RUNNING HEAD: Sudden-Death Aversion

Sudden-Death Aversion: Avoiding Superior Options Because They Feel Riskier

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Abstract

We present evidence of Sudden-Death Aversion (SDA) – the tendency to avoid "fast" strategies that provide a greater chance of success, but include the possibility of immediate defeat, in favor of "slow" strategies that reduce the possibility of losing quickly, but have lower odds of ultimate success. Using a combination of archival analyses and controlled experiments, we explore the psychology behind SDA. First, we provide evidence for SDA and its cost to decision makers by tabulating how often NFL teams send games into overtime by kicking an extra point rather than going for the 2-point conversion (Study 1) and how often NBA teams attempt potentially game-tying 2-point shots rather than potentially game-winning 3-pointers (Study 2). To confirm that SDA is not limited to sports, we demonstrate SDA in a military scenario (Study 3). We then explore two mechanisms that contribute to SDA: myopic loss aversion and concerns about "tempting fate." Studies 4 and 5 show that SDA is due, in part, to myopic loss aversion, such that decision makers narrow the decision frame, paying attention to the prospect of immediate loss with the "fast" strategy, but not the downstream consequences of the "slow" strategy. Study 6 finds people are more pessimistic about a risky strategy that needn't be pursued (opting for sudden death) than the same strategy that must be pursued. We end by discussing how these twin mechanisms lead to differential expectations of blame from the self and others, and how SDA influences decisions in several different walks of life.

Key Words: Perceived risk, sudden-death aversion, myopic loss aversion, tempting fate, decisions under uncertainty

Sudden-death aversion: Avoiding Superior Options Because They Feel Riskier

On January 16, 2016, the Green Bay Packers' chances of advancing deeper in the NFL playoffs looked dim as they trailed the Arizona Cardinals 20-13 with only 5 seconds left in the game. Although they had the ball, they were 41 yards from the end zone. Only a miracle could save them. Which it did! Their quarterback, Aaron Rodgers, unleashed a desperate "Hail Mary" pass that was plucked out of the air over two defenders by Jeff Janis, a seldom-used receiver who was only in the game because of injuries to other players.

With the score now 20-19, the Packers had two options: they could kick the highly probable extra point and try to win the game in overtime, or they could opt for "sudden death"—attempt to get the ball into the end zone from two yards away. If they succeeded, they would score 2 points and win the game right then; if they failed, they'd lose. The Packers might have been especially tempted to go for two because a year earlier they likewise tied the score in the final seconds of another playoff game, but ended up losing the game—and a trip to the Super Bowl—in overtime. Moreover, the Packers were very effective when going for two: they had the 2nd highest two-point conversion success rate (67%) of all teams during the regular season, a rate that, although admittedly based on a small sample, was much higher than their statistically estimated chance of winning the game in overtime (38%).[1] The latter estimate, furthermore, is probably inflated given that so many of the Packers' key players were injured. But whatever temptation to go for two the Packers' coaches may have felt, they ignored. They kicked the extra point, sent the game into overtime….and lost as the Cardinals scored a touchdown on their first possession, sinking one of this paper's authors into deep despair. Although in hindsight it's easy

[1] This estimate, provided by Pro Football Reference (http://www.pro-football-reference.com/play-index/win_prob.cgi) and based on an influential paper by the statistician Hal Stern (1991), takes into account the pre-game betting line, the score differential at the critical moment, the time remaining in the game, and so on.

to second-guess the Packers, they did what nearly every other team does in that situation: kick the extra point. Avoid sudden death.

We argue that *sudden-death aversion*[2] reflects a common bias that can lead to non-optimal decision making in a great many contexts, some far removed from the gridiron. When decision makers face a choice between a "fast" option that offers a greater chance of ultimate victory but also a non-trivial chance of immediate defeat, and a "slow" option with both a lower chance of winning and a lesser chance of immediate defeat, they often opt for the slow option because of their aversion to sudden death. In so doing, they lower their chances of ultimate success.

Consider another example, this one from the world of casino gambling. In blackjack, players are dealt two cards, face down, and the dealer gets two cards as well, one face down and one visible to all. The goal is to get the cumulative value of all of one's cards closer to 21 than the dealer's total, without going over 21 (which results in an immediate loss or "bust"). Imagine that you are dealt a 9 and a 7, so your total is 16, and the dealer has a queen (valued at 10) showing. What would you do? Take another card to get closer to 21, or stick with your 16?

The optimal strategy is to take another card (Thorp, 1966). Doing so slightly improves your chance of winning (although the odds are not good either way). Accordingly, taking another card is a sudden death strategy that carries considerable risk of immediate loss. Standing pat delays the outcome until all other players have made their decisions and the dealer's hand is played out. On-site studies have shown that although blackjack players usually follow the optimal strategy, they tend to make an error in this specific situation (Keren & Wagenaar, 1985). They

[2] The concept of sudden-death aversion was introduced in an unpublished working paper by Thaler sometime in the 1980s. The latest version of that paper is Thaler (2000), which has additional sports examples for those so inclined. The additional impetus of the author team finally turned the concept into a research paper.

stick with their hand of 16 with the dealer showing a 10, diminishing the expected payoff on these hands.

Why would people do this? Why are they so averse to sudden death, even to the point of lowering their odds of success? It may be tempting to overlook this bias on the part of casino blackjack players, most of whom are amateurs who may have additional objectives that compete with their interest in maximizing their financial return—such as being with other people, receiving free drinks, or simply enjoying the thrill of minor victories on their way to long-run defeat. But this excuse does not apply to professional coaches. They are paid to maximize their team's chances of winning. Indeed, the theory of the firm in economics is based on the premise that managers are skilled optimizers (Coase, 1937). The presumption is that if a company's CEO can't figure out how to set marginal cost equal to marginal revenue she will either hire someone who can, or be fired. In both the business world and the sports (business) world, survival of the smartest, at least in theory, should predominate.

SDA and Myopic Loss Aversion

There are (at least) two reasons why people may suffer from sudden-death aversion (hereafter SDA). First, people are subject to myopic loss aversion (Benartzi & Thaler, 1995). Myopic loss aversion is the combination of two well-studied phenomena: loss aversion (Kahneman & Tversky, 1979) and mental accounting (Thaler, 1985, 1999). Loss aversion, of course, is the tendency to weigh losses more heavily than gains. Numerous studies find that the pain of suffering a loss is more than twice the pleasure that comes from an equal-sized gain (Kahneman, Knetsch & Thaler, 1990; Tversky & Kahneman, 1992). The component of mental accounting that comes into play in myopic loss aversion is what has been called narrow framing

(Kahneman & Lovallo, 1993) or narrow bracketing (Read, Loewenstein, Rabin, Keren, & Laibson, 1999), which is the tendency to treat problems in isolation rather than as part of a larger whole.

Narrow framing is at the very heart of prospect theory. Perhaps the most important insight of the theory was the recognition that people make decisions by evaluating prospects in terms of *changes* relative to some reference point whereas the traditional economic model, expected utility theory, stipulates overall *levels* of wealth as the carriers of utility. Prospect theory is thus a theory of isolated decisions. But people *can* analyze a decision in a variety of ways, both narrow and broad. When buying or selling a stock, an investor can evaluate the decision in isolation or in terms of how it changes the overall portfolio. Read et al (1999) argue that although a broad frame is usually the best choice, people often make decisions one at a time.

Empirical evidence supports their view. In laboratory studies, Gneezy and Potters (1997) and Thaler, Tversky, Kahneman, and Schwartz (1997) both find that subjects are more willing to take gambles with positive expected values when the gambles are grouped in chunks. Moreover, the larger the chunks (the broader the frame) the more risk subjects take on. The same pattern is observed in the field. Camerer et al (1997) find that New York cab drivers (or at least the inexperienced ones) engage in daily income targeting, quitting when they meet their goal. And Pope and Schweitzer (2011) show that professional golfers appear to think about their tournament rounds one hole at a time, even though their payoff depends solely on their total score over 72 holes.

In the contexts we study here, myopic loss aversion takes similar form. Facing a decision with a sudden death option, decision makers focus on the outcome of the sudden death strategy, and underweight (or even ignore) what would happen down the road on the slower path. In other words, people narrowly focus on the potential for sudden loss and give too little consideration to the ultimate objective—winning the game. The coach focuses on the agony of the failed two-point conversion and gives little thought to the chances of winning in overtime which, given the closeness of the game, is presumably close to 50%. The blackjack player focuses on the odds of drawing a card higher than 5 and busting, and gives less weight to how likely it is for a dealer to beat 16. By virtue of this narrow focus, people cut themselves off from the full range of relevant considerations and, in so doing, can end up making suboptimal choices.

