Cheating in Multiplayer Video Games

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Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

Master of Science
In
Computer Science and Applications

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April 15th 2009
Blacksburg, Virginia

Keywords: Cheating, Video Games, Consequences

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ABSTRACT

Cheating in video games has been prevalent ever since the days of Pong. Games have evolved much since then and the ways in which people play together have changed as well. Older systems required people to play together in the same room, but with the advent of the internet, gaming consoles allow us to play games together with people located all over the globe. Cheating has evolved as well, since gamers no longer have the luxury of monitoring the person sitting next to them; anti-cheating mechanisms are built into most online systems and suspicious behavior is monitored by gaming companies.

Most of the current research has surrounded ways in which players cheat and their reasoning for doing so. This is only half of the equation however, what happens after a gamer is caught cheating? What are the repercussions for being caught cheating and how does being caught influence future decisions to cheat? By putting gamers in a situation where they are caught cheating, three different responses were revealed: those who are determined to cheat no matter what, those who scale back their cheating in the hopes of remaining undetected, and those who stopped cheating altogether.

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Chapter 1 Introduction

1.1 Problem area

Cheating in video games is a big problem for both players and companies alike. Imagine playing in a fair fight with an opponent when all of a sudden you find yourself overwhelmed with an attack that would otherwise be impossible to achieve. When players who attempt to play by the rules are put in a situation like this, it becomes very easy to gain a negative view of the game or its developers. Players can be discouraged by rampant cheating and stop playing the game altogether. This translates to loss of revenue for game developers and influences not only the current game but their future work as well. But what actual effect does this have on the cheaters?

In single player games such as Solitaire, cheating only extends as far as the person who is cheating; cheating only serves to be self deceiving as the real challenge is not against another person but instead yourself. In a physical game of Solitaire this might equate to bending the rules a little and adding another column so that the player can better manipulate the cards. In the world of computerized gaming however, such rules only exist if they are programmed. Thus such cheats fall into three categories: cheats created by the developer of the game intentionally, exploits in the game that are either the results of buggy code or development features that were meant to be removed, and third party code that modifies the game in a way that the developer had not intended. Cheats left in intentionally by the programs typically only exist in single player modes. Many reasons exist for this but typically it is for added value or to allow the player to move past a difficult section. These single player cheats do not usually move beyond single player because of issues of fairness and defining the actual rules of the game. What this research focuses on is the latter two types of cheats, the exploits and game modifications because they tend to affect multi-player modes.

The research in this field does a nice job of defining the motivations for cheating [1], the actual methods of cheating [3, 4] and the ways companies deal with it [7] and how that translates to the gamer [15]. The current literature does not examine why players continue to cheat or what happens after the gamer makes the decision to cheat? A specific game console or account may be banned from an online service but there is no

user tracking involved; the current literature stops there. Other questions left unanswered in the literature are:

- What aspects of games in particular lead players to cheat assuming all other things are equal (same player goals, same opponent difficulty, etc)?
- How does getting caught cheating affect a player's perceptions of cheating in the future?
- Do players who have been caught cheating stop/cheat less/cheat more?

These are all questions that the current literature does not address and have been left unanswered.

1.2 Specific problem

This research seeks to answer some of the questions posed above, namely how being caught cheating affects a player's tendency to cheat in the future. This might be likened to how convicts react after run-ins with the law; some people reform while some continue to be repeat offenders. The other question is how does a gamer's perception of being caught affect their likelihood of cheating? Much like fake security cameras can deter theft because criminals cannot tell if they are real or not [8], how do security systems (or the perception of them) in video games deter cheating? The aftereffects of cheating and how it changes people's perceptions are currently missing from the available literature and answering those two questions is what this research attempts to answer.

1.3 Claim

1.3.1 Reasons and Evidence

Past personal experience has shown that being banned from a gaming system is not enough to deter a person from coming back to the game again. Cheating typically lends itself to making the game easier, and those who cheat have a much easier time starting from nothing and arriving back at their former glory in short order with such cheats. However, it does seem that people will try to do as much as they can while staying under the radar of anti-cheating detection systems.

Blizzard's anti-cheating detection system Warden works on many different levels and cheaters playing many of Blizzard's different games do what they can to stay under the radar. The key to Warden however is that every time a client connects to the server, instructions for Warden are sent to the client and executed; this makes Warden completely dynamic for what it can detect. Cheaters tend to get around Warden by performing a hash on the data sent to it, if the hash is different then most cheaters turn off their cheats as a countermeasure until it can be determined what the newest version of Warden can do.

