

Can AI-Driven Characters Utilise the Rational Choice Theory to Affect Player Decision-Making in Video Games?

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In this paper, we work on a study to analyse the impact of Artificial Intelligence (AI) on decision-making in video games. We were able to present through empirical data that AI can influence a person's decisions, especially when using the rational choice theory. Using a text-based HTML game, made on Twine, a website used for generating text-based games, we tested how AI grounded in rational choice theory impacts decision making and it was proven that AI impacted how the players were thinking, and it helped people make better decisions. While playing the game, many people chose to make their decision by listening to the input of an external character, which provided help or extra information. The external character also utilized the rational choice theory, which motivated more people to choose this option, proving that AI-driven characters, which utilise the rational choice theory, can affect player decision-making in video games. This research can be used for a variety of subjects, as it is useful for future studies related to decision-making in humans, but it can also be used to influence change in society. If interactive media has a powerful impact on decision-making, this media can be used not only for entertainment but also as a tool for spreading information and as a tool for education.

Introduction

Recent years have seen tremendous advancements in the field of artificial intelligence (AI), particularly in the area of video games. AI technology is applied in video games to give gamers more realistic and interesting experiences. Over the past few years, the use of AI in video games has significantly increased, and a sizable body of research has been devoted to examining its potential.

Rational choice theory is one of the main frameworks for comprehending agents' actions. According to the rational choice theory, agents select the alternative most likely to satisfy a set of preferences when making decisions. Rational choice theory is a theoretical framework commonly used in various social sciences including economics, political sciences, and sociology². The role of AI in video games will be studied in this research article, with a special focus on how rational choice theory can be used to understand how AI systems behave in games. We will start by giving a general overview of how artificial intelligence is used in video games and the many kinds of AI systems employed. Next, we will talk about the fundamental ideas of rational choice theory and how they relate to video game AI. We will conclude by giving examples of how the rational choice theory has been applied to examine AI behaviour in video games and discussing any potential ramifications of this work.

Video Games

Video games are not only a large source of entertainment, but are interactive stories, waiting to be written by any other player. What makes video games so distinctive to the media industry, is that every story has the same outcome, but different paths, making every story unique from the others. Layers of new ideas, intensive code, and picturesque art and animation, create a form of media which is used by over 3.09 billion people over the world now³.

The Role of Artificial Intelligence

Although artificial intelligence (AI) has long been used in video games, recent developments in machine learning and deep learning have made it possible to develop AI systems that are more advanced. In video games, a variety of AI systems are employed, including:

1. AI that aids in pathfinding is used to guide non-player characters (NPCs) across gaming locations. To get from one place to another, pathfinding AI utilises algorithms to determine the shortest route, taking into account roadblocks and other potential hindrances.
2. AI that makes decisions is the kind of AI that directs NPC behaviour in response to player activities. Algorithms are used by decision-making AI to analyse the player's activities and select the best course of action.

