

# A Study on the Impact of DDoS Attacks on the Switching Intent of Online Video Game Players

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## ABSTRACT,

*In recent years, online gaming has taken over the entertainment business, surpassing the music and film industries. However, due to the importance of always being available, video game servers have become a major target for availability breaches, namely for Distributed Denial-of-Service attacks. In this paper, the impact of the perceived severity of such malicious attacks on the switching intent of online video game players is investigated. Moreover, the effect of two possible moderators is explored – lack of attractiveness of alternatives and switching costs. Data was collected through an online survey, in which a 100 people participated, and a regression analysis was performed in SPSS 28. The results show that the intent to switch to a game from another publisher rises as the perceived severity of such DDoS attacks increases. However, no significant moderators were found. These findings suggest that no matter whether online video game players believe there are no suitable alternatives, or that they would incur high switching costs, if they perceive such service interruptions as severe, they intend to make the switch to another game. The results suggest that investing in DDoS prevention is crucial for online video game publishers, as such attacks may harm customer retention.*

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## Keywords

Distributed Denial-of-Service, switching intent, failure severity, lack of attractiveness of alternatives, switching costs, online video games,

# 1. INTRODUCTION

In 2022, gaming surpassed the combined earnings of both the film and music industries with a total revenue of \$185 billion, placing it in the leading position of the entertainment business (Agarwal, 2023). According to Statista, over 3 billion people worldwide played video games in 2022, out of which 1.17 billion used online gaming services (Statista, 2022). The competition in the industry is strong and diverse, with publishers, such as Activision Blizzard, Nintendo, Ubisoft, Electronic Arts, etc. Online video games come in a wide variety of genres, are available on different platforms, such as consoles, computer or mobile devices and are either free, require a paid membership to play, or a complete purchase of the title prior starting to play it is needed. The fact is that no matter the circumstances, gaming has become not only one of the biggest forms of entertainment in the world, but also developed a competitive scene, where players get the opportunity to even build professional careers. The market for competitive gaming, also known as eSports, is projected to grow to \$5.48 billion by the end of 2029 (Fortune Business Insights, 2022).

Although online gaming is a great way of connecting gamers all over the globe, it has turned into a good target for data breaches, most commonly for availability breaches, caused by Distributed Denial-of-Service (DDoS) attacks (Businesswire, 2020). According to reports, over 77% of cyber-attacks are aimed at online gaming services, due to the importance of their availability (Businesswire, 2020). A successful DDoS attack results in the overload of the game servers, leading to a slower response or a complete crash of the service for the users (Hadji-Vasilev, 2022). Despite their size, these big video game companies have also fallen victim to such malicious cyber-attacks, as for an example, the hacker Austin Thompson, also known as DerpTrolling, who took down all EA servers by using DDoS software multiple times in the period 2013-2014 (Cimpanu, 2019). Such attacks result not only in extra costs for the companies, but also in lost revenue due to the downtime of the service (Nassiri, 2019). However, another victim that must be considered, besides the video game publisher, is the user. Although some gamers switch between a few video games, others are dedicated to a single title, having sunk in thousands of hours, and possibly money. This paper will investigate how much influence such attacks have on the switching intent of the online gamers. When an attack occurs and players are not able to play their favorite game, would this force them to look for a substitute, or would they simply wait out until the servers are restored?

## 1.1 Research objective

The aim of this thesis is to gain insight of the customer's switching behavior following an availability breach caused by a DDoS attack in the domain of online gaming. The main objective of this research is to assess whether and how does the severity of such an availability failure impact

the user's switching intent and whether there are any moderator variables influencing this relationship.