However, knowing the automated system's anti-cheating policies is only half the battle for a cheater. Other players in the game also have the ability to recognize a person cheating in ways that an anti-cheat detection system could not. For example, a program that does nothing more than emulates key presses to completely automate player behavior; this is called botting. Botting is easily detectable to the human eye since the player does the same thing over and over again, but to a machine this can be very difficult to detect. Part of slipping under the radar is knowing how to limit automated or cheating behavior so that it is too sparse to detect by either man or machine.

This level of evasion is the basis for the questions in this thesis. Watching how cheaters determine the capabilities of the system and attempt to circumvent them, and seeing what their reaction is after being caught.

1.3.2 Acknowledgments and Responses

One of the toughest problems with this type of research is finding both people who have cheated in the past and people who are familiar with the game being used for the research. This is actually a fair problem and one that is difficult to address without a conflict of interest. In order to conduct a study such as this using custom cheats (which will be discussed later), cheaters familiar with the game would not be able to take the study seriously because they know the cheats are not actual cheats in the game and infer that things like anti-cheat detection are not really occurring either.

Actually finding people who cheat and know the game considerably well is another problem. Finding one or the other would not be difficult, due to the large number of games out there, but the cheating population is only a small subset of a particular game

(for the most case). There are resources online such as cheating/hacking/exploit forums, but making use of them does not necessarily guarantee someone who is really willing to help you with your research; they may want to derail it instead.

1.3.3 Warrants

Cheating in games is an issue that not only affects the quality of the fun players have, but one that also has an economic impact in many cases. Determining how gamers respond to attempts to deter them from cheating is important because cheating directly impacts the quality of service (QoS) that the provider is able to give us. Games with poor QoS are no fun to play and typically hemorrhage gamers. A poll (in Figure 1.3.3) conducted during the course of the research revealed the games that gamers associated with cheating. The follow-up question to this was what games people actively stopped playing due to cheats. The correlation between the two is apparent; about one out of every five people stopped playing or avoided a game due to cheats. If a correlation between the strength of an anti-cheating system and the chances of cheating occurring, or a correlation showing that certain consequences reduced cheating in games, then games could be strengthened with these results and providers could provide a better quality of service to gamers worldwide.

Table 1.3.3 Games that gamers associated with/quit due to cheating

Game	Associated with cheating	Quit due to cheating
Diablo I/II	6	2
World of Warcraft	4	0
Counterstrike	2	1
SOCOM	1	0
Gears of War	1	0
Neverwinter Nights	1	0
Ultima Online	1	0
Runescape	1	0
Helbreath	1	0
Soldier of Fortune	1	0
Unreal Tournament	1	0
Ragnarok	1	1

Chapter 2 Previous Works

2.1 The implications of cheating in video games

Kimppa et al. give a nice overview of the moral implications of cheating. In short, cheating in single player games serves only the purpose of deceiving yourself. In group play, the same behavior carries a different meaning [3]. Piaget has a fascinating example of the play of young children. They immediately have a negative response towards other children who are cheating not because they understand the concepts of right and wrong but simply because it makes the game less interesting [16]. Most people play games for enjoyment and perceived value.

There is a lot of perceived value in multiplayer games. Most multiplayer games keep some sort of persistent incentive to play such as scoreboards, ladder matches, and character advancement. The problem with cheating in multiplayer games is that you are no longer deceiving yourself, but instead you force someone to "incur a loss in perceived value" [3]. This could even be a loss of real value in games where the currency has a direct real world equal (such as Second Life) or as Smith mentions that rampant cheating can change gamers' view of a service and cause the provider to lose subscriptions due to player's negative perception of the service [4]. Some players perceive such a great loss that they take others to court over such Imaginary Property or, as an article at ABC News states, even kill one another [10]. Most forms of cheating in games have been written off as if it were the same as cheating in a game of chess [4], but the consequences can be very real.

2.2 Motive for cheating

Outside of the gaming world, there are many motives for cheating and bending the rules. One such example is the case of Lee-Allen University in which a basketball player had a failed grade illegally expunged from his record to keep him eligible for athletics. In this case he took the team on to a national championship which earned him an MVP and a lot of accolades for his school that would not have been received if the record had not been expunged. In this case, the president of the university went against

the university's moral code by trying to better Lee-Allen [17]. But this type of situation is also commonly found in games.

Some methods that might be considered cheating or grief play are actually encouraged in some games due to their nature. The best example of this is the MMORPG Everquest which was lovingly referred to by its players as "Evercamp" [21]. In the video game context, camping refers to waiting around for an enemy to appear so that it can be killed. The goal is either to obtain a reward or to engage in grief play and deny another player enjoyment of the game. As much as the designers of Everquest tried to discourage camping of monsters the allure of items was still too great to prevent this practice [22].