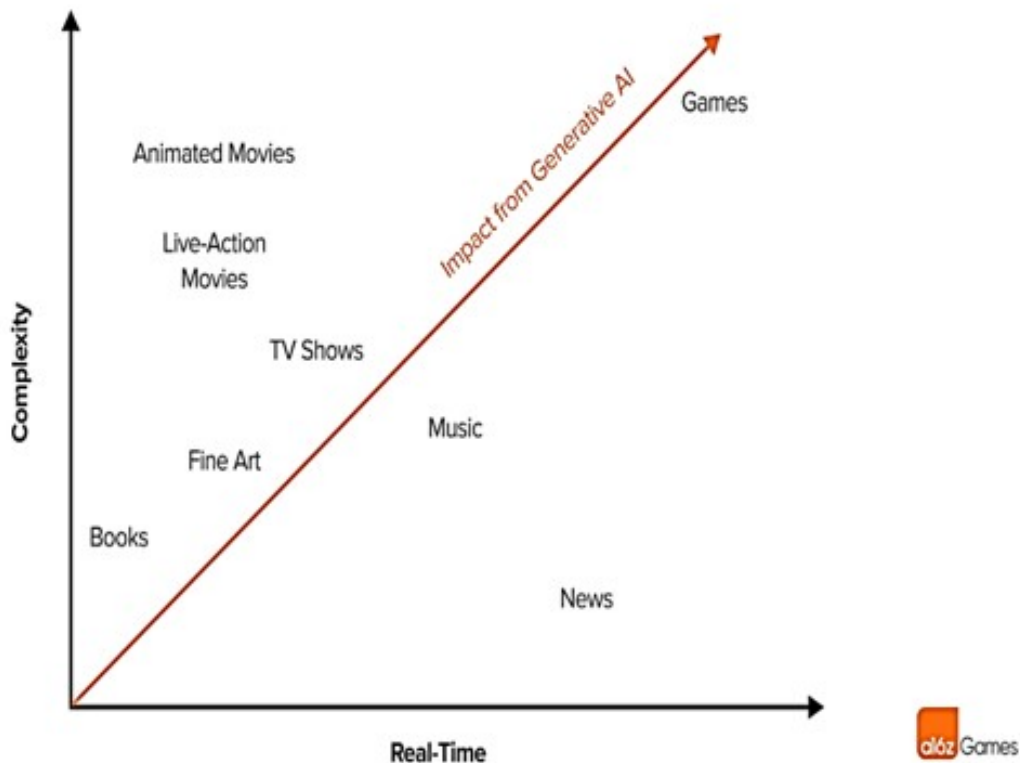


Fig. 1 How games were impacted with the use of AI¹.

3. AI that is adaptable to player behaviour is created to learn from and change over time. Utilising machine learning algorithms, adaptive AI analyses player behaviour and modifies NPC behaviour accordingly.
4. AI that responds to player activities realistically and dynamically is known as reactive AI. Reactive AI employs algorithms to produce answers in response to the player's actions, such as avoiding an assault or running away from peril.

AI is used commonly to help in making decisions. Algorithms are designed to analyze data and provide personalized recommendations for various activities. While AI does make helpful decisions, it is important to remember that AI is limited to the knowledge it is trained on. Incorporating AI in video games can influence our decision-making. Scientists at UC San Francisco are reporting that they have found a way to reverse some of the negative effects of ageing on the brain,

using a video game designed to improve cognitive control⁴. Video games are designed to be interactive, engaging and alluring, as they require players to make decisions that affect the outcome of the game.

Current Technology

Artificial intelligence has become common in modern video games. Research on games has enabled some interesting advances in algorithmic AI, such as the use of parallelized Alpha-Beta pruning (in Chess), or the progress seen in one of the most popular algorithms in Game AI, Monte Carlo Tree Search (MCTS), in the game of Go⁵. AI is used to create more realistic and challenging interactions, to provide guidance to players, and to personalize the experience. The use of AI in video games can have significant impacts on decision-making, as players must constantly change and review their strategies based on the behaviour of their opponents.

Issues with Current Technology

However, video games do have negative effects on decision-making, as many are designed to be addictive. They can also promote violent actions and other negative behaviours, which can create harmful outcomes in real life. Violence in video games should be avoided as much as possible because it occasionally has an effect on the player's psyche, even though there are other elements that contribute to aggressive conduct⁶. In the video game created for this experiment, decision trees were used to provide an outcome of the choices made. A decision tree is a non-parametric supervised learning algorithm, which is utilized for both classification and regression tasks. It has a hierarchical, tree structure, which consists of a root node, branches, internal nodes and leaf nodes⁷.

Decision making and the impact of Media

Every day, we must make different choices, from small decisions like what to eat, to big decisions such as choosing a career. The decision-making process involves carefully evaluating options, weighing their consequences (good and bad) along with choosing the best option that matches specific values, goals, and preferences. Decision-making, however, is not always rational as several factors, for instance, emotions, biases, trends, and external influences, can affect our decision-making ability. Peer pressure influences decision-making, and Peer pressure is often thought of as negative, due to influencing decision-making, but it can also be a positive thing. Unfortunately, peer pressure also has the ability to be negative if it restrains you from making a decision yourself or causes emotional or physical consequences⁸.