## 1.2 Research question

In order to fulfill the aforementioned objective, the following research question must be answered:

*“What is the effect of failure severity on the customer's switching intent in the domain of online gaming?”*

## 1.3 Academic relevance

When reviewing the literature, many studies can be found on customer's switching intent (Manrai and Manrai, 2007; Liang et al., 2013). The impact of service failure is also a well-researched phenomenon (Martin et al., 2017; Sharifi et al., 2017). The nature and effect of DDoS attacks is also well-studied, however most of the studies done on the topic focus mainly on the impact on the victim company's stocks and revenue rather than the effect of such malicious acts on the customer's intent (Mirkovic and Reiher, 2004; Abhishta, et. al, 2018). When explicitly looking into the domain of online gaming, studies about availability failures can in fact be found (Jo et al., 2020). However, currently there is an existing gap in the literature when considering the three aforementioned topics altogether – that is, how does an availability breach caused by a malicious DDoS attack affect the switching intent of online videogame players. The aim of this research is to fill in this gap and therefore contribute academically to the fields of service failure and customer behavior.

## 1.4 Practical relevance

The results of this research will have real-world implications for the publishers of online videogames in a few ways. Firstly, this study will reveal how important service failure caused by DDoS attacks are to the users, allowing the publisher to determine how much should it invest into DDoS prevention. Secondly, in the case of an already occurring cyber-attack, this paper may help the publisher to decide how important it is to act swiftly in restoring the service by revealing how much the impact of the attack affects the customer's switching intent. Lastly, this paper may motivate the online videogame publishers to formulate a strategy for retaining customers when a DDoS attack occurs by revealing how much impact in reality do such availability breaches have on the customer behavior.

# 2. LITERATURE REVIEW

## 2.1 Key concepts

### 2.1.1 CIA triad

The CIA triad is a well-known information security model, encapsulating IT security's main objectives (Figure 1). These objectives are divided into three categories – confidentiality, integrity and availability. When a data breach occurs, the CIA triad can be used to determine the effect of said breach. A confidentiality breach would mean that there has been unauthorized disclosure or use of information, an integrity breach can be defined as unauthorized modification of information and an availability breach means that there has been a prevention in the authorized use of information when required (Oscarson, 2003). This research will focus on the third type of data breach – that of availability, explicitly when caused by a malicious DDoS attack.



Figure 1- The CIA triad

### 2.1.2 Distributed Denial-of-Service (DDoS) attack

By definition, a DDoS attack is a malicious attempt at hindering the availability and legitimate use of an online service (Mirkovic and Reiher, 2004). Although there are many possible ways to carry out such an attack and many possible motivations behind one, the end-goal is always the same – to inflict damage to the service provider and/or the user by forcing service failure (Mirkovic and Reiher, 2004).

### 2.1.3 Online gaming

This research will focus on such breaches of availability in the domain of online video games; therefore, this is another important concept that must be introduced. Online gaming can be defined as playing a video game over the Internet, whether it is played on a computer, console or a mobile phone (Schurman, 2023). In order to play online video games, servers are required, which are hosted by the game provider. The users access these servers and can play with thousands of others online (Wollacot, 2023). However, these servers often become targets for DDoS attacks, as they are easily susceptible to their effects, due to the importance of their availability (Gavric and Bojovic, 2022).

## 2.2 Independent variable – Service failure severity

Service failure can be defined as any type of error, mistake, deficiency or problem that occurs during the provision of a service (Koç, 2017). The nature of DDoS attacks, that of being a malicious attempt at hindering the availability of

an online service, makes them a cause for such service failures. This research will study the effect only of DDoS attacks resulting in service failure. A critical characteristic of service failures is their severity. By definition, service failure severity is the loss degree felt by customers after a service failure (Smith, 1999). This definition, however, makes the phenomenon very subjective in nature (Ye and Luo, 2016). This means that each customer may perceive the severity of the service failure differently.

## 2.3 Dependent variable –Switching intent

The dependent variable in this research is the switching intent of the customer. Switching intent can be defined as the customer's self-reported likelihood of ceasing an existing service relationship temporally or permanently (Wirtz et al., 2014). Although a positive relationship has been established in empirical studies between switching intention and switching behavior, this relationship is not found to be consistently strong (De Mesquita and Shin, 2023). This research will focus on the switching intent, rather than behavior, as behavior is much more difficult to measure by the means of this study. The existing literature shows that there is an established positive relationship between service failure severity and switching intent and this research will further develop it (De Mesquita and Shin, 2023).