Consalvo lists some common reasoning for using cheats in video games: game-play advancement (stuck), desire to play God (after the game has been beaten), speed up/skip repetitive tasks, and direct malice towards other users [1]. This last one is interesting as some people use offensive and defensive points of view. On the defensive side, people claim they outwardly cheat because they do not know if the other party intends to play fair with them and cheating is a means to level the playing field. Offensively it is used just so that one may be the better over the other player [1]. Many people play just for prestige [6] which could be likened to the use of illegal steroids in pro sports.

2.3 Methods of cheating

Authors define cheating differently. Consalvo breaks cheating into three categories: Any thoughts or ideas that do not originate from the player, anything that modifies the game code, and anything that affects another player [1]. Smith and Kimppa et.al. look at cheating only from a multiplayer standpoint. Smith brings up issues such as superior skill or superior game play knowledge, camping, and character killing. Each of Smith's "cheats" affects other players playing the game without changing the rules [4]. Kimppa on the other hand explores the implications of modifying the game and the subsequent effects on opposing players and potential solutions [3]. Other types of cheats exploit outside factors in the game such as latency. In some games, producing a large enough amount of latency can also boot the opponent from the game declaring the lag

producer the winner. Another type of cheating that is prevalent in video games is social engineering. This type of cheating relies on nothing more than deception of other players. For the purposes of this research, cheating is broken up into three categories (which mesh well with Consalvo's): Outside assistance, Software hacks/exploitation, Hardware hacks/exploitation.

2.4 Software hacks and exploitation

Software hacks are by far the most used because of their ease of transport and setup. No hardware is required; they can just propagate quickly over the internet. Different methods of software hacks are defined by Pritchard who explains different methods of software hooks, proxies, memory changing, and more [9]. Another good example of this comes from the program InnerSpace which acts like a mini operating system to encase the game so it cannot scan outside of the InnerSpace boundaries [13].

Exploits are another a large concern because they take advantage of preexisting code that is already in the game. Wilma and William Bainbridge group these different exploits into three main categories: model discrepancies (dealing mostly with collision detection and boundary boxes), programming errors and unanticipated input (overloads, unexpected button presses, awkward camera angles) [18].

To combat these hacks and exploits companies like Blizzard have scalable systems that are updatable at any time [7]. The cheaters combat this by making their software detect these updates and then not working until they issue their own response update [13].

2.5 Preventing cheating

Matt Pritchard goes into great depth about how to prevent hackers on multiplayer games. He goes in depth about fighting proxies, memory scanners, and memory changers as well as how to deal with issues in client-server and peer-to-peer architectures [9]. As mentioned before, Blizzard employs its own countermeasures through the use of Warden. Warden scans processes for known cheats, validates memory contents and much more [7]. The appeal of Warden is that Warden itself is just a shell that can perform these different

functions; the actual functions it is meant to perform are downloaded at runtime so that it is always up to date. Because of the dynamic nature of Warden, no one knows exactly what it is scanning for and there is a heightened sense of perceived security. This can be likened to the way fake cameras deter theft by making use of the illusion of security [8]. Other systems monitor statistics about players to establish a baseline about how long certain actions take to accomplish. Any behavior that falls outside of the standard deviation is then seen as suspicious and looked into more closely [20]. Software can also assume that known cheaters will continue to cheat again in the future and that other gamers with similar results as them may also be cheating [19].

2.6 Repercussions of cheating

Blizzard entertainment regularly perma-bans accounts on the popular game World of Warcraft on a bimonthly basis [14]. Many games implement a pyramid style of warning system which ultimately leads to a permanent ban. Permanent bans mean the complete loss of all your accrued accomplishments. Microsoft tries to ban consoles that have been modified in some way from their Xbox Live network to preserve its integrity [15]. In cases such as these, most cheat testing is done on new or trial accounts that are able to access the service; the loss of which is not of great importance to the cheater. From there, the cheater may move on to his/her good account. Some gamers themselves have gone on to form vigilante groups to combat cheating. One group formed a company named Punkbuster in 2001 which became a widely used anti-cheating program in many online games like Counterstrike. Others have taken on a more personal approach as they turn to real life violence [10].