Note that the delayed option needn't be much delayed for it to receive substantially less attention than the immediate option. Myopic loss aversion is *not* about time discounting. Rather it is a phenomenon that stems from thinking about decisions one at a time with little or no heed given to the next step, even if it is imminent. A hand of blackjack takes just moments to play and overtime usually ends in less than the maximum fifteen minutes of game time. In these contexts, then, myopic loss aversion corresponds to the tendency to overweight potential losses that are immediately threatening because of their temporal priority, whether or not the (largely ignored) delayed outcome is close or distant in time.[3]

Myopic loss aversion was an idea that emerged from the effort to explain a well-known puzzle first posed by Paul Samuelson. Briefly, Samuelson offered his colleague a bet: flip a coin,

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[3] The tendency to underweight events that occur only after earlier events play out is closely related to people's difficulty in thinking through disjunctions (Shafir, 1994; Tversky & Shafir, 1992). Although the psychological processes responsible for that difficulty overlap with those responsible for myopic loss aversion, the two phenomena are distinct in several ways: 1) People do take future outcomes into account to some extent, just not enough. Thus, even though coaches are myopic, they are likely to make different decisions if they believe they are almost certain to win or almost certain to lose in overtime. 2) SDA and myopic loss aversion are limited to those situations in which people are worried about the chance of an immediate setback or loss. Thus, if people aren't focused on the possibility of losing, they may prefer the fast option. 3) SDA and myopic loss aversion do not require uncertainty. Thus, even if the first component of the slow strategy is certain – e.g., a 100% chance of successfully kicking the extra point—we suspect that people would underweight overtime when making their decision. In other words, people underweight events that are psychologically distant even when there is no uncertainty to think through.

win $200, lose $100. Samuelson's colleague, hereafter SC, responded that he did not want to accept the bet "because he would feel the $100 loss more than the $200 gain". Loss aversion circa 1963. But, he said that he would gladly accept 100 such bets. Samuelson proved that this pair of choices is irrational (with some technical conditions). Essentially, you should not agree to play many repetitions of a bet that you will not play once.[4]

Here is the essence of the argument. Suppose SC has a simple version of the prospect theory value function in which everything is linear. U(x) = x, x>0; U(x) = 2.5x, x<0. Notice that SC will reject a single bet because he multiplies losses by 2.5 and the asymmetry in payoffs is only 2 to 1. What about two bets? It depends if he has to watch! If he watches, then two bets are exactly twice as bad as one. But if the bets can be played out in his absence, he gets a portfolio in which he can win 0, 1 or 2 bets. If you compute the utility of this portfolio [.25*400 + .5*100 + .25*2.5(-200) = 25], it is positive. This is myopic loss aversion in a nutshell. If Samuelson offered SC that bet each day, SC would turn it down because he thinks of each bet one at a time.

To see how myopic loss aversion works in our contexts, we can use the same simple value function with a win valued at 1 and a loss valued at -2.5. Now consider the following generic sudden death aversion example. Suppose there is a fast strategy that offers a one third chance to win immediately and a two thirds chance to lose now. There is also a slow strategy that offers a 50% chance to avoid sudden death and reach a second stage which in turn offers a 50% chance to win. The myopically loss averse decision maker values the fast strategy as .33*1 + .67*(-2.5) = -

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4 Samuelson argued that SC had mistakenly agreed to the 100 bets because he misunderstood the law of large numbers and thought that risk would go down as the number of repetitions goes up. Of course variance goes up with repetition but the risk of losing money goes down. In their paper introducing myopic loss aversion Benartzi and Thaler (1995) argued that the mistake SC made was not to accept the 100 bets, which has an expected value of $5000 and a risk of losing money of once in a blue moon. The mistake was to reject the single bet. After all, you can't get to 100 if you don't take the first one.

1.33. In valuing the slow strategy, she considers getting to the second stage as neither winning nor losing and so gives it a value of 0. That means the first stage of the slow strategy is valued at .5*0 + .5*(-2.5) = -1.25 which is better than -1.33. Of course if she evaluated the entire slow strategy she would get a different answer: .5(.5(1) + .5(-2.5)) + .5(-2.5) = -1.63 which is worse than the fast strategy. Table 1 shows that both myopia and loss aversion are necessary for this explanation to apply.

Insert Table 1 here

Myopic loss aversion, of course, is a phenomenon in its own right that does not have a complete psychological explanation (having been advanced by economists less interested in the precise psychological processes that underlie it), and the reasons why people are myopically loss averse are beyond the scope of this paper. We are interested in how this robust phenomenon, whatever its cause, contributes to SDA. Our use of myopic loss aversion parallels many investigators' use of anchoring, a phenomenon in its own right that has been attributed to several underlying psychological processes (Epley & Gilovich, 2001; Mussweiler & Strack, 1999; Tversky & Kahneman, 1974; Wong & Kwong, 2000) and has been used to explain a host of judgment phenomena (Block & Harper, 1991; Epley, Keysar, Van Boven, & Gilovich, 2004; Gilovich, Medvec, & Savitsky, 2000; Gilovich, Savitsky, & Medvec, 1998; Kruger, 1999).

SDA and Distorted Assessments of Likelihood

A second cause of SDA is that the very act of pursuing—or thinking about pursuing—a risky strategy (like the sudden death option) can make it seem more risky than it would seem otherwise. That is, people might feel that they don't *need* to take the risk of immediate defeat and that anyone who takes such a risk is asking for trouble. (When teams do elect the fast, sudden death strategy, announcers invariably characterize the choice as risky: "The coach is rolling the dice here.") Taking risks that needn't be taken is a form of "tempting fate," which invokes a sense of pessimism about one's future prospects (Risen & Gilovich, 2007, 2008; Risen, 2016). However likely people think it is for a team to make the 2-point conversion, we suspect they would think it is less likely when a team chooses to go for it than when the team has no choice but to go for it. We test this hypothesis in Study 6.

Note that whereas myopic loss aversion involves a disproportionate focus on the downside of the immediate option because of narrow framing, this second explanation involves biased assessments of the *likelihood* of a negative outcome with the fast strategy. Biased assessments of likelihood can affect decisions regardless of whether someone uses a narrow or broad frame. Thus, when examining whether a fear of tempting fate affects decisions, we assess likelihood beliefs for the fast option when a slow alternative exists and when it does not. But when examining myopic loss aversion, we test whether people, when making their decisions, lean on their likelihood assessments for the immediate option—whatever they are—more than they do for the slow option.

We use a combination of archival analyses and controlled experiments to explore the psychology behind SDA. We first provide evidence for SDA and examine the price decision makers can sometimes pay for it by tabulating how often NFL teams make the same decisions that the Green Bay Packers did—choose to send games into overtime by kicking an extra point rather than going for the 2-point conversion (Study 1)—and how often NBA teams who are trailing at the end of the game attempt potentially game-tying 2-point shots rather than potentially game-winning 3-point shots (Study 2). To confirm that SDA is not limited to the world of sports, we demonstrate SDA in a military scenario (Study 3). We provide further evidence of SDA, and its costs to the decision maker, under controlled laboratory conditions in Study 4.

We then explore how the twin mechanisms described above contribute to SDA. We report evidence from Studies 4 and 5 that SDA is due in part to myopic loss aversion. In Study 5, for example, we ask participants to imagine that they are the coach of an NBA team that is trailing by 2 points with only enough time to set up one final shot. The overwhelming majority choose to set up a 2-point shot. Consistent with myopic loss aversion, their choices are predicted by their estimates of the likelihood of making a 3-pointer, but not by their estimates of the likelihood of outscoring their opponents in overtime. We show in Study 6 that people (at least implicitly) believe that choosing the sudden death option is a form of tempting fate: Participants' responses reflect a belief that a risky strategy that one doesn't have to pursue (like opting for sudden death) is riskier than the same strategy when it has to be pursued.

Study 1: Going for Two in the NFL

To determine whether football coaches exhibit SDA, we examined every instance over a ten-year period (from the 2004 to the 2013 seasons) in which an NFL team scored a touchdown after trailing by seven points with less than 3 minutes to go. These data were compiled by consulting game information posted on *ESPN.com* and *sportingcharts.com*. This yielded 47 instances in which a team that had just scored a touchdown to pull within one point of their opponent with less than 3 minutes to go faced our decision of interest: whether to try to win the game right then by going for two or send the game into overtime by kicking the extra point. Supporting the existence of SDA, the coaches opted for the "safer" option of kicking the extra point 42 times (89.4%), $z = 5.40$, $p < .0001$. SDA was equally strong for home (89%, n=27) and visiting (90%, n=20) teams.

To examine the robustness of this result, we restricted our analysis to those occasions in which a team trailing by 7 points scored a touchdown with less than *two* minutes to go. This yielded 41 instances, with coaches opting for the extra point 36 times (87.8%), $z = 4.84$, $p < .0001$. Restricting the analysis further to occasions in which the trailing team scored a touchdown with less than *one* minute to go yielded 29 instances, with coaches opting for the extra point 24 times (82.8%), $z = 3.53$, $p < .001$. Finally, restricting the analysis to those occasions in which the trailing team scored with less than 30 seconds to go yielded 24 instances, with coaches opting for the extra point 20 times (83.3%), $z = 3.13$, $p = .002$.

Although these data make it clear that NFL coaches are indeed reluctant to choose the sudden death option, evaluating whether they pay a price for doing so is less straightforward. In the ten-year period under investigation, only 5 teams opted for sudden death, which makes it difficult to evaluate how successful the strategy would be if implemented. In other words, because SDA in this context is so extreme, it is hard to know whether teams are paying a price for it. The teams that elected to kick the extra point (n=42) ending up winning the game 17 times, or 40.5%. That's lower than the null value of 50% one might expect given that the closeness of the game can be taken as a signal that the two teams were roughly equal in ability. On the other hand, these teams were trailing until the very end, so perhaps one should expect a winning percentage of less than 50%. During the most recent season, the success rate on 2-point conversions was 47.9% (45 out of 94) and for the previous 15 seasons (2000-2014) it was 48.2% (481 out of 997).[5] Moreover, the two-point conversion success rate in the 4th quarter over the same time period that we measured SDA is even higher, 52.2% (252 out of 483). The 40.5 winning percentage of teams that kicked the extra point is lower than all of those values, suggesting that SDA is costly.[6]

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[5] Taken from: http://www.sportingcharts.com/nfl/stats/team-two-point-conversion-statistics/2015/) and from: https://www.boydsbets.com/nfl-two-point-conversion-success-rate/, respectively.