## 2.4 Moderator variables – Attractiveness of alternatives and switching costs

### 2.4.1 Lack of attractiveness of alternatives

The first moderator variable in this research is lack of attractiveness of alternatives. This term is defined as the customer's perception of the lack of various alternatives available in the market (Han et. al, 2009). The moderator role of this variable is well studied, showing that there is a negative moderating effect of lack of attractiveness of alternatives on the relationship between customer satisfaction and loyalty (Han et. al, 2009). This research tested further this moderating quality on the relationship between failure severity and switching intent.

### 2.4.2 Switching costs

The second moderator variable in this research is the switching costs. This phenomenon can be defined as the costs perceived by the customer when switching to another product (Grant, 2020). Although the most prevalent costs are monetary, they can also be psychological and time- or effort based (Grant, 2020). Switching costs are widely studied as a moderator for switching behavior, showing that high switching costs significantly and positively moderated the relationship between customer satisfaction and customer retention (Han et al., 2009). In this research, this moderator effect was reviewed, as to whether switching costs do have an impact on the relationship between failure severity and switching intention.

## 2.5 Hypotheses

Based on the description of the variables, the following relationships were expected. The independent variable,

service failure severity, was expected to have a positive relationship with the dependent variable, switching intent. Furthermore, the first moderator, lack of attractiveness of alternatives was expected to have a negative moderator role on the relationship between the independent and dependent variables. What is more, the second moderator, switching costs, was also expected to affect negatively the relationship between the independent and dependent variables.

Based on these expectations, the following hypotheses were formed.

**H1:** Service failure severity is positively related to switching intent.

**H2:** Lack of attractiveness of alternatives negatively moderates the relationship between service failure severity and switching intent.

**H3:** Switching costs negatively moderates the relationship between service failure severity and switching intent.

## 2.6 Conceptual framework

After introducing the variables, describing their relationship and forming the hypotheses, the following conceptual framework can be presented (Figure 2).

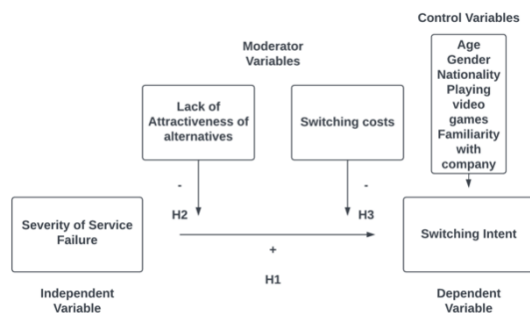


Figure 2- Conceptual Framework

## 3. METHODOLOGY

In this chapter, the methodology used to test the hypotheses will be described. This includes information on the type of research design, what research method was used, where the data was collected, the operationalization of the variables and how the data will be analyzed.

### 3.1 Research design

As mentioned, this paper will investigate how does the severity of a service failure, caused by a DDoS attack affect the switching intent of the customers in the domain of online gaming. In order to fulfill the purpose of this

paper, a combination of primary and secondary data will be collected and analyzed.

#### 3.1.1 Secondary research

By definition, secondary research is research that has already been conducted by others and its resources and data is already available (Chrysochou, 2017). In this paper, secondary research was used in the literature review section, including various literature sources. Furthermore, secondary data was also used in the operationalization of the variables, which will be discussed later in the methodology section. Important keywords that were used in the collection of secondary data are online gaming, Distributed Denial-of-Service, switching intent, switching behavior, switching costs, attractiveness of alternatives, information breaches and customer exit.

#### 3.1.2 Primary research

Primary research can be defined as research that utilizes data, collected by the research for the purpose of their research objectives (Chrysochou, 2017). As this study will take a quantitative approach, the primary data will consist of various data collected by an online survey. This data will then be analyzed in SPSS 28, in order to make conclusion about the hypotheses and answer the research question.

