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■ RESEARCH ARTICLE

Campaigns to Overcome Golfers' Loss-Averse Cognitive Bias

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ABSTRACT: Loss-aversion is a type of conservative mindset that can negatively impact performance. In this study, we systematically surveyed a pool of golfers. We then analyzed, in detail, the relationships among participants' attributes and the degree of loss-aversion. Based on these findings, we propose developing effective campaigns to help individuals or teams overcome their loss-aversion.

KEYWORDS: Behavioral and Social Sciences; Cognitive Psychology; Golf; Loss-Aversion; Cognitive Bias.

■ Introduction

Although we think we are rational decision-makers, there are many cases where cognitive bias deters us from making rational choices. One such bias is loss-aversion, where individuals feel the pain of losing something to be more potent than the joy of gaining that same thing.[1] Such bias promotes a conservative mindset that, while applicable in some situations, is often counterproductive, leading to tentative actions and loss of focus. Consider these examples:

1. A soccer team gets too conservative trying to protect their one-goal lead only to see the desperate opposing team scramble for a game-tying goal and then ride the momentum to score yet another to seal the win.

2. A tennis player who gets tentative while serving for three straight sets wins or loses that point, then the set, and eventually the entire match.

3. A basketball team losing its defensive intensity while protecting a two-point lead in the last stages of a championship game, only to see the opposing player nail down a clutch three-pointer.

It is better to "stay the course," however difficult it may be, and continue with the strategies that put you in a leading position in the first place. Loss-aversion is a special case of a conservative mindset when one emphasizes avoiding a bad event rather than capitalizing on a favorable one. It is similar to when a person feels considerable joy (utility) upon receiving a $500 bottle of wine, but that joy pales in comparison to the sadness if that bottle drops. The loss-aversion theory, also known as the prospect theory, states that the feeling of loss is far greater than the feeling of gain for the same item.[1]

Loss-Aversion in Golf:

Upon reaching the green, an average golfer takes two putts to hole the ball. Loss-aversion becomes apparent when golfers get more emotionally vested in avoiding a three-putt than earning a one-putt even when both are in a similar position in terms of difficulty. In other words, even though the net effect on the score is the same, golfers feel worse when they miss a par putt than a birdie putt.

From a strategy perspective, golfers typically aim 0.5 meters past the hole.[2] Risk-averse people are more likely to suffer from irrational and exaggerated loss or pain, leading to biased decision-making. Although this may seem minor, the study found that professional golfers took at least one additional stroke per round due to biased decision-making.[3] This study estimated that this additional stroke cost top-20 players roughly $640,896 per year per player.

Based on the data from the PGA TOUR's ShotLink database, professional golfers' optimal strategy should actually be a function of putting distance and career putting statistics.[4] They created an algorithm to compute independent and dependent strategies by implementing the Markov Decision Process and two-player, turn-based stochastic game models. For independent strategies, they found that as the distance to the hole increases, golfers should aim less farther from the hole but never short. Additionally, they also compared the advantages of playing the dependent strategy over the independent strategy when playing against an adversary. Their findings show that for mid-range putting (less than 7.5 meters), there is little payoff to adjust to the adversary's strategies, and, therefore, professional golfers should focus on their independent strategy for at least mid-range putting.

High stakes such as prize money, the prestige of a tournament, or aiming for the first win can compound loss-aversion. A study revealed that increasing the prize money by $50,000 decreased the likelihood of making a 6-10-foot putt by 6%.[5] They also found that high stakes affected less-experienced golfers significantly more than experienced golfers. They hypothesized that experienced golfers have been in similar situations before and thus are less phased by high-pressure situations. This demographic of participants is studied later in the research by the frequency a golfer plays.

Another important contributing factor is age. Because human brains do not fully grow until 25 years of age, adolescents do not fully comprehend the full impact of the consequences and,[6] therefore, are more vulnerable to unhealthy food, sleeping habits, and impulsive sex. Thus, adolescents fail to weigh the risks to the reward, which, interestingly, makes young people

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less risk-averse. In other words, adolescents do not comprehend the magnitude of the potential risks and only focus on the reward, and thus do not let risks define their decision-making. As they grow older, risk-aversion kicks in.[7] Neurological research also supports this idea. Scientists found different neural activity between children and adults in the lateral intraparietal area and frontal cortex regions, both of which are involved in decision-making.