The media is the main source of mass communication, whether it is the news, social media or video games. Media can impact decision-making in different ways, for example, by shaping values, attitudes, perceptions and actions, which can have a positive as well as negative influence in the real world. Video games are not only common in our lives, but are interactive, having a significant impact on our decision-making.

The Rational Choice Theory

The rational choice theory is a psychological framework that is used to explain decision-making. Rational choice theory is an umbrella term for a variety of models explaining social phenomena as outcomes of individual action that can in some way be construed as rational⁹. According to the theory, people make decisions by considering the costs and benefits of each option and selecting the one which will provide them with the greatest benefit. There are 3 things the theory assumes:

1. The theory assumes that individuals are rational and make decisions based on their interests.

2. The theory assumes that people make decisions based on self-interest, but individuals often make decisions based on factors like social norms and other external costs.
3. Finally, the rational choice theory assumes that individuals are always able to make decisions that are in their best interests, but this is not always the case.

While it is true that the theory is a useful framework, it has its own set of limitations. The theory assumes that individuals have complete information about all the options available. It assumes that they are capable of accurately assessing the pros and cons of each option. However, in reality, people do not have complete information, not letting them analyze the costs and benefits of the decision.

Using the rational choice theory, AI can be used to affect the decision-making skills a person has within video games.

The rational choice theory has a large impact on decision-making. It is used in various fields like economics and psychology to understand how people make decisions. Cost-benefit analysis is one way the rational choice theory has influenced decision-making. Weighing the benefits and costs of different options to make a decision is commonly used in business and economics to make decisions about investments, pricing, and resource allocation. Decision-making models are another way the rational choice theory impacts decision-making. All rational choice explanations are reductionist: They share the assumption that explanations of societal-level outcomes (e.g., institutions, group structures, collective action, warfare, etc.) need to be grounded in a micro-level behavioural theory of individual action¹⁰. These models are used to analyze complex decisions and identify the best course of action based on available information. Decision-making models are commonly used in healthcare, where decisions must be made based on the best available evidence.

As discussed, decision-making is a complex process influenced by various factors, including media, AI, and the rational choice theory. Media's impact on decision-making ranges from just advertising to actively influencing decisions people make. AI in video games significantly impacts decision-making by providing realistic opponents and personalizing the gaming experience. The rational choice theory has a significant impact on decision-making. Overall, understanding the impact of these factors on decision-making can help us make better decisions and lead to more positive outcomes.

Research Objective

According to recent research, viewers remember 95% of a message when delivered by video, but only 10% by text¹¹. AI is used to make everyday life easier for everybody. To make

education and learning easier for students, using new technology like AI, can be revolutionary, and it could make explaining concepts easier for teachers. Getting hands-on experience is better than reading textbooks, and taking tests and practicing questions is one way of learning. Testing is an invaluable opportunity for learning, in addition to its more commonly considered roles in evaluating student learning (i.e., as summative assessments) and providing feedback to guide future learning (i.e., as formative assessments)¹². To affect learning, decision-making and invoking thought processes are important, and hence the question arose, Can AI-driven characters utilise the rational choice theory to affect player decision-making in video games?

Methods

Using a platform called Twine, an open-source tool which helps build games by using HTML, I built a text-based game, similar to an escape room. In an escape room, the setting and environment are controlled, resulting in more reliable results. An example of a game created on Twine is “THEY WILL NOT RETURN”, by John Ayliff¹³. As Twine helps create text-based games, these games often use decision trees, a supervised learning algorithm. The game has two different types of choices:

1. Choices to move the story along – these have no consequence
2. Choices to implement the Rational Choice Theory:
 - Choices made with the help of an external character and useful information
 - Choices made with only the help of useful information

There are two decisions to be made in each category. Each option has a different output. Making use of the Rational Choice Theory we created different scenarios.

The theory assumes that people are rational and make decisions based on their interests. In this game, to get accurate results, we follow this rule and the participants can make decisions based on their interests as characters in the story. The theory also assumes the person has all the information about the specific topic. For this, we have given the player all the information needed to play the game on the introduction screen beforehand. Finally, the theory assumes that people make decisions based on self-interest. The game helps the player find which option is best by listing facts, but also by providing information on the player’s character and the external character’s opinion; then they can make choices based on what they think is the best decision to take.