## 3.2 Research method

The primary research method of this study was an online survey. In this case, this was a favorable quantitative method, as it not only allows collecting data from a big sample but is also more suitable for the generalization of the phenomenon being studied (Chrysochou, 2017). However, surveys do have drawbacks, such as a vulnerability to different biases, which must be taken into consideration (Chrysochou, 2017).

## 3.3 Sampling

The sampling phase of the research is defined as the selection of the participants in the study (Chrysochou, 2017). As this paper investigates the switching intent of people playing online video games, the questionnaire was distributed in multiple online communities, forums and social media platforms, all of them connected to online gaming. Furthermore, the survey was conducted in English, as it "is the language of global online gaming", with the goal of collecting data from multiple cultures and nations over the world and contributing to the representativeness of this research (Peake and Reynolds, 2020). Overall, the survey collected a total of 100 valid responses.

## 3.4 Designing the questions

As mentioned, in order to collect quantitative data to test the hypotheses and answer the research question, an online survey was used. The operationalization of the variables can be seen below (Table 1). The structure of the survey was divided into three parts. The first part contained the control questions, the second part was a fictional

announcement of a service interruption due to a DDoS attack published by Electronic Arts (See Appendix A), and the last part was the main questionnaire. The survey questions were adapted to previously done research and can be found in the appendix (Appendix A).

**Table 1**

*Operationalization of variables*

Type of variable	Variable	Source	Questions	Items
Independent	Service failure severity	Wang et. al, 2011	7 Likert scale questions	3 Questions
Dependent	Switching intent	De Mesquita et. al, 2023	7 Likert scale questions	2 Questions
Moderator	Lack of Attractiveness of alternatives	Han et. al, 2011	7 Likert scale questions	3 Questions
Moderator	Switching costs	Han et. al, 2011	7 Likert scale questions	4 Questions
Control	Age, gender, nationality	N.A.	Demographic data	3 Questions
Control	Playing video games	N.A.	Yes/No question	1 Question
Control	Familiarity with company	N.A.	Agree/Disagree questions	2 Questions

### 3.4.1 Control variables

It is worth noting that some control variables were included in the survey. In order to account for other factors that may influence the outcome of the survey, the control variables age, gender, nationality, the respondent's experience with video games and familiarity with Electronic Arts were included. The inclusion of such variables also contributes to avoiding a weakness of the survey method, which is research bias (Bhandari, 2021).

## 3.5 Data analysis

In order to analyze the primary quantitative data that was collected from the survey, SPSS 28 will be used. After the data has been cleaned from missing values, the characteristics of the sample will be presented. Thereafter, the descriptive statistics will be shown with the goal of summarizing the results of the survey. Subsequently, a correlation matrix will be presented. Lastly, two linear regression analyses will be performed, in order to gain

insight of the relationship between the independent, moderator and dependent variables.

## 4. ANALYSIS AND RESULTS

In this chapter of the paper, the analysis and the results of the data will be presented. Firstly, the socio-demographic variables will be discussed. Thereafter, the descriptive statistics of the independent, dependent and moderator variables will be presented. Subsequently, the correlation matrix of the variables will be shown and discussed. Lastly, the two regression analyses will be presented.

### 4.1 Sample characteristics

In total, 100 valid responses were collected in this study. Overall, most of the respondents in the questionnaire identified as male (Male=69, Female=28, Non-binary=2, Prefer not to say=1). Furthermore, although most of the respondents were Bulgarian (77), there were participants from other countries, such as Germany (8), the Netherlands (7), India (2), etc. Out of the 100 participants, 87 indicated that they play online video games and 13 answered that they do not. When asked about whether they are familiar with the company Electronic Arts, 91 of the respondents gave a positive answer, however not all of them have played online video games by this publisher (88). The full frequency tables of the socio-demographic data can be found in the appendix (See Appendix B).