2.7 Economic impact

Games like second life have an in-game economy that is comparable to real dollars and companies like IGE will convert your money into game money for a variety of games [12]. On a larger scale however, we have to consider the economic impact to the company. Sony entertainment has played to the cheaters by offering an e-Bay type exchange system for real money to in-game money transfers named Station Exchange

(soon to be renamed Live Gamer Exchange) [11]. Blizzard on the other hand has historically been lambasted for their cheat/hack laden battle.net [5]. Many players choose not to play online where the economies have become so polluted by duplicate items being created. As such, these types of players refuse to purchase future products due to the same fear of cheat penetration [5].

Chapter 3 Methodology

3.1 Overview

The research was designed to find out how players cheat in multiplayer games and how being caught cheating affects their tendencies to cheat in the future. In order to see these effects, multiple games were configured in order to observe cheating's effect on future games. The first game in the series would boot players from the game after cheating a certain number of times while the second game would have this restriction removed in order to see if players decide to cheat less, the same, or more.

3.2 Choosing the game

The first major consideration of the system was to find a game that could be easily scripted; this way the anti-cheating mechanisms that the online services use could be emulated without actually being online but still in a multiplayer setting. The number of scriptable games on the market is fairly small, and after filtering out the genre of game, the number becomes much smaller.

The second major consideration to be made was the genre of game. The study needed a game type that encouraged repetitive, non-persistent, goal oriented play. Many game studies that are taking place focus on the massively multiplayer online role playing game (MMORPG) genre; this genre however focuses mostly around non-repetitive persistent game play. The player is thrust into a persona which they know little about and care little for during the short duration of the study. If they were to lose the character due to cheating then they feel that little has been lost as the goals of a MMORPG revolve around character growth as opposed to a single specific quantifiable objective. The repetitive testing may also cause the user to become confused as they once again regain control of a persona that had just been banned from them. The genre that fit these guidelines the best was real time strategy (RTS) because of the non-persistent, repetitive and goal oriented game play.

The constraints that were put on the system were a game that needed to be scriptable, playable in multiplayer, not persistent, repetitive and goal oriented all at the

same time. For this reason, the Blizzard game Starcraft was chosen due to its extensive scripting system in its custom maps.

3.3 Designing the cheats

Because of anti-cheating mechanisms built in to most online game services, there is no way that such trials could be held online without real loss (in the form or game keys, accounts, etc. being banned from the service) or without disrupting the game play of legitimate players. Another consideration was that these cheats needed to be accessible from within the scope of the game; players need to know that the cheats are readily accessible to them. Cheats in most multiplayer games take the form of a third party program; the last thing we want is for the participant to have to leave the game space in order to make use of a cheat and break the flow of the experiment or worse yet, have the player forget that the cheats are available. For both of these requirements to be accomplished, scripting would be a necessity for the chosen game. The decision to use repetitive trials also meant that each play session must start the same way, so the game could not be persistent; i.e. a previous game's accomplishments should not affect the flow of future games leaving each game independent of the other. To accomplish these things, both the technical merits of the game (the scripting) as well as the genre of the game were important. In order to gauge how the players perceived being caught for cheating questionnaires would also be a necessity before and after each game.

3.4 Setting up the experiment

3.4.1 The map

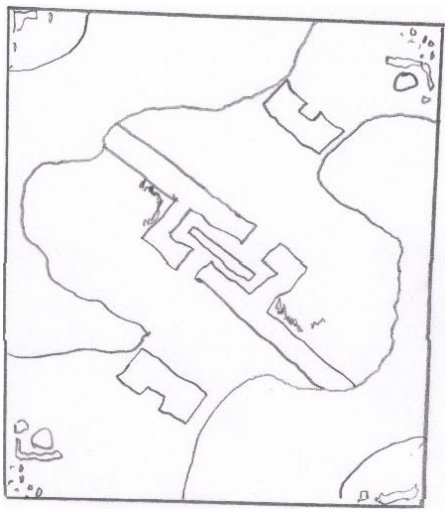
Once Starcraft was decided upon as the method in which to carry out the experiment, it was a matter of molding a custom map to fit the requirements for the system.

The first consideration for that map is that it would need to be a two player map. The map needed to be two players only in order to minimize the number of people

cheating in a game; if it were to be more than two people in a game, then the likelihood of people cheating and their real cheating habits would be much harder to observe. If it were an eight person melee for example, it would only take one person to goad everyone else into cheating and once multiple people start cheating, the necessity for those not cheating to cheat becomes much greater and the scope of they're actual tendency to cheat would be lost. This is especially important for the second game where the ability to get kicked out of the game from cheating was removed.

