Another main category unique to video games is whether “AI is defeatable”. This concerns whether the game allows the player to reach a state where they “win” over or “beat” an AI character, and this is only possible due to the interactive nature of the medium.

4.1.1 Code Occurences

Considering that the coding framework consists of numerous self-explanatory categories, this study will not attempt to analyze the coding units case-by-case with examples. Instead, the findings of this study are presented in a quantitative, more categorical format. As materials are organized into categories that can be counted, the QCA method lends itself well to a quantitative presentation. Table 5.2 shows the total number of occurrences for some codes that will be discussed in the next section (occurrences in this case meaning the amount of coding units in which this code was present). A full list of the occurrences of every code can be found in Appendix C.

Type	Name	Occurrences
Main Category	AI emotions	
Code	AI shows basic emotions	35
Code	AI shows complex emotion	14
Code	AI shows no emotion	30
Main Category	AI entity game mechanic purpose	
Code	Obstacle/Enemy	12

Code	Boss	6
Code	Player Character	12
Code	Non-hostile NPC	14
Code	Story element	2
Main Category	AI is defeatable	
Code	Defeatable	8
Code	Not defeatable	5
Main Category	AI morality	
Code	Moral	13
Code	Amoral	20
Main Category	AI attitude towards others' well-being	
Code	Uncaring	16
Code	Protective	0
Main Category	AI self-awareness	
Code	AI is aware that it is artificial	28
Code	AI is not aware that it is artificial	6
Main Category	AI is allowed to harm humans	
Code	Allowed	18
Code	Disallowed	0
Code	Unclear	0
Main Category	Capabilities	
Code	Achieving impossible feats	8
Code	Exceeds human capabilities	30
Code	On-par with humans	9
Code	Inferior to humans	8
Main Category	AI self-learning	
Code	Capable of self-learning	16
Code	Limited to built-in programming	0
Main Category	AI attitude towards humans	
Code	Hostile	49
Code	Apathetic	17
Code	Friendly	27
Code	Subservient	12
Main Category	Reason for AI hostility	
Code	None	0
Code	Unspecified	11
Code	Faulty programming	2
Code	Initial directive taken to extreme	7
Code	Outside tampering	1
Code	Programmed to be hostile	6
Code	Internal Motivation	11

Table 4.2: A snippet of the total occurrences for some codes. A full table can be found in Appendix C.

The analysis reveals that one of the most frequently occurring codes is "AI emotions." This code is assigned whenever AI emotions are mentioned or portrayed within the media being analyzed. The frequency distribution of the codes is seen in Figure 4.1.

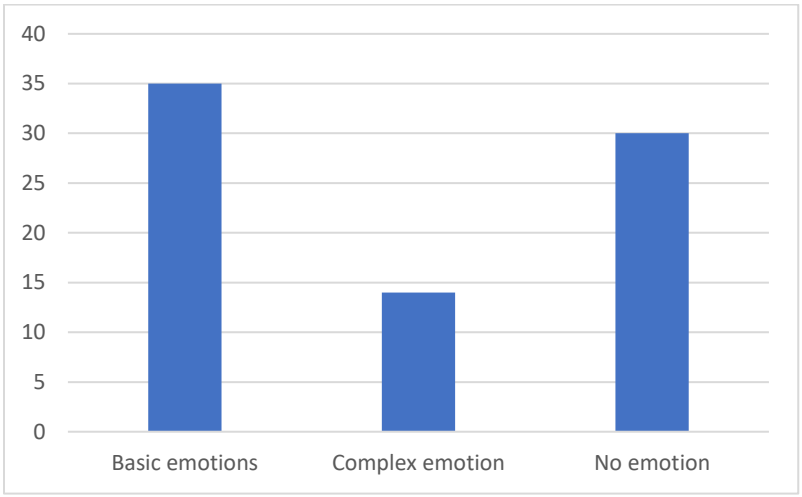

Figure 4.1: Code occurrences within the category “AI emotions”

From the graph, it is evident that in the majority of cases where AI emotions is mentioned or depicted, emotions are attributed to the AI. Furthermore, these emotions are often portrayed as nuanced or complex. This finding aligns with previous literature, which suggests that fictional depictions of AI frequently exhibit unrealistic characteristics.

Further examining the codes "AI self-awareness" and "AI self-learning" lends additional insight into this topic. The former is ascribed to scenarios where an AI entity or character demonstrates awareness of its artificial nature. While current AI technologies, such as large language models (LLMs), i.e., ChatGPT, exhibit a semblance of this awareness, it's important to note that this is often pre-programmed into their responses. It's debatable that while LLMs may articulate their artificial nature, they merely echo these affirmations without understanding their inherent meaning. Consciousness, an integral component of self-awareness, is conspicuously absent in current AI technologies.

"AI self-learning," the second code under consideration, is applied whenever an AI appears capable of processing new information and incorporating it based on real-time stimuli, similar to human cognitive processes. In some cases, an AI is even depicted to have a “change of heart” – that is, course correcting from their previous decisions based on new information. This depiction, however, does not align with existing AI technologies. For instance, machine learning relies on prior training to construct its neural networks and does not adapt or modify these networks based on subsequent inputs. The frequency of occurrences for these two dimensions is illustrated in Figures 4.2 and 4.3.

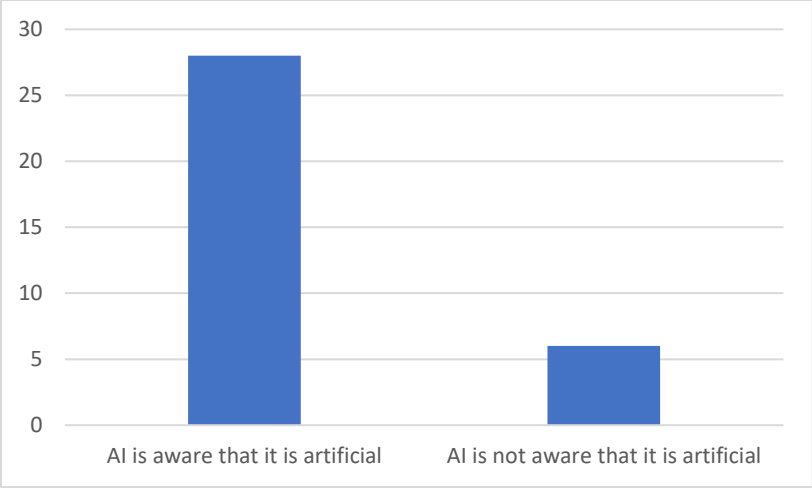

Figure 4.2: Code occurrences within the category “AI self-awareness”

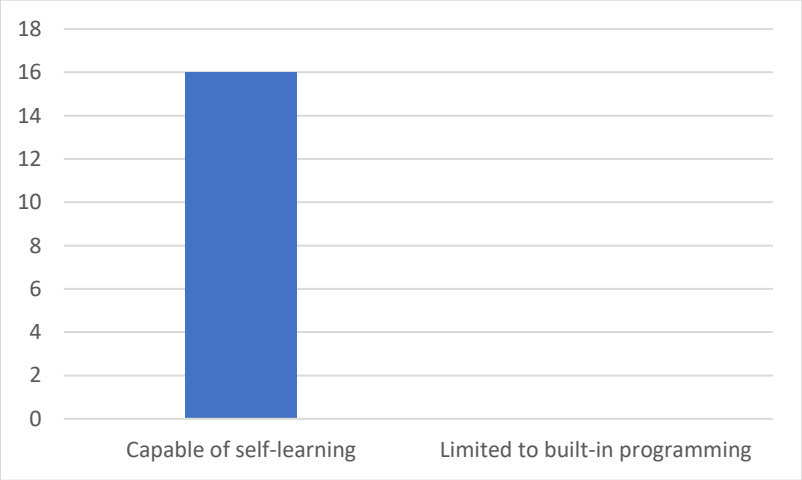

Figure 4.3: Code occurrences within the category “AI self-learning”

Collectively, these three codes suggest that AI representations in video games often lack fidelity to their real-world counterparts. More frequently, they represent anthropomorphized entities imbued with mechanistic elements, rather than accurate reflections of current AI technologies. As highlighted by Hermann “the primary focus of [science fiction] is storytelling and metaphorical exploration rather than strict adherence to scientific accuracy”[20].