### 4.2 Descriptive statistics

The descriptive statistics of the variables are presented in Table 2. The variables in the table were computed by adding the scores of the questions per category and dividing the total by the number of questions, as per the operationalization table. In Table 2, the mean and the standard deviation of each variable are included.

**Table 2**

*Descriptive Statistics*

	Mean	SD
Severity	5.14	1.23
Switching costs	4.01	1.59
Lack of attractiveness of alternatives	3.89	1.70
Switching intent	4.33	1.66

The first row of Table 2 represents the answers to the survey questions in connection to the perceived severity of the interruption shown to the respondents in the survey. The mean of the independent variable “Severity” is 5.14 (SD=1.23), which can be interpreted as the respondents answering “Somewhat Agree” to the claim that the DDoS attack is severe. The second variable, “Switching Costs” stands for the second category of questions in the survey, namely that of the perceived switching costs, which could occur if the respondent decides to switch to a video game from another publisher. With a mean value of 4.01 (SD=1.59), these results show that the participants in the study neither agree nor disagree to the claim that they will encounter high switching costs if they have to switch to another video game publisher. The third variable in Table 2 is “Lack of Attractiveness of Alternatives”. With a mean of 3.89 (SD=1.70), the results show that on average, the respondents neither agree nor disagree to the claim that there is a lack of attractive alternatives to video games published by Electronic Arts. Lastly, the fourth row shows the descriptive statistics of the dependent variable “Switching Intent”. The mean, equal to 4.33 (SD=1.66) can be interpreted as the participants neither agreeing nor disagreeing that they would switch to another video game publisher if a DDoS attack occurred.

### 4.3 Correlation analysis

The correlations between the dependent, moderator and independent variables are presented in Table 3.

**Table 3**

*Correlation matrix*

	1	2	3	4
1. Severity	---			
2. Switching Costs	.42	---		
3. Lack of attractiveness of alternatives	.19	.59	---	
4. Switching intent	.38	.44	.16	---

As shown in the table, the correlation between dependent variable “Severity” and the independent variable “Switching Intent” was found to be moderately positively strong ( $r(98)=.38$ ,  $p<.001$ ). Similar results can be observed for the correlation between the first moderator variable “Switching Costs” and the independent variable,  $r(98)=.44$ ,  $p<.001$ . However, the second moderator “Lack of Attractiveness of Alternatives” was not found to be significantly correlated with “Switching Intent”,  $r(98)=.16$ ,  $p=.12$ .

### 4.4 Regression analysis

In order to test the hypotheses and reach a conclusive answer to the research question, two regression analyses were performed in SPSS 28 – one with and one without the moderator variables “Switching Costs” and “Lack of Attractiveness of Alternative”. The results can be observed in Table 4.

**Table 4**

*Results of Regression Analyses*

	Model A	Model B	Model C
Severity	.49 (.13)*	.26 (.13)*	.79 (.32)*
Switching Costs		.50 (.13)*	.74 (.48)
Lack of Attractiveness of Alternatives		-.15 (.11)	.32 (.46)
Severity x Switching Costs			-.05 (.09)
Severity x Lack of Attractiveness of Alternatives			-.09 (.09)
Constant	1.80 (.67)*	1.55 (.67)*	-1.20 (1.66)
R <sup>2</sup>	.13	.27	.29
F(df)	14.99 (1, 98)	11.69 (3, 96)	7.76 (5, 94)

\*  $p<.05$

#### 4.4.1 Regression analysis without moderators

In Table 4 the results of the first regression, using the independent variable “Severity” as a predictor for the dependent variable “Switching Intent”, can be observed in column “Model A”. Overall, the simple linear regression indicated that independent variable “Severity” predicted “Switching Intent”,  $R^2 = .13$ ,  $F(1, 98) = 14.99$ ,  $p<.001$ . Additionally, the results reveal that “Severity” significantly and positively affects “Switching Intent”,  $B=.49$ ,  $p<.001$ . This **confirms H<sub>1</sub>**, namely that service failure severity is positively related to the switching intent.