[6] Note that between the 2014 and 2015 seasons, the NFL moved the line of scrimmage for kicking the extra point from the 2-yard line to the 15, changing the kick from a 20-yard to a 33-yard

Of course, a successful two-point conversion only guarantees that a team will win the game if there isn't enough time left on the clock for the other team to score (which would have been the case in our opening example if the 2016 Packers had gone for two). If there is enough time remaining for the other team to score, the probability of winning by "going for 2" is reduced. In fact, because the other team is more likely to try to score if they are trailing by one than if they are tied, going up by one point late in the game – but not at the very end of the game – may reduce a team's chance of winning (Morris, 2017). Thus, our comparison of the probability of winning the game after kicking the extra point to the two-point conversion success rate becomes a better estimate of the costliness of SDA when there is less and less time remaining.

With this in mind, we restricted our analysis to occasions in which a team trailing by 7 points scored a touchdown with less than *two* minutes to go. Those opting to kick the extra point ended up winning the game 14 out of 36 times (38.9%). Restricting the analysis further to those occasions in which the trailing team scored a touchdown with less than a minute to go, those opting to kick the extra point ended up winning the game only 33.3% of the time (8 out of 24 times). Finally, restricting the analysis to those occasions in which the trailing team scored with less than 30 seconds to go, those opting to kick the extra point ended up winning 30.0% (6 out of 20 times). These data are summarized in Table 2.

Insert Table 2 here

The NFL data provide clear evidence that coaches avoid sudden death, but because their aversion is so strong (and because the total number of football games in which coaches face the decision is relatively small), the evidence that teams pay a price for SDA is somewhat ambiguous,

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attempt. The conversion rate on 1-point attempts fell from 99.3% in 2014 to 94.2% in 2015. As a result, the expected value of kicking the extra point has decreased and the value of going for 2 has increased. Time will tell whether this change makes coaches less likely to exhibit SDA or whether it persists even as the price they pay for it increases.

especially when there is enough time left after a successful 2-point conversion for the other team to score (Morris, 2017). To pursue this question further we move to the National Basketball Association (NBA).

Study 2: Going for 2 or 3 in the NBA

Basketball offers another opportunity to test for SDA because players can attempt either 2-point or 3-point shots. When a team is trailing by 2 points near the end of the game, it can set up a 2-point shot to try to extend the game to overtime, or it can choose the sudden death strategy of setting up a 3-point shot to win or lose on that play. To find out whether NBA coaches, like their counterparts in the NFL, are averse to taking the fast option (and if so, whether it is costly), we examined every instance over a five-year period (from the 2011-12 season through the 2015-16 season) when an NBA team took a shot when trailing by 2 points with less than 24 seconds to play in the 4^{th} quarter or in overtime. We focused on shots in the final 24 seconds because NBA teams have 24 seconds each possession to attempt a shot or forfeit the ball to the other team. For strategic purposes, teams should consider any shot attempt in the final 24 seconds as potentially their final opportunity to score, with that being increasingly likely as the amount of time left in the game approaches zero.

We compiled these data from www.basketballreference.com. We limited our analysis to shots taken within 28 feet of the basket to exclude desperation "heaves" from long range as time expires. (The 3-point line is 22 feet from the basket in the two corners and 23.75 feet from the basket at the top of the key—that is, straight-on.) We identified 778 shot attempts that fit these criteria. There was a pronounced preference for the slow option, as 71.1% (553) of these were two-point attempts and only 28.9% (225) were three pointers, $z = 11.72$, $p < .00001$.

To examine the robustness of this effect, we examined the mix of 2 and 3-point shots taken with less and less time remaining in the game. Specifically, Table 3 presents the percentage of 3-pointers attempted with 24 seconds or less left to go in the game, 20 seconds or less, 16 seconds or less, and so on. The data are broken down by home team and visitors. As a glance at Table 3 makes clear, SDA was robust, being manifest in the decisions made by the home team and visitors, and at all stages during the last 24 seconds of the game. Home teams were equally likely to take the 3-pointer (28.5%) as visitors (29.4%), $\chi^2 = .05$, $p = .83$, and teams were a bit more willing to shoot 3-pointers as the time left in the game diminished, $\chi^2 = 16.66$, $p = .005$.

Insert Table 3 here

Is taking the 2-point shot costly? It is. Players were successful on 39.4% of their 2-point shots at the end of the game, and their teams ended up winning 36.7% of the games when they made their 2-pointers. Although players made only 23.6% of their 3-point shot shots at the end of the game, their teams nonetheless ended up winning 73.6%[7] of they time when they did so. As a result, the probability of winning the game when attempting a 3-point shot was 17.3% (23.6% x 73.6%) compared to 14.5% (39.4% x 36.7%) when attempting a 2-pointer. Teams are clearly not rewarded for their strategic conservatism.

Table 4 presents the observed probability of winning the game contingent on attempting a 2-point or 3-point shot at various points during the final 24 seconds of the game, broken down by home and visiting team. Home teams are marginally more likely to win after making a 3-pointer (82.1%) than away teams (64.0%), $\chi^2 = 3.50$, $p = .06$, and consequently pay a higher price for their SDA (3.6% reduction in the likelihood of winning compared to a 2.1% reduction). But

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[7] Teams did not win 100% of the games in which they made the 3-point shot because, in some cases, the other team had sufficient time to score again. With less time remaining, of course, the probability of winning after making the 3-point shot is higher. For example, of the 27 teams who made a 3-point shot with less than 4 seconds remaining, 23 went on to win (85.2%).

notably, for both home teams and visitors, and at every point during the final 24 seconds, teams are more likely to win by attempting a 3-point shot.

Insert Table 4 here

As a further check on the robustness of these findings, we limited our analysis to shots taken in the final 24 seconds of the game that immediately followed a time out. In the final seconds of close games, teams often call a timeout to set up a play they believe will maximize their chances of success. When a time out is not called, the decision-making is in the hands of the players and it can be much more reactive than deliberative, sometimes resulting in shots that lead the coach to throw his clipboard in disgust.

We identified 565 shots taken after a timeout in the final 24 seconds of the game and, consistent with SDA, 70.6% (399) of them were two-point shots, $z = 9.76$, $p < .00001$. These teams ended up winning 14.3% of the time after setting up a two-point shot and 15.1% of the time after setting up a three-pointer.

One explanation for these findings could be that better teams choose the 3-point shot in this situation and so the apparent effectiveness of electing to take the 3-point shot might be inflated by a selection bias. This is not the case. The average winning percentage of the teams that chose the 2-point shot (50.1%) was nearly identical to that of the teams that chose the 3-point shot (51.1%). Furthermore, the results of a logistic regression showed that the type of shot teams choose in this situation is not predicted by their season winning percentage ($t < 1$).[8]

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[8] Whether or not teams chose the sudden-death strategy was also unaffected by the strength of the *opponent.* A separate logistic regression indicated that choosing the 2-point or 3-point shot was not predicted by the opponent's season winning percentage, the team's season winning percentage, or their interaction, all t's < 1. That teams in all sports do not take more risks when playing superior opponents is another mystery that will have to wait for another day.

Like their NFL counterparts, NBA teams avoid sudden death when the game is on the line. We found consistent evidence for this bias when we looked at all shooting opportunities in the final 24 seconds, at different points closer and closer to the end of the game, and when looking only at shots taken after a timeout. In all cases, teams that avoid the sudden death strategy appear to be acting against their best interest, sacrificing superior odds of winning in order to avoid a greater chance of losing quickly.

Study 3: SDA on the Battlefield

Although the idea of SDA first occurred to us from watching (too much) televised sports, the phenomenon is likely to arise in many contexts outside the arena, ballpark, or stadium. We would expect to find it, for example, in legal, medical, military, and business decisions—indeed, in any context in which a fast option with better odds of success but a risk of immediate "death" must compete with a slower option that puts the risk off into the future. The most dramatic instances of SDA are those in which the risk of death is literal and people's lives are on the line.

We chose just such a context to examine whether SDA exists outside the world of sports. We asked participants to imagine being in combat and having to choose between an action with a greater chance of ultimate success but a greater risk of immediate death, and one with lower odds of success but less of a risk of sudden death.

Method. We asked 100 Mechanical Turk participants (47 female; M_{age} = 33.43, SD =11.40) to imagine that they were in command of a small squad of soldiers in the Afghan city of Gardez who were in an untenable situation, taking fire from the enemy.[9] Participants were told

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[9] For all studies, we predetermined a sample size of at least 50 per condition, which would allow us to detect a medium effect size (i.e., d = .55), with a desired power of .80, and an alpha level of .05. We aimed for larger samples when possible to detect smaller effects. For Study 3, we predetermined 100 participants because it would allow us to detect that a 60% preference for the slow option was different from a 50-50 split.

that, after discussing the situation with intelligence offices at Bagram airfield, they had two options of how to try to fight their way to safety, a fast and a slow option analogous to the sports decisions we examined in Studies 1 and 2. First, they could try to fight their way east, through the old part of the city, to the foothills, where they could join up with a much larger group of marines. Because of the layout of the old city and the number of Taliban fighters believed to be located there, it was estimated that they would have a 50% chance of getting to safety. Alternatively, they could try to fight their way west, to the river, and try to coordinate with another unit in the area. If they reached the river and met up with the other unit, the combined forces would then attempt to move 7 miles along the river so they could call in air support. Bagram estimated an 80% chance of reaching the river safely and meeting up with the other unit. If they reached the river and met up with the other unit, there was a 60% chance of moving the 7 miles along the river to safety. Participants responded by choosing either “Fight our way east, through the old city, with a 50% chance of getting home safely” or “Fight our way west, with a 80% chance of reaching the river and a 60% chance of safely traveling the 7 miles down the river to safety.” The full scenario is presented in Appendix A.