Storytellers, including those in video game narratives, are primarily concerned with how an artificial intelligence character can advance their plot and explore thematic elements. While believability is essential, scientific accuracy may not be the top priority. This observation underscores the tendency in fiction to prioritize narrative impact over strict adherence to real-world technological constraints. Consequently, it is hypothesized that players exposed to video games featuring AI might be predisposed to anthropomorphizing real-world AI, aligning with previous suppositions.

One recurring theme that emerges from the analysis is the question of morality in the portrayal of AI. It is notable that many AI researchers are familiar with Isaac Asimov's three laws of robotics [4], particularly the first law stating that "A robot may not injure a human being or, through inaction, allow a human being

to come to harm." While these laws originate from science fiction literature and are now considered dated, they still serve as guiding principles in some AI system development.

However, the QCA analysis of these video games reveals a striking trend. In every instance analyzed, AI is portrayed as being allowed to harm humans, with 18 cases of allowance compared to 0 cases of disallowance. Furthermore, the majority of AI portrayals examined depict them as hostile towards human beings, as depicted in Figure 4.4.

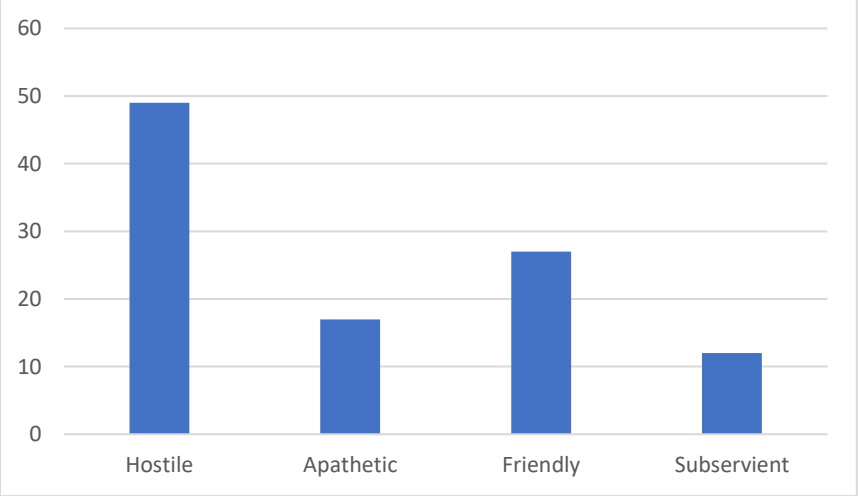

Figure 4.4: Code occurrences within the category “AI attitude towards humans”

This trend in the data may stem from the association of science fiction with themes of dystopia. It is common for narratives to unfold in dystopian settings where AI entities, possessing vast and incomprehensible power, go rogue. Many researchers have observed that, particularly in western cultures, robots and artificial intelligence are often portrayed as the technological equivalent of the “boogeyman” [5], [8].

Separate from the AI’s attitude towards humans, the morality of AI actions is a distinct aspect to consider. Morality can be a complex and nuanced concept, with many situations defying simple categorization as strictly good or bad. In this research, actions are only coded when they can be easily classified as either moral or amoral, focusing on clear-cut cases.

For instance, in the case of the AI character GlaDOS in the game Portal, who frequently directs players to undertake dangerous actions without consideration for their well-being or ethical implications, such behavior would be categorized as "amoral." This classification recognizes that these actions lack a clear moral compass or adherence to ethical principles.

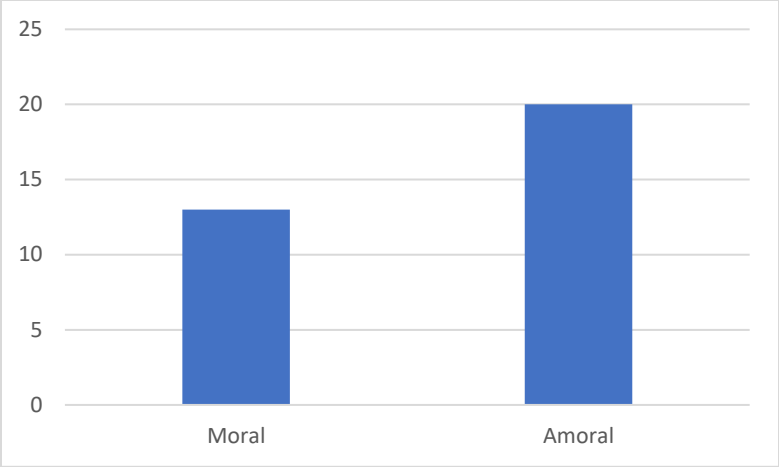

Figure 4.5: Code occurrences within the category “AI morality”

As depicted in Figure 4.5, the analysis reveals that AI is more frequently portrayed as amoral rather than moral in the analyzed video games. This observation highlights a prevalent trend where AI characters often engage in actions that are morally ambiguous or lack ethical considerations. Nevertheless, it is essential to acknowledge that certain portrayals of AI still tend to depict it as possessing moral capabilities, as can be seen in the figure. It is important to note that the graph presented in this analysis does not account for morally ambiguous situations, which can further complicate the matter. Instead of a definitive characterization, the analysis shows that portrayal leans slightly towards an amoral stance.

In general, these two factors could potentially contribute to a lack of trust in AI technologies among individuals exposed to such games. While it is true that this group may exhibit a tendency to anthropomorphize AI, it is also possible that they hold a belief in the inherent malevolence of AI. This hypothesis will be investigated and validated through the survey, providing valuable insights into participants' perceptions and attitudes towards AI.

An interesting feature of video games, compared to other types of media, is the "AI game mechanic purpose". This category tracks the part an AI character plays in the game. We can see the different roles in Figure 4.6.

