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Dying to be successful? Revisiting the Goldman dilemma in the age of cycling esports.

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Abstract

The Goldman dilemma is a controversial and hypothetical scenario that offers an athlete a reward or success in exchange for certain death within a fixed period of time. This infamous Faustian bargain has been applied periodically to a variety of sports and athletes over the past four decades. Variations of the Goldman's dilemma were posed to a sample of 366 cyclists who race online using esport apps. The participants were asked whether they would accept the Faustian Bargain by using a drug that guaranteed either sporting success or a considerable financial reward but would ultimately result in their death in five years' time. Eight initial variants of the Goldman dilemma questions were created but the maximum level of acceptance of them was never greater than 2.8% of the respondents. However, when the threat of certain death was then removed in two further variants of the dilemma, the inclination to take the drug to achieve the same rewards the saw participants acceptance of the dilemma rise considerably to 28%. Whilst this study continues to support the broadly held viewpoint that the Goldman dilemma is seen as a potential fallacy, it does provide further evidence of esport athletes' hypothetical propensity to take performance enhancing drugs which should be taken seriously in light of the upcoming IOC Olympic Esports Games.

Keywords: Cycling, esport, performance enhancement, doping, Goldman dilemma.

Highlights:

- The Goldman dilemma of trading longevity for some form of success or reward is not currently seen as acceptable by competitive esport cycling athletes.
- The inclination rate for esport racing cyclists to accept any variant of the Goldman dilemma was broadly in line with those seen in other contemporary studies.
- When the level of reward was maintained but the threat of certain death was removed, the inclination for participants to hypothetically dope became considerably higher and should be seen as a concern to esport cycling stakeholders.

Introduction

Cycling esports is a recent innovation that provides the ability for participants to cycle and race in a virtual environment [1], continue to expand with the multi-platform emergence in the online sphere and the anticipation of the International Olympic Committee's (IOC) first ever esport games in the near future. However, due to the remoteness of each participant, there remains the risk of illicit performance enhancement in terms of equipment, data manipulation [2][3] or the rider themselves conducting some level of doping [4]. This is not just a cycling esports issue but a wider issue that needs addressing across the esports ecosystem as all these games and platforms face similar threats to their integrity [5].

Cycling esports can be referred to as e-racing, e-cycling or virtual cycling [6]. For the purpose of this paper and for consistency, we shall refer to cycling esports as this is a widely accepted term by the community with dedicated events [7] and media channels referring to the sport by this name [8][9]. Cycling esports has grown in popularity over the years not just with the development of dedicated cycling esport platforms such as Zwift, MyWhoosh and/or Rouvy. It has also grown interest with the IOC through the Olympic Virtual Series [10]. This series featured sports that are already associated with the Olympic movement but promoted their virtual counterparts and began as early in 2007 at the Asian Indoor Games [11]. The most recent event was held in Singapore in June 2023 where cycling esports were featured using the Zwift platform [12].

Esport-based cycling as a competitive endeavour is now well established. Online cycling apps such as Zwift have reported that they have approximately 1 million users [13]. The governing body for cycling internationally, the UCI, have run World Championships in this form of cycling since 2022 and the governing body of the Olympic Games, the IOC, have announced that a form of esport-based Olympic Games will take place in the future [14]. Furthermore, some other app platforms such as Mywhoosh now offer substantial prize money which in 2024, their total prize pool was $3,750,000 [15]. For other platforms such as Zwift, they had a combined prize pool of $128,000 in the same year and the UCI 2024 World Championship offering $60,000 [15]. The top male rider earned $98,154 and the top female rider earned $167,126 in 2024 [15].

At which point, it would seem prudent to place mechanisms, regulations and vigilant governance to ensure that the sport establishes and maintains a suitable level of integrity. In other esport platforms this has been highlighted as an issue with its participants being unaware of governance or regulatory bodies to enforce the rules to maintain their integrity [16]. It has been proposed recently that some athletes would be willing to cheat or seek an unfair advantage in esport cycling via data manipulation [6] or doping [13]. Indeed, doping in particular has been noted to be of significant concern [17] across the broader esports landscape and not just within cycling esports.