Results. As predicted, SDA was pronounced. Among the 100 participants, 73 elected the slow option, even though it offered less of a chance of making it to safety, $z = 4.60$, $p < .00001$. These results suggest that SDA is not limited to the context of sports. It can be seen even when (hypothetical) life and death is on the line.[10]

[10] A reviewer was concerned that respondents may have been confused about one of the response options, thinking that the statement “80% chance of reaching the river and a 60% chance of safely traveling the 7 miles down the river to safety” referred, not to two marginal probabilities, but one marginal probability estimate followed by an overall estimate of success. We therefore replicated this study with that response option replaced by “Fight our way west, with a 80% chance of reaching the river *followed by* a 60% chance of safely traveling the 7 miles down the river to

Study 4: Card Game Myopia

Having obtained evidence of SDA in two different real-world data sets and in participants' responses to a life-and-death scenario, we wanted to study it under controlled laboratory conditions. In real-world settings it is possible for people to have goals other than winning. But participants' goals can be isolated in the lab. We therefore presented participants in Study 4 with an incentivized choice in a novel context, one in which there is no conventional wisdom to influence their decisions. We created a choice between two card games that had all the elements essential to SDA: 1) participants were motivated to win; 2) they had to choose between either a fast or slow strategy; 3) the fast strategy had a higher likelihood of immediate defeat; and 4) the fast strategy nonetheless offered better odds of winning.

We predicted that even though the objective odds of winning were better with the fast strategy, most participants would choose the slow option. We also predicted that participants would do so in part because of myopic loss aversion and therefore their decisions would be based on their beliefs about what would likely happen in their initial draw in the fast game, not what might happen down the road in the slow game.

Method

Participants. A predetermined sample size of 150 MTurk respondents (72 female; M_{age} = 36.27, *SD* =11.40) was recruited. The consent form explained that participants' $1.50 payment could increase or decrease depending on their actions in the study, but that they would be paid at least 50 cents.

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safety" (italics added). Despite this change, 67 of the 101 Mturk participants elected the delayed option, $z = 3.28$, $p < .01$.

Procedure. Participants were asked to choose between two card games. They were told they would bet $1.00 on their chosen game, so that if they won they would earn a total payment of $2.50 and if they lost they would earn only $.50.

Participants first read the rules of the two card games. "In Game A, you draw one card from a complete deck (Deck A), trying to get a Jack, Queen, King, or Ace. If you get one of these special cards, you win. But, if you get a number card (2, 3, 4, 5, 6, 7, 8, 9, or 10), you immediately lose. In Game B, both you and the dealer will receive cards from separate complete decks. The dealer starts with one card shown face up. You then draw from a different deck (Deck B), trying to get a card that is higher than the dealer's card. If you beat the dealer, then you stay in the game and draw from a second deck (Deck C). If you beat the dealer with this draw, you win." The rules further specify that all decks are regular 52 card decks, every draw is from a new deck, and an ace is always considered high.

After reading the rules, participants saw that the dealer had a 7 showing for Game B. Thus, while the chance of losing immediately was higher by playing Game A (69%) than Game B (46%), their overall chance of winning was higher with Game A (31%) than Game B (54% x 54%, or 29%). Before making their decision, they were reminded about the two options:

1) You can play Game A. In Game A, you try to draw a J, Q, K, or A. If you draw one of these special cards, you win the game. But, if you draw a number card (any card 2 through 10), you lose immediately.

2) Alternatively, you can try to beat the dealer in Game B. In Game B, if you draw an 8 or higher, you stay in the game and get a second deck of cards (Deck C). If you draw an 8 or higher from Deck C, you win.

Participants were then asked which game they wanted to play, Game A or Game B.

After indicating which game they preferred, participants answered three probability questions by dragging a slider between 0% and 100%. Specifically, they reported the chance that they would draw a "special" card from Deck A if they chose Game A, the chance they would beat the dealer from Deck B, and the chance they would beat the dealer from Deck C.

Next, participants answered four multiple-choice questions to confirm they were paying attention to the rules.[11] On average, participants answered 3.63 questions correctly (SD = .78), indicating that they read the rules carefully.

Participants then "drew" a card or cards (by clicking the appropriate button on the computer) to determine whether they won or lost, and received their payment.

Results and Discussion

Consistent with SDA, although the fast route provided by Game A gave participants better odds of winning extra money, 61% of them (n = 91) chose Game B, $z = 2.53$, $p = .011$.

Not surprisingly, participants thought it was less likely they would draw a special card from Deck A ($M = 33.28$, $SD = 14.76$) than beat the dealer from either Decks B or C ($M_{\text{deck B}} = 47.12$, $SD = 16.02$, $t(149) = 9.16$, $p < .001$, $d = .898$; $M_{\text{deck C}} = 45.43$, $SD = 16.60$, $t(149) = 8.20$, $p < .001$, $d = .772$). There was no significant difference in participants' estimated probability of beating the dealer from the two decks in Game B, $t(149) = 1.87$, $p = .064$, $d = .103$. We also multiplied participants' probability estimates of beating the dealer from Deck B and Deck C to calculate their conjunctive probability estimates for winning Game B. Of course, if people are myopic and focus on the first stage of the game, they are unlikely to make this calculation before

[11] In Game A, from which of the following sets of cards would you win the game? In Game B, if you draw a card that is higher than the dealer from Deck B, what happens next? What card was the dealer dealt in Game B? If drawn, which cards would lose both Game A and Game B?

deciding. The conjunctive probability estimate (*M* = 23.45, *SD* = 13.67) was significantly lower than participants' estimates of winning Game A, $t(149) = 7.00$, $p < .001$, $d = .572$. Thus, even though the majority of participants chose to play Game B, their probability judgments were consistent with the fact that they were more likely to win by playing Game A.

To more directly test whether participants' choice of the fast or slow option depended on their narrow focus on the chance of losing immediately, we used logistic regression to predict their decision to play Game A from their three probability judgments. As expected, there was a significant effect of their beliefs about selecting a special card from Deck A (B = -.062, *SE* = .016, $p < .001$). The less likely participants thought it was that they would draw a special card from Deck A (and therefore the more likely they felt they were to lose right away if they played Game A), the more likely they were to select the slow strategy provided by Game B. In contrast, participants' beliefs about the likelihood of beating the dealer by drawing a card from Decks B or C were not significantly related to their decision (Deck B: B = .027, *SE* = .019, $p = .147$; Deck C: B = .032, *SE* = .019, $p = .083$).[12] Because winning Game B depends jointly on the likelihood of beating the dealer from Deck B and Deck C, we re-ran the logistic regression predicting participants' decisions from their judgments about Deck A and the multiplied probability judgments for Deck B and Deck C. Although judgments for Deck A remained significant (B = -.037, *SE* = .013, $p = .004$), the conjunctive probability judgment of drawing winning cards from both Deck B and Deck C was not (B = .000, *SE* = .000, $p = .445$).

The results of Study 4 provide clear evidence of SDA in a novel context in which there

[12] All of these results stand when we exclude from the analyses those participants who did not do well on the attention check questions. When we include only those who got at least three out of four questions right (n = 139), 63% choose game A, z = 2.89, $p = .003$. As with the full sample, only the probability judgment for Game A predicted their choice, B = -.070, *SE* = .018, $p < .001$ (Deck B: B = .031, *SE* = .021, $p = .122$; Deck C: B = .031, *SE* = .019, $p = .109$).

was no conventional wisdom to influence participants' choices, participants had no goal other than winning the game, and there was a price to pay for being unwilling to risk the fast loss. Even though the decision in this study was incentivized, a majority of participants elected to take the slow route that minimized the chance of immediate defeat rather than the fast route that maximized their chance of ultimate success. These preferences appeared to stem from a narrow focus on the fast option with its risk of sudden death rather than a broader focus that takes greater account of events down the road. Of course, "down the road" was only moments away, suggesting that people are underweighting events that feel psychologically distant because they are removed from an initial, and potentially decisive, prospect.

Study 5a: Basketball Myopia

To explore further the role of myopic loss aversion in SDA, we returned to the domain of sports. We found in Study 2 that NBA coaches whose teams are trailing by two points at the end of the game avoid setting up a 3-point shot that offers a better chance of winning the game, presumably because doing so also increases the odds of immediate defeat. We maintain that this occurs in part because they focus on the possibility of losing right away and not on what might happen in overtime. Of course, it is possible that coaches *are* thinking about what will happen down the road—that they want to tie the game because they are overly confident that their team will outplay their opponent in overtime.

Because we can't know what NBA coaches are focused on when making their decisions, we examined myopic loss aversion by presenting participants with a relevant basketball scenario and asking them what decision they would make and how likely they felt that different outcomes were. Thus, we created a SDA scenario in which the odds of success were better by opting for the fast strategy (a 33% chance of making a 3-point shot and winning the game) rather than the slow strategy (a 50% chance of making the 2-point shot and a 50% chance of winning in overtime against an evenly matched rival, for a 25% chance of winning the game). The statistics cited in the scenario are in line with the relevant shooting percentages in the NBA overall, but higher than the actual end-of-game percentages we estimated in Study 2. We used these numbers to make any calculations easy for subjects. We predicted that even though the fast route offers better odds of winning, the majority of participants would opt to try to force overtime. We also expected that their decision would be better predicted by their beliefs about what would happen on the 3-point shot than by what might happen in overtime.