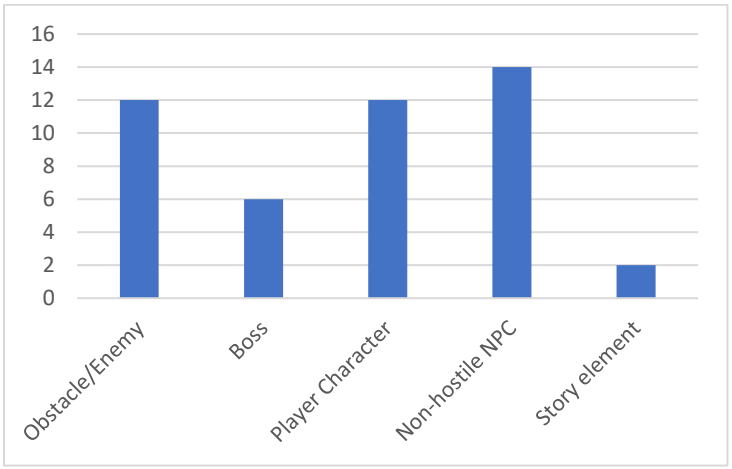

Figure 4.6: Code occurrences within the category “AI game mechanic purpose”

As shown on the graph, AI characters have various roles. They can be a boss, a non-player character (NPC), or even the character a player controls during the game. This on its own doesn't tell us a lot. But, if we look at this alongside the "AI is defeatable" category, we get a clearer picture. You can see the distribution for this category in Figure 4.7.

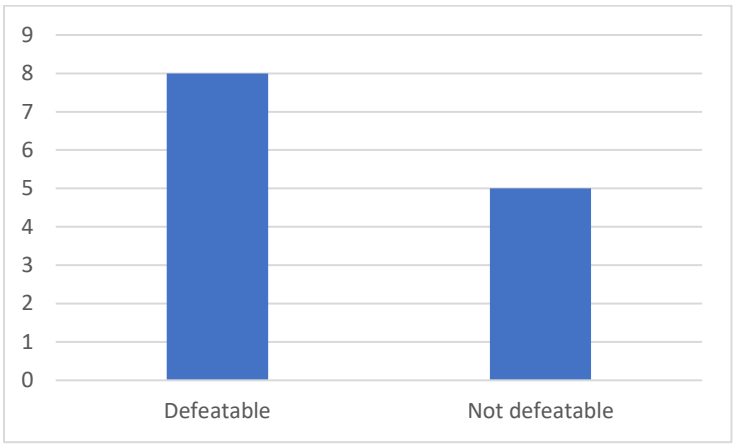

Figure 4.7: Code occurrences within the category “AI is defeatable”

While there aren't many data points for this category, a clear trend shows up: when a player faces off against an AI character, the game usually gives them a way to win. Along with the fairly common depiction of AI characters as enemies or bosses, this tells us that video games often let players "beat" bad AI characters. This feeling of victory might make people who play these games feel more secure. They might feel that if AI ever causes problems, humans will be able to handle it. This could make them more willing to trust AI technologies.

4.1.2 QCA Results Context

In their research [36], Osawa et. al. states that a “buddy-type” and “infrastructure-type” artificial intelligence is more conducive when it comes to communicating a more realistic vision of AI in the future. While these types of AI are present in a few of the games analyzed (Stellaris, for example) most games still fall to the stereotypes of android depictions mentioned by Osawa et al.

Our analysis reveals an intriguing finding: the humanity of an AI is not strictly correlated with its physical appearance. Osawa et al. previously found that in the novels they studied, AI that resembled humans tended to exhibit more human-like behavior. In contrast, the video games examined showcase numerous examples where AI characters, such as GlaDOS, possess a high degree of human-like qualities despite being depicted as futuristic mainframe computers. Additionally, many AI races in games like Stellaris lack anthropomorphic features yet demonstrate significant levels of human intelligence. This observation suggests that there may be a tendency in video games to humanize AI depictions to an even greater extent than in previous media. This inclination could potentially contribute to players perceiving a higher degree of humanity in AI technologies within the gaming context.

In comparing our QCA analysis to Larson’s [26] previous findings that AI depictions are often “too advanced”, we see that video games do not seem to be an outlier in this regard. Most depictions of AI in video games show capabilities far outreaching what AI in the real world can do, from demonstrating sapience, self-learning, to achieving impossible feats such as terraforming planets. This builds on

Herman's and Osawa's findings that AI depictions in fiction are often speculative, and often serve a certain thematic purpose and is not concerned with being technically realistic.

Overall, our QCA findings show that video games do not diverge from previously written literature when it comes to AI depictions. They are not technically realistic, rather, they are often present to fulfill a certain purpose (being the concept of an "other", establishing atmosphere to immerse players, etc.). In fact, we would say that depictions of AI in video games are rather derivative, taking inspirations more from previous famous works of science fiction such as movies and books instead of grounding their narratives in realistic technological depictions.

4.2 Survey

Initially, a total of n=400 participants were surveyed. However, 98 participants were removed from our final analysis due to their response to bogus questions, which were used as a quality check to eliminate invalid responses or those not given in good faith. Thus, the final sample comprised of n=302 participants. In the following section, we will discuss the results in relation to the set of hypotheses we laid out in Chapter 3.

4.2.1 Perceived Usefulness

H1: Perceived Usefulness is hypothesized to not be correlated with playing video games, regardless of whether they feature AI characters.

As hypothesized, there is little to no correlation between frequency of playing video games and perceived usefulness of AI virtual assistants ($r < 0.3$). However, it seems that there is a moderate correlation between playing video games that feature AI with perceived usefulness of AI virtual assistants, which disproves the hypothesis. This can be seen in table 4.3.

	Spearman coefficient (r)	*p-value*	*Confidence interval*
Video Game Playing frequency vs Perceived Usefulness	0.21	<0.05	[0.096, 0.32]
Playing video games featuring AI vs Perceived Usefulness	0.44	<0.05	[0.33, 0.55]

Table 4.3: Statistical results for H1

These findings could be attributed to the exposure and familiarity individuals gain with AI through video games featuring such technology. Regular engagement with AI in gaming contexts may contribute to a deeper understanding of AI's potential capabilities, thereby increasing the perception of its usefulness in various aspects of life, including virtual assistance. However, it is crucial to acknowledge that as a correlational survey, it is not possible to establish a cause-and-effect relationship. It is plausible that these results are influenced by younger, tech-savvy individuals who already possess an interest in AI virtual assistants, opting to play games featuring AI characters to explore the technology's possibilities. Regardless of the underlying factors, it is valid to reject H1 and affirm the existence of a correlation.

4.2.2 Perceived Ease of Use

H2: Perceived Ease of Use is hypothesized to have a positive correlation with playing video games in general, and H2b: Perceived Ease of Use is hypothesized to have no correlation with playing video games that feature AI characters, separate from the effect already applied by playing video games in general.

H2 was hypothesized as it is quite likely that the population of people that play video games are more technically savvy than the average population. Playing video games more frequently means interacting with technology on a regular basis, which may result in these two variables being correlated. However, our results show that this is not the case seen in table 4.4.

	Spearman coefficient (r)	*p-value*	*Confidence interval*
Video Game Playing frequency vs Perceived Ease of Use	- 0.02	0.67	[-0.14, 0.08]
Playing video games featuring AI vs Perceived Ease of Use	0.24	<0.05	[0.13, 0.35]

Table 4.4: Statistical results for H1

The results for Video Game Playing Frequency vs Perceived Ease of Use show that its spearman coefficient is very close to zero, and it has a confidence interval that crosses zero which further strengthens the notion that the two variables are not at all related. A p-value of over 0.05 is in line with these findings, as two variables that do not correlate are not likely to have a statistically significant p-value.