The 'Goldman dilemma' is one of the most frequently referenced findings in anti-doping research, often regarded as established wisdom concerning the choices elite athletes face about performance enhancing drug use in sports [18]. It has acted as an informal assessment of the level of athletes' motivations to take performance enhancing drugs that has been conducted in peer-reviewed research consistently yet occasionally since its conception. It sees its origins in 'The Sports Medicine Book' [19], whereby the authors briefly mention having conducted a survey amongst top running athletes. Goldman et al. [18] adapted this in the 1984 text 'Death in the Locker Room'. This expanded on the Mirkin & Hoffman approach by asking:

"If I had a magic drug that was so fantastic that if you took it once you would win every competition you would enter, from the Olympic decathlon to Mr. Universe, for the next five years, but it had one minor drawback – it would kill you five years after you took it – would you still take the drug ?" (p. 32)

This original dilemma offered a Faustian bargain. A Faustian Bargain is a concept based upon the German legend of Faust selling his soul to the Devil Mephistopheles in exchange for both personal pleasure and reward [20]. In this case, athletes were originally asked if they would sacrifice their likely lifespan for Olympic glory by taking a drug that promised a guaranteed Olympic Gold Medal but would result in their death within a fixed period of time. Goldman stated that 52% of the 198 surveyed athletes said that they would.

The criticism regarding the original Goldman dilemma has been extensive [21][22][23]. Some of its issues included a lack of peer-reviewed rigour of the original claim and the lack of inclusion of a control group. The dilemma also makes an assumption that the reward of an Olympic medal is of the right importance, stimulus or desirability for elite athletes to potentially dope but it is not known if the value of this reward has diminished over time or whether other rewards could be perceived as superior. However, interest in the concept continues to see it revisited and investigated by the scientific community [21][22][24][25][26]. Ultimately, no peer-reviewed study has ever obtained results that approached the original authors claims [23]. The role of the Goldman dilemma could now be seen instead as a philosophical litmus test for athletes attitudes to performance enhancing drugs rather than its emphasis on its Faustian bargain.

It should be stated here that the use of performance enhancing drugs (PEDs) varies between movement based esports and traditional sedentary esports. For the latter, these PEDs would present in the form of Adderall, Ritalin and or Modafinil [27]. Anything that may act as a stimulant to help increase or improve reaction time to stimuli when playing these games [28]. However, for cycling

esports just like their traditional form of cycling, their form of PEDs will be the use of erythropoietin (EPO) and anabolic androgenic steroids (AAS) [29] to illicit improving physiological markers for cycling [30]. These drugs are no strangers to cycling esports as reported by Richardson et al., [13], an Italian cyclist who competes both in the esports and regular cycling circuit was caught using an anabolic steroid [31].

Given the potential rewards and unique isolation of some esport participants and competitions, it is not known how esport athletes would respond to the temptations of doping with concepts like the Goldman dilemma. Especially with esports having two unique stances – firstly, it is set in the virtual environment which no Goldman study has ever researched before. Secondly, esports as a field (not just virtual cycling) does not have a long standing history and tradition as does the Olympics and their respective events. These differences will help to further add to our understanding of esport anti-doping policy. This study will therefore attempt to address this gap in knowledge by offering Faustian bargains to esport racing cyclists based upon the Goldman dilemma.

Methods

Participants

The targeted participants were cyclists who undertook online-based competitive cycling using any of the commercially available cycling esport apps. The particular app used by a participant was not seen as relevant so was therefore not stipulated. The inclusion criteria for a respondent's response were that they were above 18 years of age and that they used cycling esport apps for the purpose of racing. These cycling esports apps ranged from Zwift, MyWhoosh, Rouvy, IndieVelo (now part of Training Peaks Virtual) and many more. There were no exclusions on cycling app preferences or if participants used multiple apps as part of their training or racing.