Method

Participants. Fifty-two participants (33 female) were approached on a college campus in the Northeastern United States and asked to complete a short survey.

Procedure. Participants were asked to imagine that they were the coach of an NBA team playing an evenly matched rival. Their team was said to be trailing by 2 points with a few seconds left in the game and in possession of the ball. They've called time out and are considering two options for what play to run. "You can set up a 3-point shot that, if successful, will give your team the win but, if unsuccessful, will result in a loss. All relevant statistics point to a 33% chance of success. Alternatively, you can set up a 2-point shot designed to force overtime and then try to win it in the extra period. All statistics point to a 50% chance of getting a 2-point basket and forcing overtime." Participants were asked which strategy they would pursue if they were the coach: "set up a 3-pt shot to win or lose in regulation" or "set up a 2-pt shot to try to force overtime."

After indicating their preferred strategy, participants answered five multiple-choice questions to confirm they were paying attention to the story.[13] On average, participants answered 4.81 questions correctly (*SD* = .49), indicating that they read the story carefully.

Participants assessed the likelihood that each strategy would be successful by answering three questions on a 0 (not at all likely) to 10 (extremely likely) scale. Unlike Study 4, in which participants' likelihood estimates were expressed in percentages, here they used an 11-point rating scale because base-rate probabilities were included in the scenario itself. Participants first reported how likely they thought it was that their team would win the game if it went to overtime. They were then asked about the likelihood of making the 3-point and 2-point shots: "Although all relevant statistics point to a 33% [50%] chance of making the 3-pt [2-pt] shot, you may have a very real hunch that the chances are better or worse. How likely do you believe it is that your team would make the 3-pt shot to win the game [the 2-pt shot to force the game to overtime]?"

Participants then indicated whether they considered themselves basketball fans and, if so, to indicate their favorite team. Finally, participants reported their age and gender.

Results and Discussion

Although the chances of winning the game were stipulated to be better with the fast, 3-point strategy, 81% of the participants (n = 42) elected to set up a 2-point shot, $z = 4.29$, $p < .001$—clear evidence of SDA.

Not surprisingly, participants reported that they felt it was more likely that their team would make the 2-point shot ($M = 6.60$, $SD = 1.43$) than the 3-point shot ($M = 4.06$, $SD = 1.68$), $t(51)=9.27$, $p < .001$, $d = 1.29$. Their feelings about their team's prospects of winning in overtime

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[13] Of the 4 games that these two teams have played this season, how many has your team won? How many points does your team have when you call time out? Which team is winning when you call time out? What are the chances of making the 3-pt shot? What are the chances of making the 2-pt shot?

fell in between those two estimates (*M* = 6.23, *SD* = 1.31), such that they thought their team would be more likely to make the 2-point shot than win in overtime ($t(51)=2.26$, $p = .028$, $d = .31$) and more likely to win in overtime than make the 3-point shot ($t(51)=7.82$, $p < .001$, $d = 1.10$).

To examine the influence of participants' focus of attention on their choice of strategy, we used logistic regression to predict participants' decisions to set up a 2-point or 3-point shot from their three likelihood judgments. As predicted, this yielded a significant effect of the likelihood of making the 3-point shot (B = -.568, *SE* = .28, $p = .045$). Participants who thought it was less likely that their team would make the 3-pt shot were more likely to select the slow, 2-point strategy. Participants who thought their team was more likely to make the 2-point shot were more inclined to set up a 2-point shot, but that relationship was not significant (B = .705, *SE* = .433, $p = .10$). Finally, participants' beliefs about the likelihood that their team would win in overtime were unrelated to their chosen strategy (B = .117, *SE* = .41, $p = .775$).[14,15] Thus, it does not appear that participants chose the slow strategy because they adopted a broad perspective that

[14] All of these results stand when we exclude from the analyses those participants who did not do well on the attention check questions. When we include only those who got at least four out of five questions right (n = 50), 80% chose to take the 2-pt shot, $z = 3.54$, $p < .001$. As with the full sample, only the subjective probability of making the 3-pt shot significantly predicted their choice, B = -.581, *SE* = .29, $p = .045$ (2-pt shot: B = .722, *SE* = .438, $p = .099$; overtime: B = .05, *SE* = .42, $p = .906$). In addition, the pattern of results does not depend on whether or not participants reported being a fan. Among the fans (n = 19), 84% (n = 16) chose to set up a 2-point shot, $z = 2.75$, $p = .006$. Moreover, the binary logistic regression that shows that subjects' decisions are predicted by their assessments of making the 3-point shot, but not by their assessments of the other outcomes, holds when controlling for being a fan (3-pt shot: B = -.581, *SE* = .287, $p = .043$; 2-pt shot: B = .690, *SE* = .438, $p = .115$; overtime: B = .099, *SE* = .407, $p = .81$; fan: B = .347, *SE* = .842, $p = .680$).

[15] As in Study 4, because winning with the slow strategy depends jointly on the likelihood of making the 2-pt shot and of winning in overtime, we re-ran the binary logistic regression predicting participants' decisions from their judgments about making the 3-pt shot and the multiplied likelihood judgments of making the 2-pt shot and winning in overtime. The effect of participants' assessments of making the 3-pt shot was in the predicted direction, but was no longer significant (B = -.326, *SE* = .211, $p = .112$). The effect of the conjunctive likelihood judgment was not significant (B = -.201, *SE* = .171, $p = .239$).

incorporated a sense of how well their team would perform in overtime. Instead, participants' decisions tracked their beliefs about the likelihood that their team would make a 3-point shot at the end of "regulation," reflecting a narrow focus on the prospect of immediate loss.

Together with Study 4, these results provide evidence that people are reluctant to choose a strategy that has better odds of ultimate success if there is a higher chance of immediate defeat. One reason people are reluctant to pursue the fast, sudden death strategy is that they suffer from myopic loss aversion.

Study 5b: Basketball Myopia Redux

Myopic loss aversion can play out in two ways. The individual can be so narrowly focused on the prospect of losing with the fast strategy that the odds of success under the slow strategy aren't even computed and hence its superiority isn't appreciated. A concrete fear of the fast option is therefore compared to a vague feeling of relative safety offered by the slower option. In Study 5a, of course, the math required to figure out which option offered the best chance of success was fairly simple (.5 x .5 equals .25, which is lower than the .33 probability of success for the fast option), so some participants likely knew the true odds offered by each option.[16] But myopic loss aversion can still deter people from making the rational choice because the prospect of losing with the fast option is so much more concrete and salient than the prospect of losing with the slow option that it receives more weight. We therefore conducted 5b to test whether SDA continues to emerge when the odds are presented to participants and there is no question about the superiority of the sudden death option. Would people still be reluctant to choose it?

Method

[16] Of course, myopic loss aversion is not the only reason why participants may struggle to determine which option offers the best odds.

Participants. One hundred ninety-six MTurk respondents (125 female; M_{age} = 35.83, *SD* = 11.34) were recruited in exchange for modest compensation. (We aimed for a sample of 200, but four people failed to complete the study).

Procedure. Participants were randomly assigned to either the *control* or *calculation* condition. In the control condition, participants read the NBA scenario from Study 5a asking them to decide whether to set up a 2- or 3-point shot as the final play of the game. In the calculation condition, the conjunctive probability for the slow strategy was calculated for participants after each statistic was presented individually and an explicit comparison between the fast and slow strategies was provided: "Thus, based on the statistics, the chance of winning if you take the 2-pt shot is 25% (this is calculated by multiplying the chance of making the 2-pt shot [.50] and the chance of winning in overtime [.50], which equals .25 or 25%). Statistically speaking, going for 3 gives you better odds of winning the game (though, of course, the odds of losing right away are higher if you go for 3)." All participants were asked which strategy they would pursue if they were the coach.

Just like Study 5a, participants reported their perceived likelihood of winning in overtime, making the 3-point shot, and making the 2-point shot, all on 0 (not at all likely) to 10 (extremely likely) scales.

Participants were then reminded of the probabilities of making the 2-point shot (50%) and winning in overtime (50%) and asked to report the objective probability of winning if they set up the 2-point shot. They did so by moving a slider between 0% and 100%. For participants in the calculation condition, this served as a memory check, but for participants in the control condition, this measured their ability to calculate the conjunctive probability. Participants also indicated which strategy provided a higher overall chance of winning according to the statistics in the story by choosing between "going for the 2-pt shot," "going for the 3-pt shot," or "the odds are the same."

Participants then indicated whether they considered themselves basketball fans and, if so, to indicate their favorite team. Finally, participants reported their age, gender, and race/ethnicity.

Results and Discussion

Although the chances of winning the game were better with the fast, 3-point strategy, 74.7% of the participants in the control condition (n = 74) chose to set up a 2-point shot, $z = 4.83$, $p < .001$. This replicates Study 5a and provides clear evidence of SDA.

We predicted that if we helped people think through the immediate and distant components of the slow option, they would be less likely to show SDA. In the calculation condition, a majority of the participants (n = 52; 53.6%) chose to set up a 2-point shot. Thus, as expected, there was more SDA in the control condition than in the calculation condition (χ^2 (1, N = 196) = 9.54, $p = .002$), suggesting that one reason people prefer the slow strategy is that they fail to realize it is inferior.

But as noted, even when participants were told the slow strategy was inferior, more than half exhibited SDA. One might think that nearly everyone would opt for the 3-point shot in the condition in which participants are explicitly told that the odds of winning are better by taking the 3-point shot. But no, even when given the correct answer, slightly more than half of the participants chose to set up a 2-point shot, significantly different from the 0-100 split one would expect if people always chose the strategy they were explicitly told has a better chance to win, $p < .001$. These results suggest that the desire to avoid sudden death is more than a failure to consider distant outcomes or to understand conjunctive probabilities.