#### 4.4.2 Regression analysis with moderators

In order to test H<sub>2</sub> and H<sub>3</sub>, a second regression analysis was performed, this time investigating the moderator properties of the variables “Switching Costs” and “Lack of Attractiveness of Alternatives”. The results of this moderator analysis can be observed in Table 4, column “Model C”.

The focus of this linear regression are the interaction variables named “Severity x Switching Costs”, which is the moderation effect of the variable “Switching Costs”, and “Severity x Lack of Attractiveness of Alternatives”, which is the moderation effect of the second moderator “Lack of Attractiveness of Alternatives”. As seen in Table 5, the results revealed a negative, but insignificant moderating impact on the relationship between “Severity” and “Switching Intent” for the first moderator “Switching Costs” (B=-.05, p=.60). Furthermore, the second moderator “Lack of Attractiveness of Alternatives” also gave similar results with B= -.09, and p=.31., showing a negative, but insignificant impact on the relationship between the dependent and independent variables. This leads to the **rejection of both H<sub>2</sub> and H<sub>3</sub>**.

## 5. DISCUSSION

After the statistical analysis in Chapter 4, enough data has been collected in order to determine whether the hypotheses are supported or rejected. In this chapter, conclusive answers to the hypotheses will be given and the research question will be answered.

### 5.1 Hypothesis 1

The results of the linear regression without moderators (B=.49, p<.001) show that there is in fact a significant, positive relationship between the independent variable “Service failure severity” and the dependent variable “Switching intent”, therefore there is enough evidence to confirm H<sub>1</sub>. In the context of this study, this can be interpreted as that if an online video game player perceives a service interruption caused by a DDoS attack as severe, their intent to switch to a game from another publisher increases. These findings not only further support the already established relationship between failure severity and switching intent (De Mesquita and Shin, 2023), but also confirm its existence in the domain of online gaming.

### 5.2 Hypothesis 2

The second linear regression that was performed in the analysis of the data tested the moderating effect of the variable “Lack of attractiveness of alternatives” on the relationship between the independent variable “Service failure severity” and the dependent variable “Switching intent”. As expected, a negative effect was observed, however there was not enough evidence to prove that it was significant (B= -.09, p=.31), thus H<sub>2</sub> was rejected. This indicated that even though no attractive alternatives are available on the market, online video game players will still intend to switch to another game if they perceive the severity of the service interruption, caused by a DDoS attack, as high. Contrary to the study done by Han et. al (2009), a negative moderating effect could not be proven. However, a possible reason for this is the difference in the

industries that were explored – the hospitality industry in the research done by Han et. al (2009) and the video game industry in this paper.

### 5.3 Hypothesis 3

Similarly to “Lack of attractiveness of alternatives”, a significant, negative moderation effect was expected from the second moderator variable in this research, “Switching costs” on the relationship between “Service failure severity” and “Switching intent”. The results from the second linear regression did show a negative impact, however not enough evidence was gathered to confirm its significance (B= -.05, p=.60). This means that H<sub>3</sub> was also rejected. These results show that even though one would incur high switching costs, whether as time, effort or money, when switching to a game from another publisher, this would not affect their intent to switch, if the perceived severity of the service interruption is high. This is contrary to already established research (Han et. al, 2009), however a good reason for this could again be that this research was carried out in the domain of online gaming, rather than the hospitality industry.

### 5.4 Research question

Now that answers to the hypotheses are given, the final research question can be answered.

*“What is the effect of failure severity on the customer’s switching intent in the domain of online gaming?”*

Hypothesis 1 shows that the effect of failure severity on the customer’s switching intent is significantly positive. Furthermore, hypotheses 2 and 3 show that there are no moderators affecting this relationship, further proving the effect of the independent variable “Severity” on the independent variable “Switching intent”. To conclude, the answer to the research question can be formulated as *“The effect of failure severity on the customer’s switching intent in the domain of online gaming is significantly positive. The higher the perceived severity of the service interruption, the higher the intent of the player to switch to a game from another publisher”*.