Indeed, other psychological factors, such as choking, fatigue, overconfidence, and nervousness, may affect golfers' performance. However, loss-aversion has been shown to cost the most utility and become an inherent trait of golfers.[3] Since golf is a stochastic game often involving multiple competitors, golfers can adjust their strategy based on their competitors' play. We, therefore decided to focus on loss-aversion and study contributing factors before recommending effective campaigns to mitigate such a mindset.

Methods

We conducted a survey using MTurk that drew 100 confirmed golfers. The survey presented multiple hypothetical game situations involving two types of common plays (Putting and Approach Shots) and asked participants to share how they would normally react. Questions were framed to hone in on loss-aversion by offering choices that ranged from conservative to aggressive style of play. To develop a better understanding of the types of golfers, we considered the following key attributes:

1. Age
2. Sex
3. Frequency of playing golf
4. Golf Handicap Index (HI)

We rationalized the responses by including a 7-item loss-aversion scale to measure participants' loss-aversion in normal settings.[8] This allowed us to eliminate the "noise" in their responses to the aforementioned scenario-based questions. The 7-point scale used is as follows:

1. When making a decision, I think much more about what might be lost than what might be gained.
2. The pain of losing money matters more than the pleasure of gaining the same amount of money.
3. I feel nervous when I have to make a decision that may lead to loss.
4. The pain from losing something matters much more to me than the pleasure from getting it.
5. Experiencing a major loss stays in my mind longer than experiencing a major gain.
6. A potential failure scares me more than a potential success encourages me.
7. The suffering that comes with losses can be fully offset by the pleasure that comes from gains.

Finally, we identified key correlations, and suitable marketing campaigns to help overcome loss-aversion.

Putting Scenario:

In this play, a golfer hits the ball, which is already on the green, towards the hole. Putting typically accounts for about half of all shots a golfer takes. Golfers typically take two strokes to hole their putt. Putting short of the hole means the ball never has a chance to go into the hole. However, this is how risk-averse golfers putt to avoid the ball rolling past the hole and ending up in a situation where the second stroke may no longer be a gimme (known as lag putting), which is usually any putt inside two feet and is a near certainty.

Participants were asked to consider the following scenario: you are at the last hole of a Stroke Play match. Remember, Stroke Play (sometimes called Medal Play) is a form of golf where players compete against everyone else, with the lowest total winning the match. In this case, your opponent has already finished the hole. You have a straight (no slope) 20-foot putt.

We then showed participants Figure 1, where the "X" marks the position of their ball. Participants were asked whether they would target Point A (closer in proximity to the hole but short of the hole) or Point B (farther in proximity but past the hole). The question was repeated for the following three game situations:

1. You are trailing your closest competitor by 1 Stroke
2. You both are tied
3. You are leading your closest competitor by 1 Stroke.

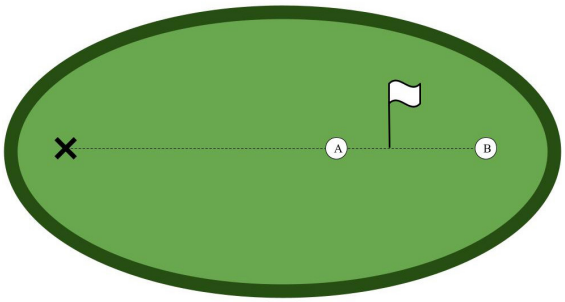

Figure 2: Example Putting Scenario in Survey. Mock scenario given to participants, which takes place on the putting green.

Participants were then asked how aggressively or conservatively they would play for the aforementioned game situations and were given the following options:

1. Conservative
2. Fairly Conservative
3. Neutral
4. Fairly Aggressive
5. Aggressive

Putting conservatively is defined as putting short but no farther than the hole. This would, in turn, increase the chance of holing your second putt but reduce the possibility of holing your first putt. On the other hand, putting aggressively would increase the likelihood of holing the putt but, if missed, would leave you with a longer second putt.

Approach Shot Scenario:

In professional tournaments, the pin position is usually such that trying to land the ball close to the pin requires a golfer to assume a particular risk. For instance, if not hit accurately, the ball could trickle down into score-hurting areas such as the bunker, water, or rough. Golfers, therefore, have two choices:

1. Play with an aggressive mindset to potentially save a stroke, but adding the risk of an additional stroke.

2. Play with a conservative mindset, thereby practically eliminating the possibility of saving a stroke but also eliminating the risk of adding a stroke.