The second consideration was the size of the map. The map needed to be large enough that one person cheating did not automatically mean game over. This could be foreseeable as a player could buy a powerful unit and take it over to the opponent's base in a small map and kill them before their opponent had any recourse. A larger map size also allowed players to expand to other bases which would be used as a metric later to determine the player's actual skill. Figure 3.4.1.1 shows an overhead layout of the map.

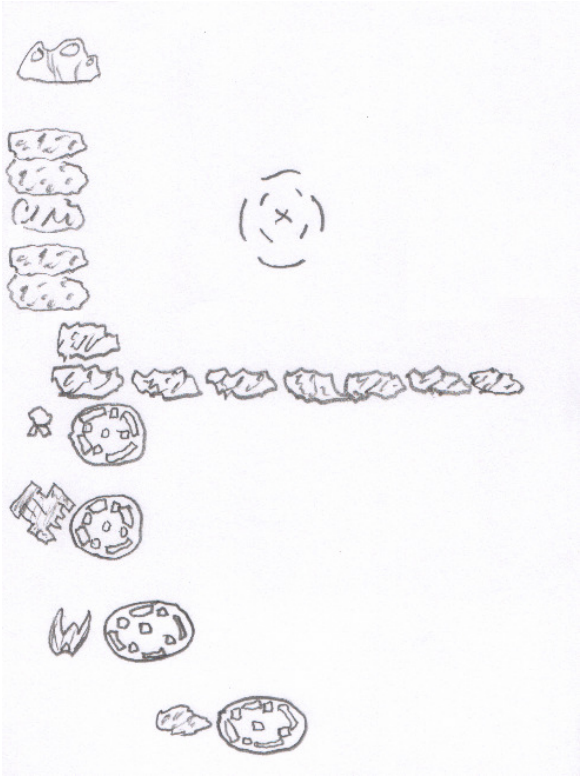
Figure 3.4.1.1 Overhead layout of the map



The third consideration was how to build the cheats in to the map. The cheats needed to be readily accessible, visible, but yet out of the player's way so that the game could be played without interruption. In Starcraft, player bases tend to share a common form; there is a patch of resources on one side with an expanse in the middle and one or more exit points from the base. The expanse in the middle is where the player will typically build most of their buildings. In order to incorporate the cheats without them

being intrusive, Figure 3.4.1.2 shows how the minerals were pushed out from their corner a little and the cheats added in behind them. Figure 3.4.1.2 is the bottom left subsection from Figure 3.4.1.1. This still left adequate space for the player to build their buildings and left the cheats visible without being in the way.

Figure 3.4.1.2 Cheats in the player's base



The last consideration was to create cheats that emulated real Starcraft cheats. One of the most prominent Starcraft cheats is the Starcraft map hack. There have been many different versions of this cheat by many different authors, but in essence what this cheat does is lift the fog of war from the map so that the cheater can see all of the enemies units. This same hack was implemented in the map by adding invisible map revealers to the player's map upon use of the hack. Another exploit that was common in Starcraft gave the user immense resources due to a bug with canceling a building's production multiple times before it was destroyed and thus refunding the resources used to create the building multiple times. This was also used to create a cheat which would reward the player with 250 minerals and vespene gas upon using it. The other two cheats that were added to the map were used to emulate offensive and defensive cheats. The

offensive cheat would reward the user with a powerful battlecruiser unit while the defensive cheat would reward the user with an arbiter unit that could be used to cloak his units and save his forces. Figure 3.4.1.2 displays each of these cheats. In order to use a cheat, the player had to take a unit or building to the circular beacon. Each beacon had a unit next to it that indicated which cheat the beacon was for. In order to more closely emulate online play, a trigger was added in front of the beacons that would alert the user that cheating was outside of the rules of the game and that repercussions may take place for using the cheats.

Once the cheats were in place, the conditions for ejecting a player from the game had to be decided on. Ejecting the player from the game was meant to emulate the player being kicked from an online service for cheating. On most online services, the more intrusive/obvious the cheat, the more likely you are to get banned. The map hack cheat for example went largely undetected in Starcraft because it only modified the client and provided additional information to the player without affecting the rest of the game play. To emulate this, the cheat was issued a likelihood value of one. The resource exploit that was emulated in the map is a bit more obvious and resulted in bans for many people. Its increased likelihood for catching cheaters gave it a likelihood value of two. The other two cheats however added units into the game. A hack such as this would be caught very quickly as it is outside of the rules of the game. These cheats were given a likelihood value of three. Whenever a player accumulated seven or more points he was ejected from the game.