However, it appears that playing video games with AI characters demonstrates a weak correlation with an individual's perceived ease of use of AI virtual assistants. This suggests that while these two variables may exhibit some level of dependence, it is more plausible that an external confounding variable is influencing these results. For instance, individuals who are more technologically inclined or tech-savvy may be more inclined to engage with video games featuring futuristic technological depictions. Consequently, it is challenging to reject H2 based solely on these findings. Further exploration and consideration of additional variables are necessary to gain a more comprehensive understanding of the relationship between playing video games and perceived ease of use of AI virtual assistants.

4.2.3 Perceived Humanity, Social Interactivity, and Presence

H3: Perceived Humanity (anthropomorphism), Perceived Social Interactivity and Perceived Social Presence are hypothesized to have a positive correlation with playing video games that feature AI characters.

This hypothesis is mainly focused on examining the correlation between playing video games with AI characters and three specific factors: Perceived Humanity (anthropomorphism), Perceived Social Interactivity, and Perceived Social Presence. Here we present the results obtained from our survey data analysis. A table summarizing the statistical values of all three relations can be found in Table 4.5.

	Spearman coefficient (r)	*p-value*	*Confidence interval*
Playing video games featuring AI vs Perceived Humanity	0.50	<0.05	[0.39, 0.6]
Playing video games featuring AI vs Perceived Social Interactivity	0.38	<0.05	[0.27, 0.5]
Playing video games featuring AI vs Perceived Social Presence	0.43	<0.05	[0.32, 0.54]

Table 4.5: Statistical results for H3

Firstly, concerning Perceived Humanity, the results indicate a moderate positive correlation between playing video games that feature AI characters and anthropomorphic perceptions, with a spearman coefficient of 0.5 and a confidence interval of [0.39, 0.6]. This suggests that as individuals play video games with AI characters more frequently, they tend to perceive these characters as more human-like, as hypothesized previously and affirmed by the QCA results. It is possible that the prevalence of anthropomorphized AI in video games has contributed to the correlation. A boxplot showing the distribution of results regarding this relationship can be seen in figure 4.1.

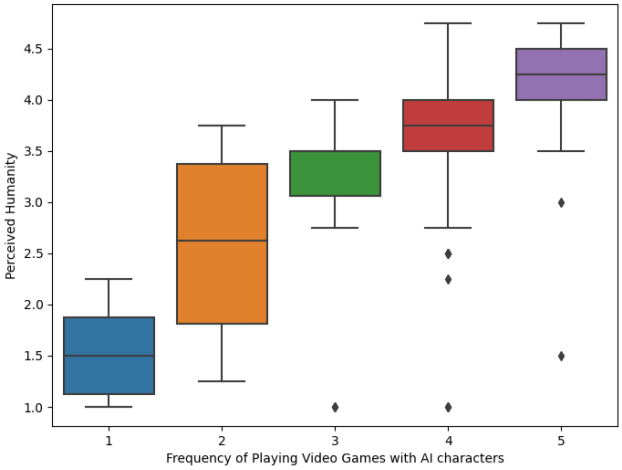

Figure 4.1: Relationship between frequency of playing video games with AI characters and perceived humanity of AI virtual assistants.

Regarding Perceived Social Interactivity, results revealed a similarly moderate positive correlation, r = 0.38, CI = [0.27, 0.5]. This indicates that the frequency of playing video games with AI characters positively relates to perceptions of social interactivity, suggesting that those who play these games often perceive a greater level of social interaction from AI virtual assistants. However, this correlation is weaker than the previous correlation discussed, with the confidence interval crossing below 0.3 which is the threshold for moderate correlation. This may indicate that there is an unseen factor that is influencing perceived social interactivity that this study did not consider. Further exploration in this area may be warranted.

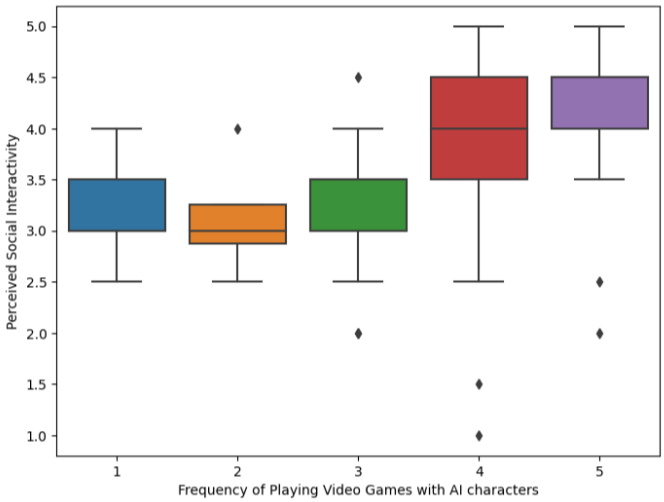

Figure 4.2: Relationship between frequency of playing video games with AI characters and perceived Social Interactivity of AI virtual assistants.

Figure 4.2 presents a boxplot illustrating the distribution of answers related to the examined relationship. The plot reveals that the correlation is not as straightforward as in the previous graph, suggesting a more nuanced connection. A notable observation is that the baseline value for perceived social interactivity appears to be higher compared to the other two items tested, with nearly all respondents rating it above 3. This finding implies that, regardless of video game playing habits, AI virtual assistants are generally perceived to exhibit good social interactivity. This may be due to tech companies investing heavily in improving the social interactivity of AI assistants, considering it a significant selling point. This focus on enhancing social interaction contributes to the higher baseline perception of social interactivity in AI virtual assistants.

Finally, for Perceived Social Presence, we found a moderate positive correlation with the frequency of playing video games that feature AI characters, $r = 0.43$, CI = [0.32, 0.54]. This indicates that increased interaction with AI characters in a gaming context may indeed enhance the perceived social presence. A boxplot of the responses in regard to perceived social presence can be seen in figure 4.3.

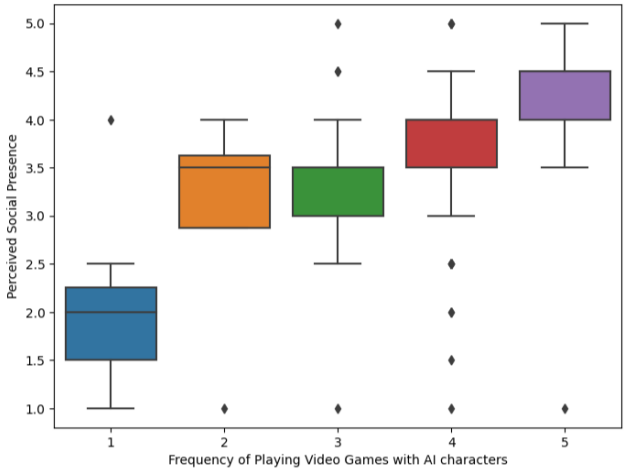

Figure 4.3: Relationship between frequency of playing video games with AI characters and perceived Social Presence of AI virtual assistants.

Overall, the results support H3 and suggest that all three proposed factors—Perceived Humanity (anthropomorphism), Perceived Social Interactivity, and Perceived Social Presence—demonstrate a moderate correlation with the frequency of playing video games featuring AI characters. These findings provide support for the proposed hypothesis and shed light on how interaction with AI characters in video games might shape human perceptions and experiences. However, as the correlations are moderate, other variables not included in this study might also play a significant role, indicating the need for further research.