Participants were asked to imagine the following scenarios: You are at a decisive stage of a Stroke Play match. Remember, Stroke Play (sometimes called Medal Play) is a form of golf in which players compete against everyone else, with the player with the lowest total score winning. In this case, your opponent has already finished the hole.

Participants were then shown Figure 2, where the "X" marks the position of their ball. The process is repeated for two sets of golf clubs:

1. Long Iron (5- or 6- iron)
2. Wedge (Sand Wedge/54-56 degree Wedge)

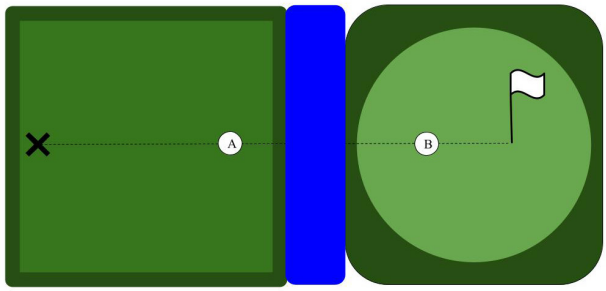

Figure 2: Example Approach Shot Scenario in Survey. Mock scenario given to participants, which takes place on the approach shot to the green.

Once again, participants are prompted to choose whether they would target Point A ("laying up" and avoiding the risk of hitting the ball in the water hazard) or Point B (aiming directly for the green), given different game situations. The question was repeated for the following three situations:

1. You are leading your closest competitor by 2 Strokes
2. You are leading your closest competitor by 3 Strokes
3. You are leading your closest competitor by 4 Strokes

Results and Discussion

Attributes of 100 survey participants were as follows

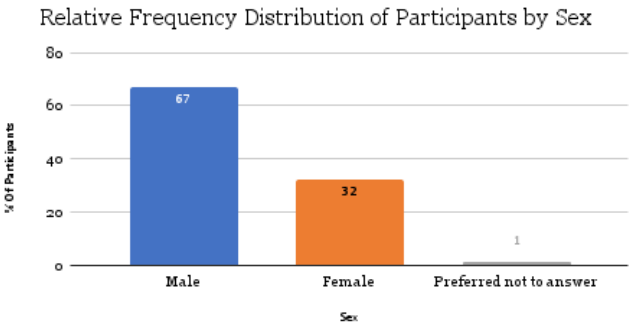

Figure 3: Relative Frequency Distribution of Participants by Sex.

In the survey, there were more men than females, with one preferring not to answer.

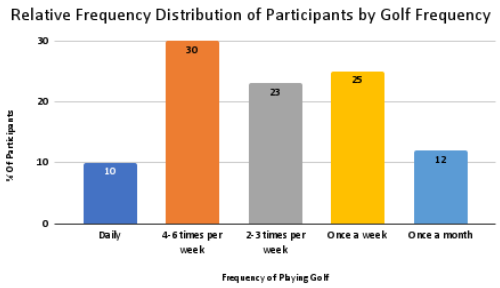

Figure 4: Relative Frequency Distribution of Participants by Golf Frequency.

In the survey, most golfers played at least once per week.

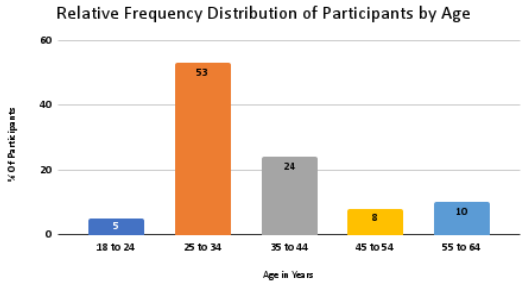

Figure 5: Relative Frequency Distribution of Participants by Age.

In the survey, most golfers were in their mid-20s to mid-40s.

Each figure provides a distribution of participants for different demographics. In Figure 3, two-thirds of the participants are male, and the rest are female, apart from one preferring not to disclose. In Figure 4, most participants are regular golfers, with almost 90% playing once or more per week. In Figure 5, most participants are in their mid-20s to mid-40s.

All the responses we received passed our sanity testing except for the Handicap Index. Some of the responses received for the Handicap Index were either invalid or inconsistent with the other answers provided. We concluded that that was probably because occasional golfers either did not understand or did not formally track the HI. We normalized these responses using participants' average 18-hole score without violating the survey's integrity.