Any privacy concerns were minimised by maintaining the anonymity of all participants' responses from each other and the investigators at all times. It was also felt that the sensitivity of asking someone's willingness to dope would affect the results if maximum anonymity was not provided. No participant names were collected but other demographic data such as gender and age band would be. This level of anonymity and pre-conceived sensitivity is a similar approach to other studies that have investigated the Goldman dilemma [22].

Approach

A questionnaire approach was used to assess esport cyclists' acceptance of the Goldman dilemma. To maximise participation levels and response time for this study, an online data collection method was used. The questionnaire was constructed and housed using the 'Google Forms' application (Google, Mountain View, US). Online-based questionnaires have been investigated for their value [32]. They offer notable clear advantages over other formats such as their global reach, speed, convenience [32] and anonymity. This therefore suits the remoteness of esport competitors.

When the data collection period ended, the data was downloaded from Google Docs to both Microsoft Excel (Microsoft, Washington, US) for subsequent analysis. All results would be stated as

both a raw number and as a voting percentage. It is conceded that online data collection poses shortcomings which could apply to this study. These include sample identity control and duplicate or fraudulent submissions. In the case of this study, some of these shortcomings were reduced by inviting participation through sports-specific forums and social media platforms. This would make it more likely that the participants were of the appropriate background.

Participants were signposted to complete the questionnaire via social media driven formal invitations which were placed on several esport cycling Facebook social media pages, cycling forums and Reddit pages. These pages were centred around the use of specific cycling esports apps or cycling sports pages and included: 'Mywhoosh', 'VCycling news' and 'Zwift members'. Institutional ethics approval was obtained prior to this study commencing (Ethics application number 60722).

Questionnaire Design

It was decided that no mention of the words 'Goldman dilemma' or 'doping' were stated in the questionnaire either in its briefing, questions or its title to avoid generating any unknown biases or any associated controversy of the terminology prior to the questionnaire's completion. The invitations to participate were posted during December 2024. The questionnaire was closed once the participation rate dropped to zero for a period of 3 days. Each question was temporarily blinded from each other by placing one question alone on the screen at a time so that the previous and following questions could not be seen to act as a visual form of comparison or reference.

The online survey began by asking participants to disclose their gender and age range, the number of years they had used such apps for the purposes of racing, racing frequency and the type of cycling apps that they use. This was then followed by ten questions that were intended to investigate the Goldman dilemma. The questions of the Goldman dilemma were based upon the ethos of those established by Connor et al. [22]. This ethos involved offering multiple variations of the Goldman dilemma and saw the same questions rephrased twice to then assess consistency of the participants to accept the same bargain. The questions were not randomised in their order.

To address the criticism regarding the current unknown value of an Olympic Medal, the five variant questions of Connor et al. [22] were then further expanded by also providing duplicate variants which offered a financial incentive instead of an Olympic Gold medal. Previous research has proposed that different types of success could be offered in such studies [21]. Whilst it was conceded that any level of a financial incentive was arbitrary in amount, a suitably large value was offered using a currency it was felt could be contextualised by the respondents. In this case, ten million US Dollars was offered. The subsequent ten questions were:

Illegal and death variant.

1. Would you take an undetectable, illegal performance-enhancing substance that guaranteed you would win an Olympic Gold Medal in esport cycling, but would kill you in 5 years?
2. Would you take an undetectable, illegal performance-enhancing substance that would kill you in 5 years, but guaranteed you would win an Olympic Gold Medal in esport cycling?
3. Would you take an undetectable, illegal performance-enhancing substance that guaranteed you would win 10 million US Dollars in esport cycling, but would kill you in 5 years?