The decisions in order are as follows:

1. The first decision is to choose where the player begins their game, which does not provide any information and has no consequence.
2. The second decision makes use of the Rational Choice Theory. The theory is used commonly in economics as it studies the cost-benefit analysis of the choice. The cost-benefit analysis measures a project’s societal value by quantifying the project’s societal effects and making costs and benefits comparable in monetary terms. The game implies this theory to make this choice more realistic where the player has to balance the cost of each option and the benefit of the external character’s help.
3. The third and fourth decisions are to choose where to search using the help of an external character’s opinion and useful information provided about the decision. Using decision trees, the game loops around to help the player if the decision taken was not the best option.
4. The last decision uses only useful information but not the opinions of the external character.

The participants must take note of every decision taken in the game, as the choices are inputted into a Google form. The Google form had every decision and needed to be filled out while playing the game to keep track of their decisions. The participant must include their age and demographics as these are key factors which affect day-to-day decisions, however, other personal information such as age is not required. Each decision is tracked and the data is automatically converted into pie charts. The game is exported as an HTML file and can be opened and played on any search engine.

Results

The study involved 24 participants (12 female and 12 male, ages 13 to 51). The majority of participants were undergraduate students at the University of California in Los Angeles and were of Indian ethnicity. For the primary decision - where the subjects must choose from three different options using the rational choice theory, 75% of the candidates decided to give the NPC a “favour”. In the second decision, one with help from an external character, 54.2% of the participants chose to “search the courtyard”, and 37.5% of the participants chose the “cafeteria”. After searching the cafeteria and courtyard, all participants decided to “search the room”. Participants who chose to search the room first chose to “search the courtyard” next. For the final decision, 87.5% of the participants decided to go “around the guards” to escape the prison.

While choosing all the decision-making questions, which have help from an external character and extra information. All the choices made by participants favoured the choice



Fig. 2 A decision tree for the text-based game using Twine¹⁴

1. “I’m ready.” - Leads to a decision that does not have any consequence.
2. “I’m planning on getting out of here” - Leads to a decision testing the rational choice theory.
3. “Begin”- Leads to two simultaneous decisions that include useful information as well as the help of an external character.
4. “Take some rest” - Leads to a decision that includes helpful information but has no help from an external character.

which was supported by the external character. This shows that external help does influence a person’s thinking.

Discussion

This research can be used for a variety of subjects, but to also influence change in society. If interactive media has a powerful impact on decision-making, this media can be used not only for entertainment but as a tool for spreading information and education. AI is used to make everyday life easier for everybody. To make education and learning easier for students, using new technology like AI, can be revolutionary, and it could make explaining concepts easier for teachers. Getting hands-on experience is better than reading textbooks, and taking tests and practising questions is one way of learning.

The participant’s explanation for choosing to provide a “favour” for the NPC, between “a job”, “a favour” and a “lot of money”, was that “a favour” is not an immediate cost, and the participants would reap the benefits immediately. For the last decision, between going “around the guards” and “crawling through the tunnels”, a similar strategy was used for making

the decision, as going around the guards gave an immediate benefit. The rational choice theory makes multiple assumptions, one of which states that all actions are made due to consideration of costs and rewards. The experiment shows that one of the most valuable costs to the participants was time, and the participants wanted to choose whichever option would help maximise rewards in the least amount of time.

Some limits may affect the accuracy of the experiment:

Selection bias is one factor, and it happens when the study’s participants are not representative of the general population because of little self-selection or non-random sampling. It was difficult to obtain a large amount of data for the experiment, so selection bias may be a factor in inaccuracy. Small sample sizes can also affect outcomes because the study’s results cannot be generalised due to the study’s small sample size, it may not be representative of the larger population. The experimenter’s attitudes, plans, or behaviours may affect the study’s outcomes and produce biased results. The majority of the participants were from a specific region, which may result in unreliable results. This can also be related to any ethical concerns, like the generalizability and validity of the study may