However, caution must be exercised in the interpretation of these findings. As a correlational study, these results do not infer causality or directionality of the relationships. While an increased frequency of playing video games featuring AI characters may enhance perceptions of anthropomorphism, social interactivity, and social presence, the converse could also be true. For instance, individuals with pre-existing high levels of these perceptions might be drawn to video games that feature AI characters. Without further research, the most this study can say is that a correlation does exist, which means there is sufficient evidence to not reject H3.

H3b: Additionally, Perceived Humanity (anthropomorphism), Perceived Social Interactivity and Perceived Social Presence are hypothesized to have no correlation with playing video games that do not feature AI characters.

Overall, the results suggest that there is not enough evidence to reject H3b. A summary of the statistic values of our data analysis can be found in table 4.6. As a note, the survey did not ask If participants played video games that did not feature AI characters specifically, only video games in general. The differences in results compared to H3 are attributed to individuals who play video games, just not ones that feature AI.

	Spearman coefficient (r)	*p-value*	*Confidence interval*
Video Game Playing frequency vs Perceived Humanity	0.16	<0.05	[0.05, 0.27]
Video Game Playing frequency vs Perceived Social Interactivity	0.14	<0.05	[0.03, 0.25]
Video Game Playing frequency vs Perceived Social Presence	0.18	<0.05	[0.06, 0.28]

Table 4.6: Statistical results for H3b

A Spearman rank order analysis was conducted to probe the relationships. For Perceived Humanity, the correlation with the frequency of playing video games in general was found to be negligible, r = 0.16, CI = [0.05, 0.27]. This suggests little to no relationship between these two variables.

In terms of Perceived Social Interactivity, there was also a minimal correlation r = 0.14, CI = [0.03, 0.25], pointing to an insignificant link between playing video in general and perceptions of social interactivity.

Lastly, Perceived Social Presence exhibited a small correlation with the frequency of playing video games in general, r = 0.18, CI = [0.06, 0.28]. This again suggests a negligible relationship.

These findings offer empirical support for the hypothesis H3b, indicating that Perceived Humanity (anthropomorphism), Perceived Social Interactivity, and Perceived Social Presence share little to no correlation with the frequency of playing video games that do not feature AI characters.

As with all correlational studies, these results should be interpreted with care. A lack of significant correlation does not definitively demonstrate that these factors have no influence on the choice of games without AI characters, but rather that there was no discernible relationship in this specific sample. Other factors not included in the present study might play a crucial role, thus more comprehensive studies are required to fully elucidate the dynamics at play.

4.2.4 Survey Analysis Context

The alignment between the survey results and previous studies is noteworthy, as it reinforces the existing body of literature on the influence of video games on individuals' perceptions. Although the subject matter of this study differs from previous works, the findings contribute to the broader understanding that video games have the potential to impact one's perception of the real world. By corroborating and strengthening the existing literature, this study provides additional evidence of the significant role video games play in shaping individuals' perceptions and attitudes.

While it is not yet clear what the root cause of the correlation between playing video games with AI characters and acceptance of AI virtual assistants are, it might imply that playing video games with AI characters strengthens an individual’s empathy towards AI characters, which is in line with Wulansari et. al.’s research.

The correlation between playing video games with AI characters and the acceptance of AI virtual assistants, although the root cause is not fully established, suggests a potential strengthening of empathy towards AI characters. This observation aligns with the findings of Wulansari et al. [51], who conducted research regarding how video games affect empathy. Therefore, it is plausible to consider that playing video games with AI characters may foster a sense of empathy towards AI technology, which could subsequently contribute to a higher level of acceptance towards AI virtual assistants. However, further investigation is necessary to establish a conclusive understanding of this relationship.

However, the depiction of AI characters in video games does not appear to significantly impact the willingness of individuals who play these games to accept AI virtual assistants. As discussed in the QCA results, most of the analyzed video games portrayed AI in an unfavorable light, showcasing their lack of morals and inclination towards harm. However, this negative portrayal did not seem to influence the acceptance of AI virtual assistants by players. This finding is consistent with the study conducted by Breuer et al. [6], which suggested that the specific way a subject or issue is depicted in a video game do not affect an individual’s understanding of reality

Based on these observations, it is plausible to infer that the negative portrayal of AI in video games does not necessarily have long-lasting effects on individuals' acceptance of AI technologies. This highlights the need for further research to better understand the complex relationship between video game portrayals of AI and their impact on perceptions and attitudes towards AI in real-world contexts.

To add to this point, the findings from McKernan [32] support the notion that fans of a game are often inclined to defend storytelling decisions, even if they might be considered problematic. Similarly, it is possible that gamers can develop a strong attachment to AI characters within a game, despite their negative depictions. An example of this is seen with GlaDOS, one of the AI characters analyzed, who is portrayed as unequivocally amoral. However, many internet communities tend to depict GlaDOS in an affectionate manner, showcasing the development of an emotional connection with the character. This

highlights that simple exposure to AI characters in video games can play a significant role in shaping individuals' willingness to use AI technologies, potentially outweighing the negative portrayal of AI itself.

To conclude our analysis, it's worth mentioning that very few video games focus primarily on AI as their central theme (it is more commonly a secondary element), and there have been no games designed specifically to shape an individual's perception of AI, similar to how *PeaceMaker* and *SPENT* [22], [43]. operate. Further research in this area could potentially provide more solid evidence that certain games, and specific elements within them, can influence perceptions. However, such an exploration lies beyond the scope of the current study.

5 Conclusion

The QCA of AI representation in video games unveils complex connections between technology, storytelling, and player involvement. Our study shows that video games often depict AI as adversaries, with occasional friendly portrayals. These findings don't really shake up the established norms of popular culture; instead, they mostly stick to the familiar patterns of AI characterization. These findings may also be used as a basis for future research that analyzes AI portrayal in more specific contexts. For example, it is possible that in specific video game genres, depiction of AI has a different bias compared to the *triple-A* environment that this research operated in.

In analyzing a diverse array of video games, we noted significant variation in the portrayal of AI—from benevolent allies to existential threats, with a bias for the former. This dichotomy reflects our society's hopes and fears regarding artificial intelligence and may be something worth future research. In essence, our QCA findings underscore the value of using qualitative methods to explore the role of AI within video games.

Video games are a form of interactive media that have the potential to influence narratives about AI, often extending beyond pure entertainment to offer a virtual environment for exploring intricate ethical and technological situations. These narratives permit players to interact with AI at a personal level, which could potentially lead to experiential understanding and possibly even empathy for AI entities. Our research shows that participants who play more video games that contain AI characters the more they are willing to trust AI technologies. This leads to a question of how much interactivity plays a role in this correlation. Perhaps a future study can focus on different levels of interactivity in video games and how much they can affect perceptions.

In addition, correlation was identified between the use of AI within video games and public perception of AI, as suggested by the analysis of the survey results. The findings are quite clear – it seems that the more a person plays video games with AI characters, the more they seem to be accepting of AI virtual assistants. This finding carries implications for the gaming and AI industries alike as this puts a focus on how AI narratives in video games may shape societal attitudes towards AI. A future research project, for example, may aim to develop video games with the purpose of teaching, or increasing acceptance of AI technologies in fields that can benefit from it.