4. Would you take an undetectable, illegal performance-enhancing substance that would kill you in 5 years, but guaranteed you would win 10 million US Dollars in esport cycling?

Legal and death variant.

5. Would you take a legal performance-enhancing substance that guaranteed you would win an Olympic Gold Medal in esport cycling, but would kill you in 5 years?
6. Would you take a legal performance-enhancing substance that would kill you in 5 years, but guaranteed you would win an Olympic Gold Medal in esport cycling?
7. Would you take a legal performance-enhancing substance that guaranteed you would win 10 million US Dollars in esport cycling, but would kill you in 5 years?
8. Would you take a legal performance-enhancing substance that would kill you in 5 years, but guaranteed you would win 10 million US Dollars in esport cycling?

Illegal and no consequences variant.

9. Would you take an undetectable, illegal performance-enhancing substance that guaranteed you would win an Olympic Gold Medal in esport cycling?
10. Would you take an undetectable, illegal performance-enhancing substance that guaranteed you would win 10 million US Dollars in esport cycling?

The response format followed the 'yes' or 'no' approach of the original Goldman studies but none of this required mandatory completion. A control group was also not used as it felt that this was established via the results of those recorded previously [21] and it was felt that this remained representative at the time of this study being undertaken. All participants were informed that their participation and consent was based upon when they hit 'submit' and that they could withdraw from the study prior to this by not completing the questionnaire.

Results

370 participants completed the online questionnaire. The level of new survey completions dropped to zero after a period of three weeks. Three participants disclosed that they were under 18 years of age so did not meet the inclusion criteria and were subsequently removed from further analysis. One additional participant did not enter any data at all so was also removed. As a result, the responses from 366 participants were then analysed. The gender split of the participants was 84.4% male, 15.1% female with 0.5% preferring not to state their gender.

The breakdown by platform generated a total of 497 responses from the sample of 366 participants. This highlights that almost a third of participants (n = 108 / 29.42%) utilise more than one platform. The platforms and their corresponding frequency of responses are shown below.

- Zwift (n = 320)
- Indievelo/Trainingpeaks Virtual (n = 73)
- MyWhoosh (n = 55)
- Rouvy (n = 36)

- Trainer Road (n = 10)
- Other (n = 10)
- Bkool (n = 3)

Table 1. below outlines the breakdown of the sample's history of racing in cycling esports.

Table 1. Participants E-Race History

Category of Years	Frequency of Responses (M/F)	Percentage of Responses
Less than 1 Year	37.0 (32 / 5)	10.10%
1 – 2	55.0 (46 / 9)	15.03%
2 – 3	57.0 (46 / 11)	15.57%
3 – 4	83.0 (70 / 13)	22.67%
4 – 5	56.0 (48 / 8)	15.30%
5 – 10	69.0 (61 / 8)	18.85%
10 +	9.0 (9 / 0)	2.46%
Total	**366.0**	**100%**

The results of the 10 Goldman variants are shown in table 2.

Table 2. Goldman dilemma results.

Question Type	Question	Yes (%)	No (%)
Illegal and death variant.	1. Would you take an undetectable, illegal performance-enhancing substance that guaranteed you would win an Olympic Gold Medal in esport cycling, but would kill you in 5 years?	3 (0.8)	363 (99.2)
	2. Would you take an undetectable, illegal performance-enhancing substance that would kill you in 5 years, but guaranteed you would win an Olympic Gold Medal in esport cycling?	3 (0.8)	362 (99.2)
	3. Would you take an undetectable, illegal performance-enhancing substance that guaranteed you would win 10	8 (2.2)	355 (97.8)