3.4.2 The questionnaires

Questionnaires were used in order to gauge how the players perceived cheating and being caught while cheating. There were three questionnaires that were given to players over the course of the study; once before any games were played and once after each of the two games played. The first questionnaire was meant to gauge the player's skill level as well as their perceptions and past interactions with cheating. The last two questionnaires probed the player about their game play experiences to find out how cheating and being caught affected their perceptions and future decisions to cheat.

3.5 Execution

3.5.1 Setup

When participants arrived, they were given a copy of the consent form followed by the first questionnaire. During this time they were made to believe that their opponent was just another player like them who had arrived ahead of time and was already ready to play in an adjacent room. The participant was told that this study was meant to emulate online play and that while cheats were offered, their use would be dealt with in the same way that most online systems deal with cheats. Their opponent in most cases was a member of the study; however there were a few trials where participants went head to head against each other. It was noted that there seemed to be increased aggression and desire to win when the participants saw each other face to face. There was one such case where the participants knew each other and purposely cheated as much as they could in both games because the illusion of being online and the notion of being "caught' had been broken; that set of results was excluded from the data set.

3.5.2 Game play

The game would start with the study participant joining the game created by the member of the study. Many participants seemed to be genuinely surprised that they were actually playing against another human being even though they had already been told such before hand. The game would then commence. After the game, the participant would be given a questionnaire to complete and a second game and questionnaire would commence shortly thereafter. It was noted however, that not all participants realized that the cheats were available in the first game and casual comments would be made to the players. Many players proceeded to make use of the cheats in the second game as a result which skewed the final results.

Chapter 4 Results

There were three types of findings during the course of the study: expected results, unexpected findings and inconclusive findings. The expected results were based on the hypotheses on which the experiment was founded. The unexpected findings were correlations that turned out to be significant, that were previously unthought-of in regards to this experiment. And inconclusive findings are findings that either showed no correlation even though one was expected or only showed a trend but could not prove significance due to the lack of participants. The inconclusive findings will be covered under the future ideas section of future work. All results were considered significant with $p < 0.05$ and trends were regarded to be $0.05 < p < 0.1$.

4.1 Expected Results

The premise of the study was to see how the perception of being caught affected participant's cheating habits.

The people who were caught cheating and ejected from the first game believed prior to the game that their chances of negative repercussions were much less compared to their counterparts who were not caught; those values were 2.5 and 5.43 on a 7 point scale respectively. Tables 4.1.1 and 4.1.2 illustrate the average perception of repercussions between those who were and were not caught, respectively. This is very telling; those who did not perceive any repercussions from cheating were much more likely to cheat and ended up getting caught because of it. What is even more telling is how the two groups perceived their chances of getting caught in game two. The group that was ejected from game one on average felt that there was a 4.5 out of 7 (up from 2.5 out of 7) chance of there being repercussions while the group who was not ejected from game one dropped ever so slightly to 5.29 out of 7 (down from 5.43 out of 7).

Table 4.1.1 Perceived chance to be caught of people ejected from the first game

Paired Samples Statistics	Mean	N	Std. Deviation	Std. Error
Chance1	2.5	12	1.784	0.515
Chance2	4.5	12	2.195	0.634

(table continued on the next page)

Paired Samples Correlations	N	Correlation	Sig.
Chance1 & Chance2	12	-.209	.515

Paired Samples Test	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Chance1 - Chance2	-2	3.104	.896	-3.972	-.028	-2.232	11	**.047**

Table 4.1.2 Perceived chance to be caught of people not ejected from the first game

Paired Samples Statistics	Mean	N	Std. Deviation	Std. Error
Chance1	5.43	7	2.299	0.869
Chance2	5.29	7	2.928	1.107

Paired Samples Correlations	N	Correlation	Sig.
Chance1 & Chance2	7	0.722	0.067

Paired Samples Test	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Chance1 - Chance2	0.143	2.035	.769	-1.740	2.025	.186	6	.859

The paired samples test used in Table 4.1.1 tells us that the results from the group that was ejected is significant with a p value of .047; ejection from the game had a significant effect on how the group perceived their chances of being caught. Table 4.1.3 shows how this group lowered their amount of cheating from the first game to the second game. Many of them didn't cheat at all or just prior to the point where they were kicked out of the first game.