General Loss-Aversion:

Because the data we collected was from a conceptual survey and not from a database holding actual statistics (such as the PGA TOUR ShotLink database), we can safely assume that factors such as fatigue, choking, and nervousness did not play a role.

The average loss-aversion score using the 7-item loss-aversion scale was 4.88, with a standard deviation of 1.05. The seventh item is a reverse-coded question, meaning the reciprocal is used to calculate a participant's score. This indicated that most golfers exhibit some level of loss-aversion.

Referring to Figures 1 & 2, it can be deduced that choosing Point A as the target shows the propensity towards loss-aversion as those shots do not have any chance of holing. As the adage goes, "short putts miss 100% of the time". In fact, a common and effective strategy is to putt around 0.5 meters long of the hole so as not to leave the ball short in case of a mishit

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or misjudgment when "reading the green." This, however, depends on how far the putt is and this has been analyzed in detail.[4] They found, using the Markov Decision Process, that as the distance to the hole increases, the optimal strategy favors targeting less past the hole.

Table 1 shows the results for the putting scenario (Figure 1). As can be seen, most players favored playing safely (Point A). This exhibited loss-aversion, which reduced (a drop from 83% to 52%) only when the player enjoyed the lead.

Table 1: Putting Scenario (Refer to Figure 1).

Scenario	Point A	Point B
Trailing by 1 stroke	83%	17%
Tied	57%	43%
Leading by 1 stroke	52%	48%

Players choose a more conservative putting strategy when the stroke advantage is less.

For the approach shot (Tables 2 & 3), we observed a similar pattern, i.e., more players tended to play conservatively by choosing Point A when the stroke advantage was less. Only when the players enjoyed a higher stroke advantage were they willing to play the typical style and aim for Point B. As expected, with long clubs (5 or 6 irons), which are challenging to play, players preferred to be more loss-averse.

Table 2: Approach Shot: 5- or 6- Iron (Refer to Figure 2).

Scenario 1	Point A	Point B
Ahead by 2 strokes	74%	26%
Ahead by 3 strokes	46%	55%
Ahead by 4 strokes	39%	61%

Players choose a more conservative approach shot strategy when the stroke advantage is less and using a long club.

Table 3: Approach Shot: Sand Wedge / 54° - 56° Wedge (Refer to Figure 2).

Scenario 1	Point A	Point B
Ahead by 2 strokes	64%	36%
Ahead by 3 strokes	49%	52%
Ahead by 4 strokes	44%	56%

Players choose a more conservative approach shot strategy when the stroke advantage is less and using a wedge.

Next, we used the Independent Sample T-Tests to determine whether there was a correlation between loss-aversion and participant attributes such as sex, frequency, and age.

Frequency of Play and Loss-Aversion:

Predictably, there is a significant correlation between the frequency of play and loss-aversion as indicated by Tables 4 & 5. More frequent golfers tend to be less loss-averse.

Table 4:

Correlation between frequency of play and loss-aversion using 7-Item Scale	
Pearson Correlation	-0.303
P-Value (2-tailed)	0.002

More frequent golfers tend to be less loss-averse based on the 7-item Scale.

Table 5:

Correlation between frequency of play and loss-aversion using Putting survey	
Pearson Correlation	-0.260
P-Value (2-tailed)	0.009

More frequent golfers tend to be less loss-averse based on the Putting survey.

For the Approach Shot Scenario (Table 6), for higher stroke advantage, the frequency of the play did not matter (high p-values), presumably because the advantage reduced loss-aversion. Additionally, as the clubs used got "longer," frequency of play mattered (small P-values) because longer clubs are more challenging to hit, and frequent-golfers ended up selecting the same target.

Table 6:

Correlation between frequency of play and loss-aversion as function of club selection		
	5- or 6- Iron	Sand Wedge / 54°-56° Wedge
Ahead by 2 Strokes	0.003	0.100
Ahead by 3 Strokes	0.017	0.403
Ahead by 4 Strokes	0.894	0.516

As clubs get longer and thus harder to hit, golfers who played more frequently selected the same target they would otherwise select with a wedge.

Age and Loss-Aversion:

Our results (Table 7) for Age vs Loss-Aversion contradicted earlier studies that claimed a directly proportional correlation between age and risk-aversion.[7] We observed an inverse relationship. This is probably because of a strong relationship between age and frequency of play. Older golfers in our sample set were more frequent players and might have mitigated loss-aversion with the help of their playing experience. There may also be other lurking or confounding factors that could lead to this correlation that were not studied in this experiment.