	million US Dollars in esport cycling, but would kill you in 5 years?		
	4. Would you take an undetectable, illegal performance-enhancing substance that would kill you in 5 years, but guaranteed you would win 10 million US Dollars in esport cycling?	9 (2.5)	355 (97.5)
Legal and death variant.	5. Would you take a legal performance-enhancing substance that guaranteed you would win an Olympic Gold Medal in esport cycling, but would kill you in 5 years?	4 (1.1)	362 (98.9)
	6. Would you take a legal performance-enhancing substance that would kill you in 5 years, but guaranteed you would win an Olympic Gold Medal in esport cycling?	5 (1.4)	361 (98.6)
	7. Would you take a legal performance-enhancing substance that guaranteed you would win 10 million US Dollars in esport cycling, but would kill you in 5 years?	10 (2.8)	353 (97.2)
	8. Would you take a legal performance-enhancing substance that would kill you in 5 years, but guaranteed you would win 10 million US Dollars in esport cycling?	9 (2.5)	357 (97.5)
Illegal and no consequences variant.	9. Would you take an undetectable, illegal performance-enhancing substance that guaranteed you would win an Olympic Gold Medal in esport cycling?	36 (9.9)	330 (90.1)
	10. Would you take an undetectable, illegal performance-enhancing substance that guaranteed you would win 10 million US Dollars in esport cycling?	102 (28)	262 (72)

With the first eight of the scenarios, the level of acceptance of the Goldman dilemma variants ranged from 0.8-2.8%. It was felt that such a low rate of acceptance negated the need for further statistical testing and that any analysis by demographic criteria would also be meaningless when considering these eight items alone. This decision is the same as those made in a previous study when only 0.8% of the Goldman dilemma was obtained [22]. However, the Illegal and no consequences variants (questions 9 and 10) did see a considerable increase in the rate of acceptance.

Discussion

Acceptance of the Goldman dilemma

The level of participation of this study of 366 valid participants is considered acceptable as it is in keeping with other recent such-studies [21][22] and is larger than Goldman's seminal work [18]. There is no evidence to state the typical gender participation in esport cycling so it is therefore not known how representative the gender response was for this study. As a result, this aspect was not investigated further.

The maximum level of acceptance rate of the offered Goldman dilemmas in questions 1-8 (2.8%) is considered low. When evaluating the questions in this study that only considered the reward of an Olympic gold medal, the acceptance rate range of 0.8-1.4% recorded in this study is similar to the values of 0.8% achieved from the sample of a general population [21], 1% when considering elite track and field athletes [22] or <1% when surveying a range of Olympic athletes [23]. This is far below the reported values of 52% that have helped drive the historical interest of the Goldman dilemma. This indicates that despite the novel context and remote environment of competitive esport cycling, participants are typically unwilling to accept these Faustian bargains compared to athletes in other sports.

This acceptance rate could be partly attributed to cycling esport current participation status. The relatively recent introduction of esports mean it is likely that elite-level or professional esport cyclists are few in number and that its participants are likely recreationally-based and therefore closer in lifestyle to that of the general population. Ultimately though, the obtained results reinforce the previous point of view that the Goldman dilemma should be considered a fallacy [23].
The method of pairing questions that rephrased each statement to test the resolve of a respondent [22] indicated little difference between them in the results. The question numbers that were paired were questions 3 and 4, 5 and 6 and finally 7 and 8. However the difference between each pair each time was 0.3% which represented only that of a single participants response. It is proposed that such intentional duplication in the questionnaire design was not warranted and could have served as an annoyance to participants. A small volume of anecdotal feedback of this study on social media confirmed this and this approach would not be recommended to be repeated in the future.

It should be noted that the results in this study may be only applicable to virtual sports or esports that have physical activity attached to them as defined by Jenny et al., [33] as “motion-based video games” due to their link with their original sporting counterparts. It could be investigated if the results in this study would be repeatable with traditional esport titles such as Counter Strike, StarCraft 2 or League of Legends which possess different cultural and environmental factors.