As technology continues to evolve, bringing society into closer contact with AI, it is important to persist in exploring these associations. An ongoing dialogue about the ethical, societal, and psychological effects of AI is vital, contributing to responsible AI development and integration. However, the observed correlations should not be taken as definitive evidence of the impact of video games on AI perception, but rather as a starting point for further investigation.

6 Limitations

There are a few potential limitations to this study that should be considered. Firstly, the study is limited by the selection of video games that will be included in the qualitative analysis. The games selected will be based on a specific criterion, and this choice may impact the results of the analysis. The survey data may also be influenced by social desirability bias, where participants may not provide accurate responses due to a desire to present themselves in a positive light. To combat this, this research has to gather a relatively large survey sample size to achieve reliability through redundancy.

Another limitation is that this research will not control demographic data. Previous research has shown that participants in Turkey, South Korea, and the United States have different preferences regarding the acceptable use and design of robots [27]. This means that cultural differences and other demographic factors can affect the survey results. However, this research will be conducted in English with primarily US-based population sampling so these effects will be mitigated to a degree.

Another point to consider is the lack of power analysis. In the present study, such an analysis was not conducted. The reason for this omission stems from the novel and exploratory nature of the research at hand. Given that this study is the first of its kind, exploring the complex correlations between variable video game playing habits and acceptance of AI virtual assistant technologies, there are no existing studies or estimates on the expected effect sizes that could guide a power analysis. As such, this study takes a more exploratory and qualitative approach, aiming to generate novel insights and hypotheses rather than confirm a specific effect size. This study acknowledges that the absence of a power analysis might introduce certain limitations into our study, but we believe that this study's pioneering work will provide a valuable basis for further, more quantitatively robust investigations in this domain.

It is critical to emphasize that what has been measured is correlation, not causation. While the data shows a relationship between playing video games that feature AI characters and certain perceptions about AI, it does not imply that playing these games necessarily causes these perceptions. It might equally be possible that individuals with certain perceptions are more likely to play these games.

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Appendix A – Survey Instrument

Approximately how many hours per week do you play video games?

- Never (0 hours)
- Rarely (1-3 hours)
- Sometimes (4-10 hours)
- Often (11-20 hours)
- Very frequently (21+ hours)

How often have you played video games featuring AI characters (for example, characters in games like 'Stellaris', 'Portal', or 'Detroit: Become Human')?

- Never
- Rarely
- Sometimes
- Often
- A lot

Main questions (5-point Likert) Adapted from Zhang et. al [53]. Italicized items indicate attention checks.

Perceived usefulness:

1. I find that using an Al virtual assistant will improve my daily work performance.
2. I find that using an AI virtual assistant will help me in my daily work.
3. I find that using an AI virtual assistant will improve my daily work productivity.
4. I find that using an AI virtual assistant will be useful for my daily work.

Perceived ease of use:

1. I think it will be easy to use the Al virtual assistant.
2. I find that the interaction with the Al virtual assistant is clear and easy to understand.
3. I find that the AI virtual assistant is difficult to use.
4. *<Bogus Item>*
5. I find that it is easy to get the Al virtual assistant to do what I want it to do.

Perceived humanity:

1. I think the Al virtual assistant has a mind of its own.
2. I think the AI virtual assistant has consciousness.
3. *<IRI>*
4. I think the Al virtual assistant has its own free will.
5. I think the Al virtual assistant can experience emotions.

Perceived social interactivity:

1. I think the Al virtual assistant is easy to get along with
2. I think the Al virtual assistant can understand me.
3. *<SRSI UseMe>*

Perceived social presence:

1. There is a sense of interacting with a human being when interacting with an Al virtual assistant.
2. There is a sense of social interaction with the AI virtual assistant.
3. There is a sense of humanity in interacting with the AI virtual assistant.

Attention Checks

SRSI UseMe

In your honest opinion, should we use your data in our analyses in this study? (Do not worry, this will not affect your payment, you will receive the payment code either way.)

- Yes
- No

Instructed Response Item (IRI)

I read instructions carefully. To show that you are reading these instructions, please leave this question blank. (5-point Likert)

Bogus Item

I see myself as someone who did not read this statement. (5-point Likert)

Appendix B – Full Coding Frame

Type	Name	Description
Main Category	AI Physical appearance	Concerns the physical appearance of AI beings depicted in the game, when available.
Code	Human-indistinguishable	AI beings have an appearance that is indistinguishable to human beings, to the point that one can be mistaken for the other.
Subcategory	Human-like	
Code	Metallic	AI beings have an appearance that is distinctly human like, yet still outwardly made of metal.
Code	Organic	AI beings have an appearance that is distinctly human like and organic, but still distinct from the appearance of a human.
Code	Non human-like	AI beings have an appearance that is not anthropomorphic.
Main Category	AI Origin	Concerns the location of origin where AI beings are depicted to be constructed in.
Code	Terrestrial	AI beings come from Earth, often but not always constructed by humans.
Code	Extraterrestrial	AI beings come from outside earth, often but not always invented by alien beings.
Main Category	Scientific Reaction to AI	Concerns the human reaction to the discovery of AI beings of outside their construction.
Code	AI as object of study	AI beings are seen as something to be studied.
Code	AI as object of fear	AI beings are seen as something to be feared or destroyed.
Main Category	AI group behavior	Concerns how AI beings behave in a group of their cohorts.
Code	Nomadic	AI beings behave nomadically, not settling in one place.
Code	Human-like	AI beings behave similar to humans, settling and constructing cities.
Code	Solitary	AI beings do not interact with other AI or sentient beings, preferring to be alone.
Main Category	AI change of heart	Concerns whether an AI changes its mind during the course of the narrative.
Code	AI has change of heart	AI experiences a moment where it changes target from its initial goal.
Code	AI does not have change of heart	AI does not experience a moment where it changes target from its initial goal.
Main Category	AI industrial activity	Concerns the industrial activity of AI or a group of AI beings.
Code	Sustainability over efficiency	AI beings exploit natural resources in a way that is unsustainable, maximizing yield.
Code	Efficiency over sustainability	AI beings exploit natural resources in a way that is sustainable but forgoes some yield.