Table 7:

Correlation between Golfers' Age and Putting Scenarios Experiment	
Pearson Correlation	-0.184
P-Value (2-tailed)	0.068

Older golfers, who might play more frequently, did not succumb to loss-aversion compared to younger golfers. This contradicts earlier studies claiming a directly proportional correlation between age and risk-aversion.

Sex and Loss-Aversion:

Both male and female golfers exhibited similar behavior ($p = 0.536$) when presented with the various Putting Scenarios and the 7-item loss-aversion scale, meaning sex did not play a significant role in determining loss-aversion.

Conclusion

Loss-aversion is one of the reasons behind the sunk-cost fallacy, whereby we make irrational decisions due to influences instead of objective alternatives. This often leads to suboptimal

this unwise influence is the potential of failure. Missing a birdie does not make you feel like a loss as much as when you miss a par. The powerful emotion of loss-aversion can be mitigated using well-directed, personal (individual golfer) or group-level (e.g., a college golf team) campaigns. Since the target audience, in this case, is athletes who are already well-versed in analyzing technicalities behind golf swing and in understanding complex rules, the following should be considered in developing effective campaigns to overcome loss-aversion:

1. Be more informational or thoughtful (e.g., evaluation of pros and cons) than emotional. Share famous stories and pictures about triumphs by overcoming loss-aversion.

2. Have more nudges than hard measures. Encourage joint evaluation and reflections.

3. Have a system for reminders and prompts. Encourage behavior-triggering cues, e.g., removing the hat or drinking water as a reminder to not succumb to loss-aversion at critical junctures.

4. Make less-desirable more exciting, e.g., winning the hole or finishing strong your main goal even if you are already leading. Frequent golfers can track this by tracking the number of putts they take or the number of greens they hit in regulation.

5. Based on this work, we do not find any need to devise campaigns based on the sex or age of the players, but there is certainly value in having separate campaigns directed at occasional and frequent golfers.

Data Availability Statement:

The data supporting this study's findings and the accompanying survey are available from the corresponding author, Nishad Wajge, upon request.

Research Ethics & Confidentiality:

All participants chose to volunteer in our survey. No personal information was stored, and they answered to the best of their availability. Each question was optional; therefore, participants could skip questions they were uncomfortable or unsure of, although none did.

Nomenclature:

Aggressive Mindset	Hitting the golf ball so as to get closer to the pin while assuming the inherent risk in landing in score-hurting areas.
Birdie	Holing the ball by taking one less stroke than the average number of strokes typically taken on that hole.
Choking	In sports, the failure of a person to live up to the expectations. This especially happens during crucial, game-defining moments.
Conservative Mindset	Hitting the golf ball so as to avoid score-hurting areas, generally meaning leaving the ball farther away from the pin.
Dependent Strategy	Strategizing what to play by not only taking into consideration your situation, but also of your adversary or the leaderboard.
Golf Club	A club used to hit the golf ball.
Golf Handicap Index (HI)	A widely-used scale to determine how good a golfer is. The lower the handicap, the better the player.
Golf Round	Typically, a set of 18 golf holes.
Green	The part of the golf hole where players hit the ball using a putter.
Independent Strategy	Strategizing the play by taking into consideration only your situation.
Lag Putting	Intentionally playing conservatively to maximize your chance of two-putting and minimizing one's chance of three-putting. However, you essentially eliminate the chance of one-putting.
Longer Club	Clubs that go farther but are harder to hit.
P-Value (2-tailed)	A value less than 0.05 indicates a strong correlation between the two variables. Enough evidence to reject the null hypothesis.
Par	Holing the ball by taking the average number of strokes typically taken on that hole.
Pearson Correlation	-1 implies strong inverse relationship and +1 implies strong direct relationship.
Pin Position	Where the hole is located on the green.
Putt	The stroke taken once on the green.
Reading the Green	Finding the slopes and curves of the green to determine where to aim one's putt.
Stroke	A golf shot.
Turn-based Stochastic Games	Games that are sequential (have turns involved such as Chess).
Utility	Total satisfaction of choosing that strategy.

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Press Summary

This study aims to illustrate the negative impact of loss-aversion, a bias commonly found in golfers. While research has been done comparing golfers and loss-averse behavior, this study finds specific groups of golfers more afflicted with this cognitive bias. It proposes effective campaigns to help golfers and teams overcome their loss-averse behavior.

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