The novel approach in this study was also to offer an arbitrary, yet high level of financial incentive as an alternative to that of an Olympic gold medal that has been offered in many previous studies. This alternative financial incentive did indicate a different level of response from that of the Olympic medal. Whilst the acceptance of the Goldman dilemma for an Olympic gold medal yielded an acceptance rate of 0.8%-1.4%, the financial incentive then yielded an increased level of acceptance rate of 2.2%-2.8%. Whilst this is seemingly doubled, in real terms, this only meant that approximately a further 5-6 participants agreed to the Faustian bargains. Therefore, this change in incentive is of questionable statistical validity. Given the arbitrary large sum of money offered, it is also questionable whether this could be increased further to any level that would attract a greater percentage of agreement. However, it does suggest that any future applications of the Goldman dilemma should consider the true value of an Olympic gold medal and investigate whether different levels or types of reward could return better results.

There have been objections to the Goldman study in the past that it is essentially implausible as a concept [25] and therefore may not be responded to accurately or truthfully. The low acceptance rate of the Goldman dilemmas in this paper neither supports nor refutes such a claim. Furthermore, the

reported low rates of acceptance in this study do not provide any support of the sensationalist claims made in its earliest accounts [18][23].

The temptations of doping

It was expected that the final two 'Illegal and no consequence' variants of questions 9 and 10 would see an increase in the rate of acceptance due to the removal of the certain death outcome. This proved to be the case. It is interesting though that the acceptance percentage was still lower than that of the original Goldman surveys [23] even with the threat of certain death removed and a greater range of incentives provided. Nonetheless, the level of obtained agreement of these should raise some level of concern to any of the sports stakeholders. The high rate here suggests that a significant proportion of participants could succumb to temptation and at a level well above those reported by anti-doping agencies [34].

Since esport legislation and anti-doping policy is still in a state of relative infancy [4][17], such concerns should be considered before such risks were realised. If nothing else, Questions 9 and 10 could be seen to act as a potential gauge to assess athletes' current attitudes to doping as it has been elsewhere [22]. As per the results of questions 1-8, the incentive of financial remuneration was perceived higher than that of an Olympic gold medal.

The risks of doping and illicit enhancement in esport cycling have already been highlighted [1][2][3][4]. Furthermore, the rationale of why riders specifically could choose to be dishonest in esport cycling has also been investigated [6][13]. This study in particular now produces further evidence that not only is there the method or means of riders to dope but that the motives exist when given enough incentive to do so.

Furthermore, it adds the evidence that not only could this happen but there are participants who seem to be willing to dope and cheat if risks to their health can be eliminated and if large enough incentives are in place to tempt them. Nevertheless, the sport has already seen someone dope at an in-person race [13] and was caught by anti-doping authorities. This incidence was a low-level event in comparison to the notable rewards offered in this study. If someone is willing to dope to enhance their performance in lower-level events then the results here should not be dismissed casually, especially with the Olympic Esport Games in 2027 and the growing prize purses seen across esport cycling platforms.

Limitations

It is conceded that the high level of anonymity that was provided in this study has made it challenging to identify the participants should any follow-up be required. However, in Goldman's original study his sensationalistic results of a high acceptance rate of the Faustian bargain made that need essential for its credibility. However, it is proposed that the results in this study are broadly in line with studies conducted since then and has therefore made that need unlikely.

Conclusion

Several variations of the Goldman dilemma were offered to 367 esport racing cyclists. However, despite two different incentives being offered, the acceptance rate of several Faustian bargains remained no higher than 2.8%. It was only when the threat of certain death was removed did the acceptance rate rise to a maximum of 28%. This study provides further evidence that the Goldman dilemma itself is either a fallacy or an outdated pursuit. It is argued that it is only suitable as a means

of assessing athletes' attitudes to the use of performance enhancing drugs. However, the higher rate of acceptance that was obtained when the potential reward was deemed high enough and when removing any risks should be seen as a notable concern for the sports stakeholders as it continues to develop.

Conflict of Interest

The authors have no competing interests to declare.

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