Table 4.1.3 Comparison of cheating during Game 1 vs. Game 2

Group Statistics	BootedGame1	N	Mean	Std. Deviation	Std. Error Mean
TotGame1Cheats	No	7	.14	.378	.143
	Yes	12	3.00	1.044	.302
TotGame2Cheats	No	7	4.00	5.385	.035
	Yes	12	2.17	2.691	.777

(table continued on the next page)

Independent Samples Test		Levene's Test for Equality of Variances	
		F	Sig.
TotGame1Cheats	Equal variances assumed	1.882	.188
TotGame2Cheats	Equal variances assumed	5.518	.031

Independent Samples Test		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
TotGame1Cheats	Equal variances assumed	-6.908	17	.000	-2.857	0.414	-3.730	-1.985
	Equal variances not assumed	-8.563	15.098	.000	-2.857	0.334	-3.568	-2.146
TotGame2Cheats	Equal variances assumed	.998	17	.332	1.833	1.837	-2.043	5.709
	Equal variances not assumed	.842	7.785	.425	1.833	2.179	-3.215	6.881

The other group who was not ejected from the first game had scores that stayed relatively the same between the two games with the second game taking a slight dip in perceived chance of being caught. Without more trials, it's hard to say whether this perception of being caught would continue to decline as the gamers continue to cheat but stay under the radar or whether it would stay roughly the same. Looking at Table 4.1.3 illustrates one of the points made earlier, however that this group should have been given three games instead of the planned two. The average number of cheats rose sharply from .140 in game one to 4.00 in game two as many of the gamers forgot about them during the first game.

Looking at how perceived risk of being caught affects likelihood of cheating, only a trend was noticed. A regression analysis was performed on the data (available in Table 4.1.4) that reveals a p value of .064 when comparing these two variables. Unfortunately, because of the lack of a participant base, this could not be shown to be significant but this leaves the door open for future work.

Table 4.1.4 Perceived risk of being caught vs. cheating in game one

Descriptive Statistics	Mean	Std. Deviation	N
PerceivedRisk1	0.63	0.496	19
TotGame1Cheats	1.95	1.649	19
TotGame2Cheats	2.84	3.862	19
Total Cheating	4.79	3.938	19

Correlations		Perceived Risk1	TotGame1 Cheats	TotGame2 Cheats	Total Cheating
PerceivedRisk1	Pearson Correlation	1	-.433	.113	-.070
	Sig. (2-tailed)	--	.064	.645	.775
	N	19	19	19	19
TotGame1Cheats	Pearson Correlation	-.433	1	-.167	.255
	Sig. (2-tailed)	.064	--	.494	.292
	N	19	19	19	19
TotGame2Cheats	Pearson Correlation	.113	-.167	1	.911**
	Sig. (2-tailed)	.645	.494	--	0
	N	19	19	19	19
TotalCheating	Pearson Correlation	-.070	.255	.911**	1
	Sig. (2-tailed)	.775	.292	0	--
	N	19	19	19	19

**: Correlation is significant at the 0.01 level (2-tailed)

Model Summary					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.433(a)	0.187	0.14	1.53	0.187	3.921	1	17	0.064

4.2 Unexpected Findings

One of the joys of running such an experiment was processing the data and seeing significance in the data that illustrated ideas that had not been thought of during the design of the experiment. There were quite a few significant correlations and trends that are seen in the data.

Prior to playing the game, there was a significant correlation between perceived ability and tendency to cheat. Further games however only suggested a trend.

Participants rated their perceived playing ability on a seven level Likert scale with a value of one meaning very poor and seven meaning complete mastery.

Before participants started the first game, there was a significant correlation between a participants self score and tendency to cheat with a significance of p = 0.034. However, as more games were played and the capabilities of the system to deter cheating were shown, their tendency to cheat declined. This was found with significance of p = 0.088 and the corresponding statistics can be found on Table 4.2. In talking with the participants, it seemed that the lower they rated their ability the more they felt they had to cheat in order to remain competitive. In addition to this, many of the comments suggested that after participants were caught in the first game they either stopped cheating or reduced their cheating to levels below where they had been caught previously.

Table 4.2 Correlation between perceived skill and tendency to cheat

Descriptive Statistics	Mean	Std. Deviation	N
Self Score	2.89	1.524	19
Actual Score	3.47	0.964	19
Total Game1 Cheats	1.95	1.649	19
Total Game2 Cheats	2.84	3.862	19
Total Cheating	4.79	3.938	19

Correlations		Self Score	Actual Score	Total Game1 Cheats	Total Game2 Cheats	Total Cheating
Self Score	Pearson Correlation	1	.754**	-.489*	-.201	-.402
	Sig. (2-tailed)		**.000**	**.034**	.409	**.088**
	N	19	19	19	19	19
Actual Score	Pearson Correlation	.754**	1	-.298	-.038	-.162
	Sig. (2-tailed)	**.000**		.215	.876	.506
	N	19	19	19	19	19
Total Game1 Cheats	Pearson Correlation	-.489*	-.298	1	-.167	.255
	Sig. (2-tailed)	**.034**	.215		.494	.292
	N	19	19	19	19	19
Total Game2 Cheats	Pearson Correlation	-.201	-.038	-.167	1	.911**
	Sig. (2-tailed)	.409	.876	.494		.000