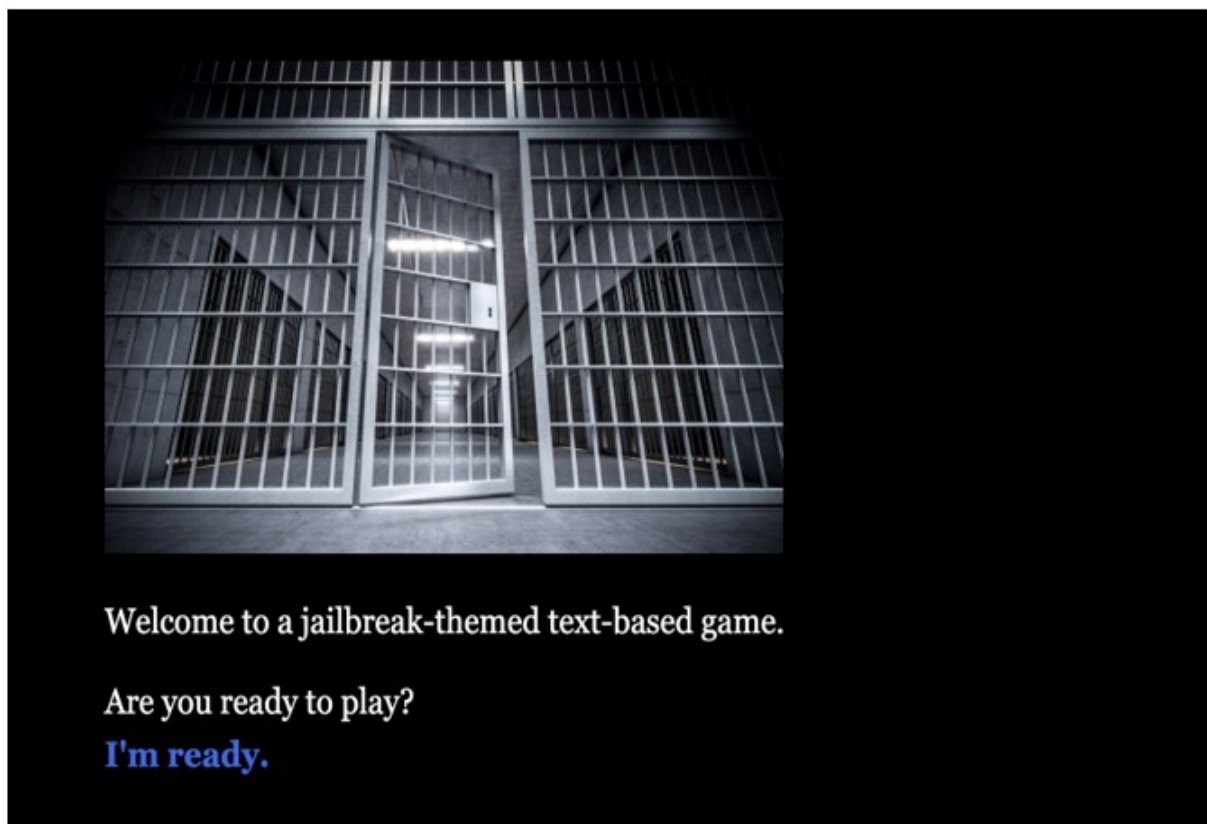


Fig. 3 The starting page of the game

be constrained by ethical issues including the use of deceit or damage to participants.

The tools used to measure variables in the experiment may not be reliable or valid, leading to inaccurate or inconsistent measurements, or the participants in the study may alter their behaviour or responses due to the awareness of being observed, leading to inaccurate results. The tool used in this experiment was a simple text-based game, made using HTML. This tool may not be able to convey the impact of AI-based characters, as the game used decision trees. In the future, there can be research on the same base, but using much more complex AI forms and models as characters.

To ensure the validity and generalizability of any experimental design, it is crucial to recognise and overcome these limitations.

Conclusions

In conclusion, this research paper has explored how AI can affect decision-making, with an experiment, and an analysis of available literature. The findings of this research paper have provided support for the initial research question and prove

that AI does impact and influence decision-making in people.