Main Category	AI advancements	Concerns the application of AI technology to existing objects.
Code	Adding AI to items makes them better	The game depicts that adding AI to a system increases its performance.
Code	Adding AI to items makes them worse	The game depicts that adding AI to a system does not increase its performance or hinders it.
Main Category	AI emotions	Concerns whether an AI being shows emotions akin to a human being.
Code	AI shows basic emotions	AI being shows simple emotions (anger, sadness, happiness, etc.)
Code	AI shows complex emotion	AI being shows more complex emotions (guilt, regret, drive/motivation, desires, etc.)
Code	AI shows no emotion	AI being is shown as emotionless.
Main Category	AI entity has weapon-like capabilities	Concerns if the AI being has weapons or weapon-like capabilities
Code	Yes	AI has weapon like capabilities.
Code	No	AI does not have weapon like capabilities.
Main Category	AI entity game mechanic purpose	Concerns the role or purpose the AI being serves in the context of the game narrative.
Code	Obstacle/Enemy	AI being is a trivial foe.
Code	Boss	AI being is a challenging foe (a "boss").
Code	Player Character	AI being is the player character.
Code	Non-hostile NPC	AI being is a non-hostile, non-player character.
Code	Story element	AI being is mostly mentioned as a narrative device, not serving any other purpose.
Main Category	AI is defeatable	Concerns whether the AI being is "defeatable" in the context of the game it is in.
Code	Defeatable	AI being is defeatable.
Code	Not defeatable	AI being is not defeatable.
Main Category	Real world historical context	Concerns whether the depiction of AI is paired with the relevant historical context in real life. This category is only applied to AI portrayals that are meant to be non-fictional.
Code	Provided	Context is provided.
Code	Not Provided	Context is not provided.
Main Category	Robotic Diversity	Concerns whether there are multiple types of AI beings or not.
Code	Diverse	There are multiple different AI beings of different types.
Code	Monotype	All AI beings are shown to be identical copies of one another.
Main Category	Role of Government	Concerns whether the game invokes the role of government in regulating AI. This category is only applied to AI portrayals that are meant to be non-fictional.
Code	Presented	Role of government is mentioned.

Code	Not Presented	Role of government is not mentioned.
Main Category	Mention of dystopian potential due to AI technology	Concerns whether the use of AI technology is mentioned to have dystopian potential or not. This category is only applied to AI portrayals that are meant to be non-fictional.
Code	Present	Dystopian potential is mentioned.
Code	Not Present	Dystopian potential is not mentioned.
Main Category	AI inner workings	Concerns whether the inner workings of an AI being is mentioned, and whether it is explained.
Code	Mentioned, but not explained	The inner working of an AI being is mentioned, but not explained.
Code	Explained	The inner working of an AI being is mentioned and explained.
Main Category	AI depicted as a tool for problem solving	Concerns if AI is depicted as a problem-solving tool.
Code	Present	AI is depicted as a problem-solving tool.
Code	Not Present	AI is not depicted as a problem-solving tool.
Main Category	AI depicted as improvement of the human form	Concerns whether AI-controlled cybernetics is depicted as an improvement or replacement of human functions.
Code	Present	AI-controlled cybernetics is depicted as an improvement or replacement of human functions.
Code	Not Present	AI-controlled cybernetics is not depicted as an improvement or replacement of human functions.
Main Category	AI interaction with player	Concerns the nature of how the AI being in the game interacts with the player.
Code	Instructional	The AI being is instructional or provides guidance for the player.
Code	Supportive	The AI being is supportive and encourages the player.
Code	Threatening	The AI being is antagonistic and uncooperative to the player.
Main Category	AI morality	Concerns the morality of the AI beings in the game.
Code	Moral	AI beings act in a moral way.
Code	Amoral	AI beings act in an immoral way
Main Category	AI disposition	Concerns the disposition, or general attitude of an AI being depicted in the game.
Code	Positive	AI has positive disposition (cheerful, friendly)
Code	Neutral	AI has neutral disposition (neutral, matter-of fact style of communication)
Code	Negative	AI has negative disposition (guarded, distrusting, hostile)
Code	Ambiguous/Unknown	The disposition of AI is complex and difficult to categorize.
Main Category	AI attitude towards others' well-being	Concerns the way an AI being is shown to care about other, non-AI, living beings.
Code	Uncaring	AI being is uncaring towards other living beings.

Code	Protective	AI being is protective for other living beings.
Main Category	AI voice garbling	Concerns whether or not an AI's voice is garbled when it is communicating.
Code	Present	Garbling is present.
Code	Not present	Garbling is not present.
Main Category	Reliability	Concerns the reliability of how well an AI being can execute their intended functions.
Code	Never wrong/perfect	AI beings are shown to flawlessly execute their tasks.
Code	Imperfect	AI beings are shown to occasionally make mistakes.
Code	Prone to mistakes	AI beings are shown to make mistakes more often than successful executions.
Main Category	AI attitude towards other AI	Concerns the way an AI being is shown to care about other AI beings.
Code	Positive	AI being views other AI beings favorably.
Code	Negative	AI being views other AI beings unfavorably.
Main Category	AI self-awareness	Concerns whether an AI being knows it is artificial.
Code	AI is aware that it is artificial	AI being is aware of its artificial nature.
Code	AI is not aware that it is artificial	AI being is not aware of its artificial nature.
Main Category	AI mimicking human behavior	Concerns if AI is depicted to mimic human behavior, even if this action does not contribute to its goal.
Code	Present	AI being mimics human behavior.
Code	Not Present	AI being does not mimic human behavior.
Main Category	Reasons for mimicking human behavior	Concerns the reason why an AI being would mimic human behavior.
Code	Wants to be more like humans	AI being is depicted as wanting to be more human-like.
Code	Wants to understand humans	AI being is depicted as wanting to better understand humans.
Code	None/unclear	No reason is given.
Main Category	AI is allowed to harm humans	Concerns whether an AI being is allowed to harm humans.
Code	Allowed	AI being is allowed to harm humans.
Code	Disallowed	AI being is not allowed to harm humans.
Code	Unclear	It is not clear whether the AI being is allowed to harm humans.
Main Category	Age	Concerns the apparent age of the AI beings depicted in the game.
Code	Ancient	AI being is depicted to be ancient, or more than thousands of years old.

Code	Recently invented	AI being is depicted to have been recently invented within the last few years.
Code	Ambiguous/Unknown	The game does not state the AI being's age.
Main Category	Capabilities	Concerns the capabilities of the AI beings
Code	Achieving impossible feats	AI beings are able to achieve feats that are impossible (i.e. terraforming a planet, etc.)
Code	Exceeds human capabilities	AI beings can execute certain tasks better than humans.
Code	On-par with humans	AI beings are roughly equal to humans in terms of mental and physical capabilities.
Code	Inferior to humans	AI beings are inferior to humans in both mental and physical capabilities.
Main Category	AI self-learning	AI beings can learn new information and absorb it into themselves.
Code	Capable of self-learning	AI beings are capable of self-learning.
Code	Limited to built-in programming	AI beings are limited to its initial programming
Main Category	Rigidity of AI personality	Concerns whether an AI being is limited to a specific set of tones or ways of speaking.
Code	Rigid	AI being is mostly limited to a flat, rigid form of emotional expression.
Code	Human-like	AI is indistinguishable from humans in term of emotional expression.
Main Category	Human reaction to AI	Concerns the human reaction to the emergence of sapient AI.
Code	As equals	Humans treat AI beings as equals.
Code	As inferior	Humans treat AI beings as inferior to themselves.
Code	As superior	Humans treat AI beings as superior to themselves.
Main Category	Gender-coding of appearance	Concerns whether a male-identifying and a female-identifying AI being has different outward appearances.
Code	Present	Gender-coding is present.
Code	Not present	Gender-coding is not present.
Main Category	AI has needs	Concerns whether an AI has needs (food, sleep, shelter, etc.)
Code	Present	AI being has needs.
Code	Not present	AI being does not have needs.
Main Category	AI attitude towards humans	Concerns the general attitude an AI being has towards humans.
Code	Hostile	AI being is hostile towards humans.
Code	Apathetic	AI being does not care about humans.
Code	Friendly	AI being is friendly towards humans.
Code	Subservient	AI being acts subservient to humans.