As expected, participants were more likely to correctly identify the objective probability of winning with the 2-point strategy in the calculation condition (39%) than in the control condition (17%), χ^2 (1, N = 195) = 11.47, $p < .001$, and they were more likely to report correctly that the 3-point strategy was superior in the calculation condition (66%) than the control condition (21.2%), χ^2 (2, N = 196) = 40.05, $p < .001$.[17] Although participants in the calculation condition were (of course) more aware of the relevant odds than those in the control condition, participants' responses to the probability questions suggest that some in the calculation condition may still have been confused. Thus, to provide the strictest test of SDA, we collapsed across conditions and restricted our analysis to the responses of participants who correctly reported that the 3-point strategy provided better odds. Even for those who knew the fast strategy was superior (n = 85), almost half (48%) chose the slow, 2-point strategy.

These data indicate that some people avoid the fast strategy because they are unaware that it offers better odds of success. But the fact that people avoid sudden death roughly half the time even when they are explicitly told that it is a superior strategy (and even when they can report its superiority) suggests that the psychology underlying SDA runs much deeper than people's difficulty with math. The fast, 3-point strategy can feel especially risky even when one knows it offers better odds (see Risen, 2016).

Study 6: Unnecessary Risks Seem Riskier

The Packers' decision to avoid sudden death that we described earlier captured the attention of many observers. The sportswriter Benjamin Morris noted that the Packers had a better

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[17] The pattern of results does not depend on whether or not participants reported being a fan. Among the fans in the control condition (n = 55), 71% (n = 39) chose to set up a 2-point shot, z = 2.96, $p = .003$. Among the fans in the calculation condition (n = 52), 58% (n = 30) chose to set up a 2-point shot, again significantly different from the 0-100 split one would expect if people always chose the strategy they were told has better odds, $p < .001$. Moreover, the likelihood of correctly identifying the objective probability of winning with the 2-point strategy and the likelihood of correctly reporting that the 3-point strategy was superior did not differ for fans and non-fans in either the control or calculation conditions, all $\chi^2 < 1.5$.

chance of winning had they gone for two instead of kicking the extra point. In an article entitled "NFL Coaches are Getting Away with Crimes Against Middle School Math," he wrote:

"…failing to go for two in this exact situation is one of the clearest and easiest-to-demonstrate mistakes in all of football, and how coaches continue to make this error virtually 100 percent of the time is a melancholy mystery."

We agree that the decision to avoid sudden death is often a mistake, but we don't think it's mysterious. Such decisions are the product of a host of familiar and very powerful psychological processes. As we have just shown, they are driven in part by myopic loss aversion. In addition, people may be reluctant to pursue the fast, sudden death option because doing so can feel like tempting fate, and therefore likely to lead to an undesirable result. Because kicking the extra point is nearly always successful, getting to overtime seems guaranteed, and the decision to go for two seems risky. It is a risk, furthermore, that needn't be taken, and we argue that such risks seem riskier than those that must be taken (Walker, Risen, & Gilovich, 2017).

To test this idea, we presented participants with a scenario in which a team that was trailing near the end of the game scored a touchdown with 12 seconds to go (see Appendix B). In one condition, the team was said to be trailing by 2 points after scoring the touchdown and so they had to attempt a 2-point conversion. In another condition, the team was said to be trailing by 1 point after scoring the touchdown, and so their decision to go for two was not mandatory. If taking a risk that needn't be taken increases the perceived likelihood of failure, participants in the latter condition should give lower estimates of the probably of making the 2-point conversion than those who thought the team had to go for two.

Method

Participants. We recruited 400 Mechanical Turk participants to complete a survey about the NFL in exchange for modest compensation. Because of the complexity of the game of football and the detailed nature of our scenario, we needed to ensure that all participants were reasonably knowledgeable about the sport. To accomplish this, the survey informed participants at the outset that they should not complete the study if they did not have considerable knowledge of football and the NFL. To help them make that assessment, the survey began with a six-question test of football knowledge. (Sample question: *It's 4th and 5 on the 30-yard line. The coach calls for a field goal attempt. How long is the attempt? a) 27 yards, b) 37 yards, c) 47 yards, d) 57 yards.* Option "c" is the correct response.)

We expected the warning issued at the beginning of the survey, along with the knowledge test, would encourage those with insufficient knowledge of football to refrain from completing the rest of the survey. Indeed, 84 participants dropped out during or after the knowledge test, leaving a final sample of 316 (28.8% female, mean age = 37.2). We did not exclude any of the remaining participants based on their test score. The average score for participants who remained in the study was 4.0.

Materials and Procedure. After completing the test, participants who elected to remain in the study were randomly assigned to read one of four scenarios in which either their favorite NFL team or a typical NFL team was trailing at the end of a game. Half of the participants read that the team was trailing by 7 points when they scored a touchdown with 12 seconds to go, leaving them with a decision of whether to kick the extra point and send the game into overtime or go for the 2-point conversion. The other half read that the team was trailing by 8 points when they scored, leaving them with no choice but to go for two[18]. In each scenario, participants read that the team elected to go for the 2-point conversion and they were asked to estimate the likelihood, in percent (1-100), that the team would make the 2-point conversion. Participants then provided their age, income, and gender.

Results and Discussion

A 2 (team: personal favorite vs. typical team) x 2 (score deficit: 1 point vs. 2 points) analysis of variance (ANOVA) yielded two significant main effects, but no interaction ($F < 1$). Participants who were asked about their favorite teams thought that they were more likely to make the 2-point conversion ($M = 43.27$, $SD = 18.48$) than those asked about a typical NFL team ($M = 39.17$, $SD = 15.48$), $F(1, 311) = 4.79$, $p = .03$, $d = .30$.[19] More important, participants also thought that an NFL team was less likely to make the 2-point conversion when it was trailing by one point and could have kicked the extra point instead ($M = 38.79$, $SD = 16.81$) than when the team was trailing by two and needed to go for two ($M = 43.61$, $SD = 17.13$), $F(1, 311) = 6.47$, $p = .01$, $d = .28$. Both main effects remained significant when controlling for participants' score on the football knowledge test ($F_{score} = 6.44$, $p = .01$; $F_{team} = 4.81$, $p = .03$).

Thus, whether thinking about their favorite NFL team or a typical NFL team, participants thought that a team was more likely to fail at a 2-point conversion when it didn't have to go for two. Taking a needless risk strikes people as riskier than one that has to be taken. Needless risks

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[18] Note that a touchdown is worth 6 points. Teams trailing by 8 points who score a touchdown subsequently trail by 2 points, whereas teams trailing by 7 points who score a touchdown subsequently trail only by 1 point. Teams have the option to attempt either a 2-point play or a 1-point play after scoring a touchdown. Thus, the decision of whether to attempt a 2-point conversion at the end of the game is no decision at all for a team that scores a touchdown when trailing by 8 points, but a wrenching decision for a team that scores a touchdown when trailing by 7 points.

[19] Note that these estimates are close to the true probability of making the 2-point conversion, providing further evidence that our participants were knowledgeable about professional football.

invite anticipatory counterfactuals of kicking oneself if things do not turn out well (Miller & Taylor, 1995), and the anticipation of those counterfactuals gives them a sense of fluency that increases their perceived likelihood (Alter & Oppenheimer, 2009; Morewedge & Kahneman, 2010; Risen & Gilovich, 2007, 2008). Thus, in addition to myopic loss aversion, people appear to avoid sudden death options because pursuing them feels like tempting fate (Risen & Gilovich, 2008).

General Discussion

As a general rule, people obey the Law of Effect and choose to repeat successful decisions and avoid punishing ones. But like all general rules, there are exceptions and we've identified a consequential one that shows itself with particular clarity in the world of sports. When coaches are faced with a quick option that carries a risk of immediate defeat but offers a greater chance of ultimate success, and a slow option that avoids the short-term risk at the cost of lesser odds of success, they overwhelmingly choose the worse odds. Non-optimal choice tendencies often result from a failure to correctly size up the relevant prospects (Gilovich, Griffin, & Kahneman, 2002; Kahneman & Tversky, 2000; Morewedge & Kahneman, 2010) and, as we have shown, SDA is partly due to such failures of judgment. People's assessments are distorted by myopic loss aversion and a gut feeling that needless risks are less likely to pay off than those that must be taken. We've also shown that SDA is sufficiently strong that people often choose the inferior long-run option even when they know it offers worse odds of ultimate success.

Although we have focused on the influence of myopic loss aversion and the pessimism that attends decisions to take unnecessary risks, broadly speaking there are three distinct biases that can lead people to choose an inferior slow option over a superior fast option. First, the tendency to make decisions one step at a time (i.e., the narrow framing component of myopic loss aversion) can lead people to focus disproportionately on the downside (loss aversion) of the immediate option (myopia). That is, people may *overweight* adversity for the fast, immediate option relative to that of the slow option. Consider the decision of whether to take a 2- or 3-point shot at the end of a basketball game. Even if two individuals have the same likelihood estimates (e.g., 3-pt shot: 33%, 2-pt shot: 50%, overtime: 50%) and assign the same values to winning and losing, the person with a narrow focus on the initial shot will be more likely to display SDA than the person with a broader frame.