## 6. CONCLUSION

The aim of this paper was to further investigate the already established relationship between service failure severity and user switching intent, but in the domain of online gaming. In order to gather the data needed, an online survey was conducted, and the results were analyzed in SPSS 28. The analysis led to two main findings:

Finding 1: *Failure severity has a significantly positive effect on the customer’s switching intent in the domain of online video games.*

Finding 2: *Lack of attractiveness of alternatives and switching costs do not have a significant negative moderating effect on the relationship between severity and switching intent.*

## **6.1 Academic implications**

As mentioned, the relationship between service failure severity and switching intent is already established, however it was not found to be consistently strong. Moreover, most of the previously done research was focused on the hospitality industry. This research shifted this focus on a different and relatively new, but rapidly growing industry – the gaming industry, with the goal of retesting this relationship. The first main finding of this paper reinforces the already established relationship between service failure severity and switching intent. Similarly to other industries, online video game players who perceive a service failure as more severe are more likely to switch to another product, or in the context of this research, to a game from another video game publisher. However, Finding 2 indicated a difference between this paper and previously done research. During the literature review, it was found that both “Lack of attractiveness of alternatives” and “Switching costs” have had a significant negative moderating effect on the relationship between “Failure severity” and “Switching intent”. Contrary to these results, the second finding of this paper implicates that this effect is not significant in the video game industry. This indicates that there may be unique characteristics to the online video games industry, which may require further research.

## **6.2 Managerial implications**

Besides the academical implications, the findings of this paper may be found to be useful to online video game publishers. The results have shown that no matter whether the player believes that there are no suitable alternatives, or that one would incur high switching costs, if such a service interruption occurs, one’s intent to switch to another publisher increases. This conclusion suggests to the online video game publishers that investing DDoS prevention would be the most effective measure to retain players if their servers are a target for such attacks. Furthermore, the results of this paper show to the publishers that if preventing DDoS attacks is impossible, it is of great importance to act swiftly in restoring the service, otherwise the perceived severity may potentially increase and thus the switching intent of the player may rise.

## **6.3 Limitations**

It is worth noting that this study has some limitations. To start off, even though 100 participants were enough to reach a conclusion, a larger sample size may make a difference. Furthermore, it is possible that the results may vary for the different companies. In this study, Electronic Arts was used in the survey, however using a company as Blizzard or Riot may yield different results, as they produce different genres of games. Lastly, although two moderators were investigated in this research, namely “Lack of attractiveness of alternatives” and “Switching costs”, there may be others, such as “Brand loyalty”, “Size of player base”, etc. This requires further research.

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# APPENDIX

## Appendix A:

Measurement of items in this study; Survey questions

Independent Variable – Failure severity: (Scale is 1 (strongly disagree) – 7 (strongly agree))

- The service interruption is severe.
- The service interruption makes me feel angry.
- The service interruption is unpleasant.

Dependent Variable – Switching intent: (Scale is 1 (strongly disagree) – 7 (strongly agree))

- After such a service interruption, I am prone to switch to a game from another publisher.
- After such a service interruption, my desire to switch to a game from another publisher increases.

Moderator Variable – Switching costs: (Scale is 1 (strongly disagree) – 7 (strongly agree))

- It would cost me a lot of money to switch to another online video game publisher.
- It would take me a lot of effort to switch to another online video game publisher.
- It would take me a lot of time to switch to another online video game publisher.
- I would feel uncertain if I had to choose another online video game publisher.

Moderator Variable – Attractiveness of alternatives (Scale is 1 (strongly disagree) – 7 (strongly agree))

- Compared to Electronic Arts, there are not many other online video game publishers that would be satisfactory.
- If I need to switch to another online video game publisher, there are not many other good ones.
- I would feel uncertain if I had to choose another online video game publisher.