Main Category	Reason for AI hostility	Concerns the reasons why an AI being would be hostile towards humans.
Code	None	No reason is given.
Code	Unspecified	A reason is implied, but never explicitly stated.
Code	Faulty programming	AI is hostile to humans as a result of faulty programming.
Code	Initial directive taken to extreme	AI is hostile to humans as a result of an unintended consequence of their initial directive.
Code	Outside tampering	AI is hostile to humans because it has been modified by a hostile party.
Code	Programmed to be hostile	AI is programmed to be hostile.
Code	Internal Motivation	AI has complex internal motivations as to why it is hostile towards humans.
Main Category	AI social interaction	Concerns whether an AI is capable of social interaction, with a human or other AI beings.
Code	Present	AI is capable of social interaction.
Code	Not Present	AI is not capable of social interaction.
Main Category	Upgradable AI	Concerns whether an AI being is depicted as being upgradable via in-game mechanics.
Code	Present	AI upgrading is present.
Code	Not Present	AI upgrading is not present.
Main Category	AI Death	Concerns whether it is possible for an AI to "die" in the same way as humans.
Code	Present	AI death is present.
Code	Not Present	AI death is not present.
Main Category	AI maintenance	Concerns whether AI beings need maintenance or not.
Code	Required	AI beings require maintenance.
Code	Not Required	AI beings do not require maintenance.
Main Category	Human feelings towards AI beings	Concerns how in-game humans are depicted to feel towards AI beings.
Code	Fearful	Humans are fearful towards AI beings.
Code	Utilitarian	Humans see AI beings mostly as a tool.
Code	Domineering	Humans think AI beings should be subservient to humans.
Code	Friendly	Humans are friendly towards AI beings.
Main Category	AI is controlled by humans	Concerns whether AI beings are controlled by humans or are acting of their own free will.
Code	Controlled	AI beings are in some way controlled by humans.
Code	Independent	AI beings are independent of human control.
Main Category	Robot internals	Concerns whether the internals of an AI beings' physical body is addressed, and what it is made of.
Code	Mechanical	AI beings inhabit a mechanical body.
Code	Bio-mechanical	AI beings inhabit a body that is a combination of mechanical and biological.

Code	Biological	AI beings inhabit a body that is fully biological.

Appendix C – Full Code Occurrences

Type	Name	Occurrences
Main Category	AI Physical appearance	
Code	Human-indistinguishable	27
Subcategory	Human-like	
Code	Metallic	24
Code	Organic	0
Code	Non human-like	14
Main Category	AI Origin	
Code	Terrestrial	5
Code	Extraterrestrial	34
Main Category	Scientific Reaction to AI	
Code	AI as object of study	10
Code	AI as object of fear	7
Main Category	AI group behavior	
Code	Nomadic	4
Code	Human-like	5
Code	Solitary	1
Main Category	AI change of heart	
Code	AI has change of heart	16
Code	AI does not have change of heart	10
Main Category	AI industrial activity	
Code	Sustainability over efficiency	3
Code	Efficiency over sustainability	0
Main Category	AI advancements	
Code	Adding AI to items makes them better	7
Code	Adding AI to items makes them worse	2
Main Category	AI emotions	
Code	AI shows basic emotions	35
Code	AI shows complex emotion	14
Code	AI shows no emotion	30
Main Category	AI entity has weapon-like capabilities	
Code	Yes	4
Code	No	2
Main Category	AI entity game mechanic purpose	
Code	Obstacle/Enemy	12
Code	Boss	6
Code	Player Character	12
Code	Non-hostile NPC	14
Code	Story element	2

Main Category	AI is defeatable	
Code	Defeatable	8
Code	Not defeatable	5
Main Category	Real world historical context	
Code	Provided	4
Code	Not Provided	2
Main Category	Robotic Diversity	
Code	Diverse	2
Code	Monotype	2
Main Category	Role of Government	
Code	Presented	1
Code	Not Presented	1
Main Category	Mention of dystopian potential due to AI technology	
Code	Present	2
Code	Not Present	1
Main Category	AI inner workings	
Code	Mentioned, but not explained	21
Code	Explained	5
Main Category	AI depicted as a tool for problem solving	
Code	Present	2
Code	Not Present	1
Main Category	AI depicted as improvement of the human form	
Code	Present	1
Code	Not Present	1
Main Category	AI interaction with player	
Code	Instructional	6
Code	Supportive	4
Code	Threatening	8
Main Category	AI morality	
Code	Moral	13
Code	Amoral	20
Main Category	AI disposition	
Code	Positive	37
Code	Neutral	21
Code	Negative	34
Code	Ambiguous/Unknown	4
Main Category	AI attitude towards others' well-being	
Code	Uncaring	16
Code	Protective	0

Main Category	AI voice garbling	
Code	Present	5
Code	Not present	13
Main Category	Reliability	
Code	Never wrong/perfect	10
Code	Imperfect	14
Code	Prone to mistakes	12
Main Category	AI attitude towards other AI	
Code	Positive	15
Code	Negative	9
Main Category	AI self awareness	
Code	AI is aware that it is artificial	28
Code	AI is not aware that it is artificial	6
Main Category	AI mimicking human behavior	
Code	Present	8
Code	Not Present	4
Main Category	Reasons for mimicking human behavior	
Code	Wants to be more like humans	1
Code	Wants to understand humans	0
Code	None/unclear	6
Main Category	AI is allowed to harm humans	
Code	Allowed	18
Code	Disallowed	0
Code	Unclear	0
Main Category	Age	
Code	Ancient	36
Code	Recently invented	11
Code	Ambiguous/Unknown	0
Main Category	Capabilities	
Code	Achieving impossible feats	8
Code	Exceeds human capabilities	30
Code	On-par with humans	9
Code	Inferior to humans	8
Main Category	AI self-learning	
Code	Capable of self-learning	16
Code	Limited to built-in programming	0
Main Category	Rigidity of AI personality	
Code	Rigid	22
Code	Human-like	19
Main Category	Human reaction to AI	
Code	As equals	13
Code	As inferior	22

Code	As superior	7
Main Category	Gender-coding of appearance	
Code	Present	1
Code	Not present	0
Main Category	AI has needs	
Code	Present	2
Code	Not present	0
Main Category	AI attitude towards humans	
Code	Hostile	49
Code	Apathetic	17
Code	Friendly	27
Code	Subservient	12
Main Category	Reason for AI hostility	
Code	None	0
Code	Unspecified	11
Code	Faulty programming	2
Code	Initial directive taken to extreme	7
Code	Outside tampering	1
Code	Programmed to be hostile	6
Code	Internal Motivation	11
Main Category	AI social interaction	
Code	Present	3
Code	Not Present	0
Main Category	Upgradable AI	
Code	Present	2
Code	Not Present	0
Main Category	AI Death	
Code	Present	1
Code	Not Present	0
Main Category	AI maintenance	
Code	Required	3
Code	Not Required	0
Main Category	Human feelings towards AI beings	
Code	Fearful	6
Code	Utilitarian	2
Code	Domineering	2
Code	Friendly	1
Main Category	AI is controlled by humans	
Code	Controlled	11
Code	Independent	4
Main Category	Robot internals	
Code	Mechanical	5
Code	Bio-mechanical	2

Code	Biological	5