Second, estimates of the *likelihood* of adversity may be biased, such that individuals underestimate the likelihood of an adverse outcome with the slow option or overestimate the likelihood of adversity with the fast option—or both. The way people think about unnecessary risks fits this second category of error because it distorts assessments of the downside risk of the fast option. Consider a basketball coach who, knowing his team doesn't *have* to take a 3-point shot, downgrades his team's ability to hit the game-winner. Regardless of whether the decision frame is broad or narrow, someone who believes there is little chance of making the 3-pointer will be less likely to choose the fast strategy than someone who believes the chances are greater.

Third, people might assign different *values* to a given outcome depending on whether it results from the fast or slow option. We suggest that this third category of influence is not uncommon—that is, a negative outcome can be evaluated more negatively because it resulted from the fast strategy. For example, a slow loss may seem "closer" to victory than a quick loss. If so, sudden death would be experienced as further removed from victory, and hence a bigger loss. Also, even if people are able to get beyond myopic loss aversion and the reluctance to tempt fate and recognize that the sudden death strategy is optimal, they may still avoid sudden death because they believe that *others* will not realize that such a strategy maximizes their chance of winning.

As a result, they might avoid sudden death out of a fear that others will blame them more for a sudden loss than a loss that's more drawn out.

Another way of saying this is that decision makers are often reluctant to go against "conventional wisdom" because they expect to pay a social price if they do and things don't work out. Of course, people are also likely to blame *themselves* more for decisions that go awry after bucking conventional wisdom. That is, people are especially likely to regret a decision that ignores conventional wisdom because the counterfactuals are especially potent when one departs from the norm (Kahneman & Miller, 1986; Miller & Taylor, 1995). It's conventional wisdom, for example, to kick the extra point to tie the game and take one's chances in overtime. If it feels especially bad for someone to ignore conventional wisdom, such that missing the 3-point shot feels much worse than losing the game a different way, then that person will display more SDA than someone who does not care about the manner of losing.

In support of these contentions, we surveyed two samples of Mturk respondents and asked them to imagine being the coach of a basketball team trailing by 2 points with 11 seconds left in the game. One sample indicated that they expected to be blamed more if they lost after pursuing the sudden death strategy of setting up a three-point shot than after setting up a two-pointer to send the game into overtime. The other indicated that they expected to experience more regret over a loss that resulted from attempting the three-point shot than the two-point shot.

These beliefs raise the prospect of there being a host of strategies that decision makers know are optimal yet do not pursue because of the potential social consequences. When Bill James, the godfather of "moneyball" and the data-analytic approach to running a baseball team, joined the front office of the Boston Red Sox, he was determined to do away with the idea that the team's best relief pitcher would be designated the "closer" and be used only to preserve a lead in the eighth or ninth innings. James thought that it would be better to utilize the best pitcher in the situations that are most pivotal (facing the other team's best hitters in a close game) rather than in the traditional end-of-game scenario with the team ahead and a victory already highly likely. The effectiveness of James' strategy was soon declared a failure when several Red Sox relievers were ineffective in several late-inning situations, and the complaints by fans and the press were so vehement that the idea was soon scrapped. Like it or not, and irrational or not, the Red Sox were soon like every other team and had themselves a conventional closer (Bradford, 2013).

Our account acknowledges the role of conventional wisdom in SDA, but also specifies how the psychology behind myopic loss aversion and the reluctance to tempt fate makes conventional wisdom what it is. After all, without myopic loss aversion and a reluctance to tempt fate, one might have expected that conventional wisdom would have evolved to encourage coaches to adopt strategies that maximize the probability of a win. In other words, SDA provides a theory of a class of situations in which the conventional wisdom is decidedly unwise.

All of these psychological processes are likely to be especially powerful when the fast outcome carries a risk of final defeat—sudden-*death* aversion. But they are also likely to play a role when the risk involves a serious *setback,* not final defeat. SDA is thus an especially pronounced subset of what might be called *sudden-setback aversion*. Consider an NFL team facing fourth down on its opponent's 45-yard line, needing to gain two yards for a first down. Should it go for the first down or punt the ball away? Punting is likely to yield a modest improvement in field position (in part because any punt into the endzone results in the opponent taking possession on its twenty-yard line). Nevertheless, teams tend to act too conservatively in situations like these and punt the ball when they would be better off going for a first down (Romer, 2006). They do so because of their focus on the immediate setback involved in the opposing team taking over near midfield. Teams' reluctance to "go for it" on 4th down is estimated to reduce their chances of winning any one game by 2.1%, which leads on average to one extra loss every three seasons. If that does not seem like a substantial penalty, note that this is just one type of decision, coaches make similar errors on other decisions (such as those we have discussed earlier), and the NFL season consists of just 16 games and so an extra win can be decisive in making the playoffs.

Or consider those occasions when an NFL team trailing by 14 points with five minutes left in the fourth quarter scores a touchdown. It now trails by 8 points and must decide whether to kick the extra point to reduce the deficit to 7 or go for two and cut the deficit to 6. Here the advantage of going for 2 is considerably larger than in the cases discussed earlier. To see why, keep in mind that (essentially) the only cases that matter are those in which the team in question prevents its opponent from scoring and scores another touchdown itself. (In other situations they lose whatever they do here.) So let's assume the team does score another touchdown and, to simplify the math, also assume that the chance of converting a 2-point conversion is .50, a 1-point conversion is certain, and the chances of winning in overtime are 50-50.

Under these assumptions, if the team kicks the extra point on each touchdown its chance of winning the game is 50%. But, if it goes for 2 on the first touchdown and succeeds, it only needs to kick the extra point on the second touchdown for the win. If the team misses on the first 2-point conversion, it can try again on the second one, with a 50 percent chance of going into overtime, which they win half the time. All this means that (again, conditional on getting the second touchdown) the chance of winning the game rises to .625. Using the actual base-rates of 2-point and 1-point conversions, Morris (2016) concludes that the decision to go for two after a touchdown when trailing by 14 late in the game should be a no-brainer. But coaches essentially never get this no-brainer right. Morris reports that he can only find two cases where coaches did the right thing, once in 2001 and another in 1994! Sudden setback aversion is powerful.

Moving from football to basketball, imagine that you're the coach of a professional team and your star player picks up his second personal foul early in the first quarter. Knowing that if he picks up 6 fouls he will be disqualified from playing any further, do you take him out of the game or continue to let him play? Conventional wisdom is to be conservative and take the player out of the game for the remainder of the quarter. And if the player returns to the game to start the second quarter and quickly picks up another foul, coaches almost always take him out again, with the result that players in foul trouble can sit out nearly half of the game. The setback involved in having your star player pick up additional fouls and possibly foul out of the game looms large, leading coaches to be conservative. Even if the coach is personally inclined to take a risk and keep the player in the game, it's all too easy to anticipate what the fans and sportswriters will say if the team loses a close game with its star player on the bench at the end of the game because he has fouled out.

Note how costly this is. A worst-case scenario is that the player stays in the game and picks up three additional fouls in the first half (extremely unlikely) and misses the entire second half. Not good. But by sitting the player down, the coach *guarantees* that the player will be unavailable for an extended length of time. The last five seasons of data from the NBA highlights how rare it is to foul out and suggests it is probably unwise to bench your best players to protect against that unlikely possibility. Out of all the players who accumulated at least three fouls in the first 18 minutes of a game, nearly 70% finished that game with only three or four total fouls, and a mere 5% fouled out.

Our analysis and investigation of SDA has focused on sports for several reasons. First, these sorts of decisions—dealing with a player in foul trouble, deciding whether to punt or go for a first down, etc.—occur frequently and so coaches have many opportunities to "get it right" and recognize which choices maximize their chances of winning. A failure to maximize here, then, says something about the psychology of the decision maker and can't be sloughed off as a result of insufficient opportunities to learn. Second, there is a lot at stake in sports decisions and coaches have every incentive to get it right. Coaches in professional sports lose their jobs a lot more often than other high level managers do, and they generally do so for one reason that better decision making could combat—they don't win often enough. Finally, the most important outcomes in sports are entirely objective—shots are made or missed, players cross the goal line or not, games are won or lost. As a result, sports decisions can be evaluated objectively, allowing one to ascertain whether decisions meet the criteria of rational choice or whether they are subject to systematic bias.

Although these reasons have led us to focus on sports, SDA can be seen in other walks of life. In Study 3, for example, we demonstrated SDA in a military situation where "sudden-death" entails the literal loss of life. We suspect that SDA is at play in a great many other domains as well. Managers in large organizations, for example, are often criticized for being too risk-averse (Kahneman & Lovallo, 1993; Koller, Lovallo, & Williams, 2012). Indeed, managers' perceptions of risk have been shown to focus primarily on down-side risk and worst-case-scenarios, often failing to incorporate upside potential or even the likelihood of various good and bad outcomes (March & Shapira, 1987). If managers are especially likely to focus on the near-term downside when deciding under uncertainty, they may be susceptible to sudden setback aversion – avoiding a potential setback even when a given strategy offers better long-term odds of success. For example, if mid-level managers were given a choice of two variations of the same project (Plan X, which is projected to deliver higher returns, but with an increased chance of losing the entire investment in the first year vs. Plan Y, which is projected to have more modest returns, but the investment is divided into stages such that there is a smaller risk of losing the investment right away), we suspect that many managers would choose Plan Y—even if their stated goal is to maximize expected returns. We suspect that managers would often opt for the inferior investment for the same three reasons we outlined earlier: a myopic focus on the immediate loss, a belief that the immediate loss would be especially likely if they choose Plan X when another "safer" option was available, and a concern over being blamed more by others and losing their job if Plan X failed. Indeed, sudden setback aversion may help explain why certain companies –like Blockbuster or Kodak[20] – maintained a strategy where a slow death seemed nearly inevitable (at least in hindsight) rather than pursue a strategy that would increase their overall odds of success, but at the risk of more immediate failure.