Control Variables

- Age – Open question
- Gender – Male/Female/Non-binary/Prefer not to say.
- Nationality – Open question
- Do you play online video games? – Yes/No.
- I am familiar with the video game publisher Electronic Arts. – Agree/Disagree
- I have played online video games published by Electronic Arts. – Agree/Disagree

### [Game giant EA hit by a cyber-attack](#)

PR Newswire

May 17, 2022 Monday 4:30 PM EST

#### **Announcement**

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Players of the video game FIFA 22 saw their activity disrupted after a Distributed Denial-of-Service (DDoS) attack hit the servers of games company Electronic Arts ([NASDAQ: EA](#)). This resulted in a service outage and gaming downtime.

Shortly before the cyber-attack, the hacking network Poodle Corp took responsibility for it via Twitter.

"We're currently informing affected users and working to resolve the issue as fast as possible," tweeted John Smith, the CEO of EA via their Twitter account.

Sean Newman, Director at Corero Network Security, said that the attack was "proof that organisations which depend on their online presence need a protection against cyber-security threats."

## Figure 3

*Announcement shown to the respondents in the survey*

## Appendix B: Results of statistical analysis

Frequency tables of socio-demographic variables:

**How old are you?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	14	1	1,0	1,0	1,0
	16	2	2,0	2,0	3,0
	18	3	3,0	3,0	6,0
	19	2	2,0	2,0	8,0
	20	8	8,0	8,0	16,0
	21	15	15,0	15,0	31,0
	22	9	9,0	9,0	40,0
	23	19	19,0	19,0	59,0
	24	16	16,0	16,0	75,0
	25	13	13,0	13,0	88,0
	26	1	1,0	1,0	89,0
	27	1	1,0	1,0	90,0
	28	3	3,0	3,0	93,0
	29	3	3,0	3,0	96,0
	31	2	2,0	2,0	98,0
	35	1	1,0	1,0	99,0
	37	1	1,0	1,0	100,0
	Total	100	100,0	100,0	

**Figure 4**

*Frequency table of variable "Age"*

**What is your gender?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	69	69,0	69,0	69,0
	Female	28	28,0	28,0	97,0
	Non-binary / third gender	2	2,0	2,0	99,0
	Prefer not to say	1	1,0	1,0	100,0
	Total	100	100,0	100,0	

**Figure 5**

*Frequency table of variable "Gender"*

**What is your nationality?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	British	1	1,0	1,0	1,0
	Bulgaria	4	4,0	4,0	5,0
	bulgarian	6	6,0	6,0	11,0
	Bulgarian	67	67,0	67,0	78,0
	Cypriot	1	1,0	1,0	79,0
	Dutch	6	6,0	6,0	85,0
	German	6	6,0	6,0	91,0
	German/Mexican	1	1,0	1,0	92,0
	Germany	1	1,0	1,0	93,0
	Indian	2	2,0	2,0	95,0
	Latvia	1	1,0	1,0	96,0
	Nederlands but also no	1	1,0	1,0	97,0
	Romanian	2	2,0	2,0	99,0
	Spanish	1	1,0	1,0	100,0
	Total	100	100,0	100,0	

**Figure 6**

*Frequency table of variable "Nationality"*

**Do you play online video games?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	13	13,0	13,0	13,0
	Yes	87	87,0	87,0	100,0
	Total	100	100,0	100,0	

**Figure 7**

*Frequency table of variable "Do you play video games?"*

**How familiar are you with Electronic Arts? - I am familiar with the video game publisher Electronic Arts.**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	9	9,0	9,0	9,0
	Agree	91	91,0	91,0	100,0
	Total	100	100,0	100,0	

**Figure 8**

*Frequency table of variable "Familiarity with Electronic Arts"*

**How familiar are you with Electronic Arts? - I have played  
online video games published by Electronic Arts.**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	12	12,0	12,0	12,0
	Agree	88	88,0	88,0	100,0
	Total	100	100,0	100,0	

**Figure 9**

*Frequency table of variable "Played games published by Electronic Arts"*