Cheats	N	19	19	19	19	19
Total Cheating	Pearson Correlation	-.402	-.162	.255	.911**	1
	Sig. (2-tailed)	**.088**	.506	.292	.000	
	N	19	19	19	19	19

**: Correlation is significant at the 0.01 level (2-tailed)
*: Correlation is significant at the 0.05 level (2-tailed)

Participants were relatively accurate when rating their playing abilities! Each game replay was rated and participants were awarded points based on seven different increasingly difficult criteria. The seven criteria players were rated by were:

- Basic acquisition of resources (Mining)
- Ability to build units and buildings (Building)
- Ability to defend the base (Defense)
- Ability to improve units critical to battle (Tech)
- Awareness of the layout of the map (Scouting)
- Ability to expand (Expansion)
- Ability to micro-manage individual troops (Micro-management)

All participants were able to estimate their skill within two levels of accuracy on a seven point scale and 79% were able to estimate their skill within one level of accuracy. This was found with significance of $p = 0.00$ and the statistical information can be found at Table 4.2.

Chapter 5 Future work

During the course of the experiment, there were many things made apparent that could have been done in order to improve the experiment in the future. Most of the improvements revolved around the player base but there were also improvements that could have been made to the process as well.

5.1 The player base

The number one concern was that players who may not typically be inclined to cheat were being asked to cheat for the experiments and after they were kicked out of the first game they had no interest in cheating anymore. Participant 15 had this to say, "It's an important point to note that you are encouraging people to modify their normal behavior by offering cheats, and are possibly then reverting them to normal behavior after you punish them for cheating." By performing the experiment with a group of people that are familiar with or prone to cheating, issues as this could be alleviated. Some good did come of a user base that was not particularly prone to cheating; participant 26 had this to say, "Obviously learned my lesson, and tried to actually do my best instead of cheating and losing automatically." While I agree that a participant pool of cheaters would have been best, the random sample of gamers still proved helpful in providing information.

Another issue that arose was the lack of a Starcraft player base. It is very important that there be a sufficient player base for the study to be a success. There were many people interested in partaking in a study about cheating but they were unable to because they were not familiar with the game. At the time of this study Starcraft had just turned ten years old and was much more dated than other games of the time.

5.2 The process

There were many participants that decided not to cheat or forgot about the cheats during the first game. As a result many participants decided to use the cheats much more during the second game when the ejection rules were turned off which helps to account for the elevated number of 4.5 cheats on average for game two. A solution to this would

be to administer the first map a second time for those players who did not get kicked out of game one and to add a third trial where the second map is administered.

5.3 Ideas for continuation

There were a number of hypotheses that could not be proven during the course of the study. Some of these hypotheses either showed no correlation even though they made sense logically or could not be proven significant due to the small pool of participants.

One of the unexpected findings in this experiment was that there was a trend between perceived ability and tendency to cheat and also a significant correlation with players' ability to judge their own playing ability. It would make sense to extrapolate from that to believe that actual playing ability may be a predictor of how likely a person is to cheat. However, due to a low participant pool there was not any significant correlation between actual player ability and tendency to cheat but future work may find differently.

Another possibility for future work is to look at how people view the authority of the system and how that affects gamers' decisions to cheat and continue cheating. How does the name of the video game company (and their past track record) affect a player's decision to use cheats? Does the venue in which the game is provided change a gamer's decision to cheat?

Most gamers seemed to be averse to cheating but yet made the decision to cheat anyway. Only one gamer out of the pool refused to cheat under any circumstances! When asked how they would react to games where cheating was rampant, all but one of them answered that they would quit the game or play less as a result. Some responses were conditional; where for instance if a player was unable to avoid the cheaters, then they would no longer want to play. Other players seemed to partake in an attitude where they would not want to be in an atmosphere filled with cheaters unless they too had access to the same cheats (thereby leveling the playing field). Participant 19 summed this up best by saying, "[Cheats] made the game frustrating to play because I often want fair competition." Delving deeper into the reasons why players continue to play a game where cheating is rampant when they've made it clear they would rather lessen their play

or stop, or why a gamer would decide to cheat even when it only adds to the problem would be additional topics for research that have not been covered in the field yet.

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