This research can be used for a variety of subjects, but to also influence change in society. If interactive media has a powerful impact on decision-making, this media can be used not only for entertainment but as a tool for spreading information and education.

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Each decision and the percentage of people who chose each decision

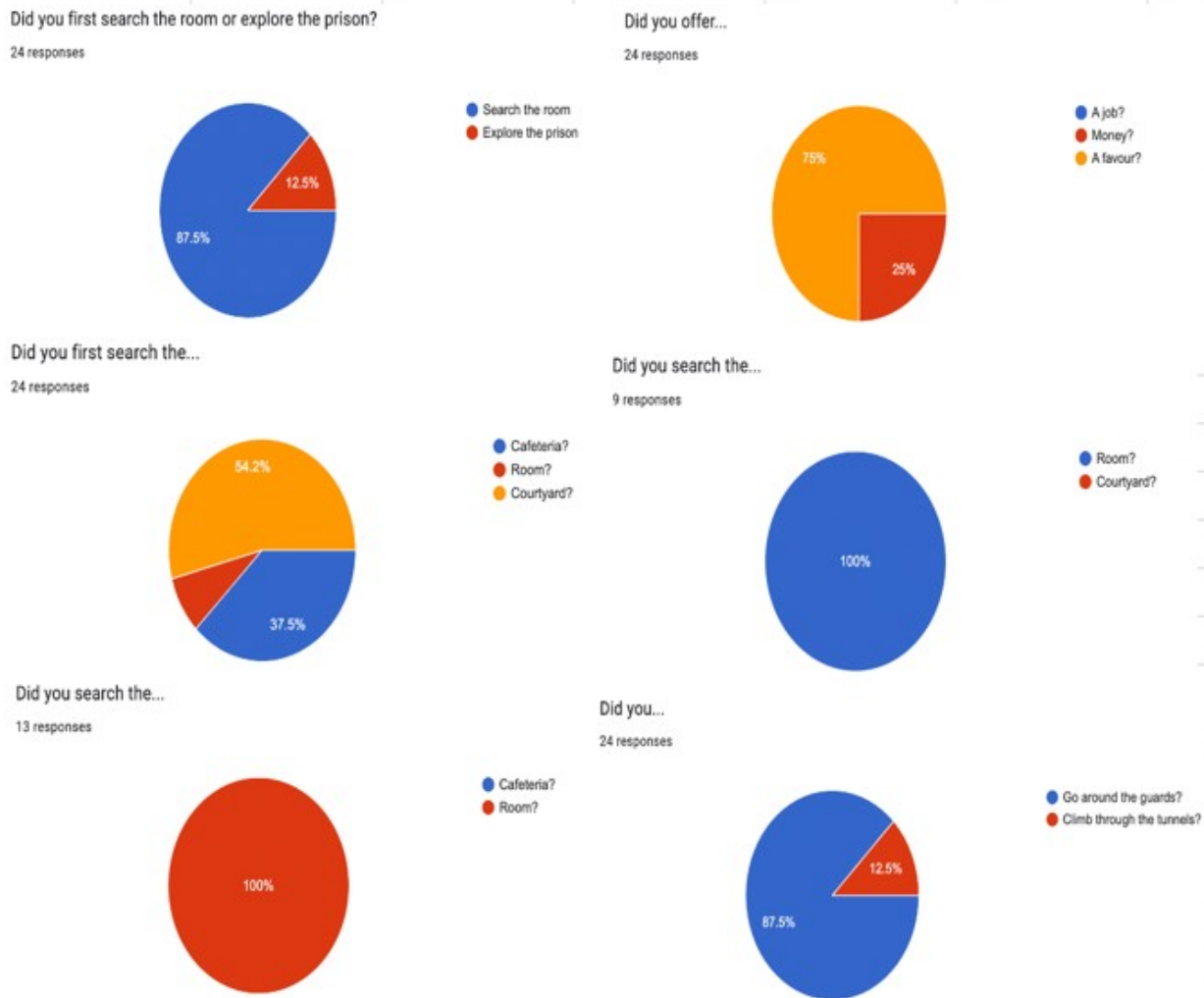


Fig. 4 Pie charts used to present data, using Google Forms and Google Sheets

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