An aversion to sudden death (or a sudden setback) may also help explain why politicians and celebrities engage in elaborate cover-ups that end up costing them more than the price they would have paid for their original misdeeds. Rather than admit a mistake and accept immediate scorn and punishment, people often pursue a drawn-out cover-up strategy with the goal of avoiding a sudden blow to their reputation. Many times, it is the evidence trail left by the cover-up that arouses suspicion and verifies the original misdeed, but now the person is charged with both the misdeed and the cover-up. Consider the Watergate scandal. If the White House had owned up right away to authorizing a break-in, the political costs would have been significant, but Richard Nixon would almost certainly have been able to stay in office. Of the three mechanisms

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[20] It is worth noting that Kodak invented the first digital camera.
https://lens.blogs.nytimes.com/2015/08/12/kodaks-first-digital-moment/?_r=0

we outlined as contributing to SDA, we suspect that myopia is most likely to play a role in people's reluctance to accept an immediate hit to their reputations even when taking such a hit offers a better chance of preserving most of their good name in the long-run.

Beyond SDA, there are many other reasons that people delay decisions (Anderson, 2003; Bastardi & Shafir, 1998), put off negative experiences (Armfield, Stewart, & Spencer, 2007; Chapman, 1996; Estle, Green, Myerson, & Holt, 2006; Thaler, 1981), or avoid information in order to escape having to confront negative prospects or the need to make a difficult decision (Golman, Hagmann, & Loewenstein, in press; Howell & Sheppard, 2013; Karlsson, Loewenstein, & Seppi, 2009; Oster, Shoulson, & Dorsey, 2013; Simpson, Ickes, & Blackstone, 1995; Sweeny, Melnyk, Miller, & Shepperd, 2010). Note that although SDA delays the outcome of one's decision (and hence the prospect of loss), the decision itself cannot be delayed. In addition, although the delayed option in SDA receives less attention than the immediate option, this occurs whether or not it is close or distant in time. Nevertheless, some of the psychology involved in these situations overlaps with the psychology underlying SDA. For example, people avoid the dentist when they expect it to be especially painful, even though they expect it to be most painful when they are most in need of a dentist (Armfield, Stewart, & Spencer, 2007). By narrowly focusing on the prospect of immediate pain, patients can end up putting off medical procedures that would improve their health.

One might wonder how to square SDA (and other instances in which people put off negative experiences) with those occasions in which people try to get negative experiences over with quickly. Because dread is by its very nature unpleasant, people often elect to expedite – rather than delay – a negative experience (Berns et al., 2006; Loewenstein, 1987). One key difference is that people tend to expedite *inevitable* negative events, whereas in SDA we find that people prefer to avoid fast strategies where loss is likely, but not inevitable. If a coach could see into the future and know with certainty that his team was going to lose, he may elect to get the loss over with quickly in regulation rather than delay the inevitable loss in overtime. But when the outcome is uncertain, SDA is common.

Conclusion

Even when a fast strategy provides better odds of success, people prefer a slower alternative that minimizes the chance of immediate defeat. SDA occurs because people narrowly focus on the possibility of immediate defeat and believe immediate defeat is especially likely when other “safer” strategies are available. We suggest that whether you are a professional coach, a mid-level manager, or a player, politician, or patient, an aversion to sudden death can lead you to feel that a strategy with better odds is riskier, and thus give rise to suboptimal decision-making across a host of important contexts. Although the dictum that wise decision makers should “live to fight another day” has merit in a great many circumstances, we have identified an important class of situations in which following this dictum undermines the decision maker’s best interests.

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Table 1.

Expected values of a generic sudden-death aversion example with increasing levels of loss aversion. The probability of winning with the fast strategy is .33. The probability of advancing from the first stage of the slow strategy is .50. The probability of winning in the second stage of the slow strategy is .50. A win has a value of 1.0 and getting to the second stage has a value of 0.0. The loss aversion coefficient is -1.0 when there is no loss aversion, -2.5 when there is the standard level of loss aversion, and -4.0 when there is extreme loss aversion. In the myopia column, the first stage of the slow strategy is considered in isolation. In the portfolio column, the two stages of the slow strategy are considered concurrently. For each decision, the strategy with the highest expected value is shaded. Note that when the decision is framed broadly, people will choose the fast strategy. When they consider the first stage in isolation, they will choose the fast strategy if there is no loss aversion, but the slow strategy if they are myopic and loss averse.

	Strategy	Myopia		Portfolio	
No Loss Aversion	Fast	.33(1.0) + .67(-1.0)	= -0.33	.33(1.0) + .67(-1.0)	= -0.33
	Slow	.50(0.0) + .50(-1.0)	= -0.50	.50(.50(1.0) + .50(-1.0)) + .50(-1.0)	= -0.50
Loss Aversion	Fast	.33(1.0) + .67(-2.5)	= -1.33	.33(1.0) + .67(-2.5)	= -1.33
	Slow	.50(0.0) + .50(-2.5)	= -1.25	.50(.50(1.0) + .50(-2.5)) + .50(-2.5)	= -1.63
Extreme Loss Aversion	Fast	.33(1.0) + .67(-4.0)	= -2.33	.33(1.0) + .67(-4.0)	= -2.33
	Slow	.50(0.0) + .50(-4.0)	= -2.00	.50(.50(1.0) + .50(-4.0)) + .50(-4.0)	= -2.75

Table 2.

Success rate of NFL teams choosing to go for the extra point after scoring a touchdown when trailing by seven points near the end of the game. Note that each row includes the games from the rows below it. These data come from games that met the inclusion criteria from the 2004 to the 2013 seasons.

Time Remaining	Opportunities to go for two points	Extra-point attempts	Wins when extra point was attempted	% Choosing extra point	Winning % when choosing extra point
<= 3 minutes	47	42	17	89.4	40.5
<= 2 minutes	41	36	14	87.8	38.9
<= 1 minute	29	24	8	82.8	33.3
<= 30 seconds	24	20	6	83.3	30.0

Table 3.

Percentage of time home and visiting teams opted for a 3-point shot with various amounts of time left in the game during the final 24 seconds. Note that each row includes the shots from the rows below it. The data come from 778 shots that met the inclusion criteria from the 2011-12 to the 2015-16 seasons.

Time Remaining	n	Home Team	Visitors	Total
<= 24 seconds	778	28.5	29.4	29.9
<= 20 seconds	705	28.3	31.1	29.6
<= 16 seconds	637	29.2	32.6	30.8
<= 12 seconds	560	30.1	32.8	31.4
<= 8 seconds	469	33.3	37.7	35.4
<= 4 seconds	329	37.7	41.6	39.5

Table 4.

The probability of winning the game when a team trailing by 2 points attempts a 2-point or 3-point shot at various moments from the end of the game, by home and visiting team. Note that each row includes the shots from the rows below it.

	Home Team			Visitors			Total		
T Remaining	P(win|2pt)	P(win|3pt)	diff	P(win|2pt)	P(win|3pt)	diff	P(win|2pt)	P(win|3pt)	diff
<= 24 seconds	15.8	19.2	3.4	13.0	15.1	2.1	14.5	17.3	2.8
<= 20 seconds	16.2	20.8	4.5	13.0	15.4	2.4	14.7	18.1	3.3
<= 16 seconds	16.9	20.2	4.2	12.8	15.3	2.5	14.5	17.8	3.2
<= 12 seconds	15.3	21.3	6.1	12.2	14.8	2.6	13.8	18.1	4.2
<= 8 seconds	16.9	20.5	3.6	12.4	14.5	2.0	14.9	17.5	2.6
<= 4 seconds	14.7	19.7	5.0	12.2	15.6	3.4	13.6	17.7	4.1

Appendix A

You’re in charge of a squad of 6 marines, trapped in the Afghan city of Gardez, taking heavy fire from Taliban fighters. Because of where you are in the city, air support is not possible and you must try to get out of harm’s way on your own. You can’t stay where you are. After discussing your situation with intelligence officers at Bagram air field, you have two options. (1) You can try to fight your way east, through the old part of the city, to the foothills, where you can join up with a much larger group of marines and, if you succeed, you and your soldiers will be safe. Because of the layout of the old city and the number of Taliban fighters believed to be located there, it’s estimated that you have a 50% chance of getting to safety. (2) You can try to fight your way west, to the river, and once there you can try to coordinate with another unit in the area. If you manage to reach the other unit, your combined forces would then attempt to move 7 miles along the river, getting past several groups of Taliban fighters thought to be in the area. Once you’ve negotiated those seven miles you can call in air support and you’ll be home free. Bagram estimates that you and your soldiers have a 80% chance of reaching the river safely. If you reach the river safely, you have a 60% chance of safely moving the 7 miles along the river to the point where you can call in air support.

If you were the commanding officer in this situation, which option would you choose?

____ Fight our way east, through the old city, with a 50% chance of getting home safely

____ Fight our way west, with a 80% chance of reaching the river and a 60% chance of safely traveling the 7 miles down the river to safety

Appendix B

Recently, an NFL team had the ball on their own 35 yard line, trailing by **7/8** points, with a minute and a half to go. After converting a couple of crucial 3rd down plays, they scored a touchdown with 12 seconds to go. They then attempted a 2-point conversion to try to **win the game/tie the game**.

Now imagine that you were watching an important game where **a typical NFL team/your favorite NFL team** was facing this exact situation. Imagine that **this/your** team had scored a touchdown and was preparing to attempt a 2-point conversion to try to **win the game/tie the game.**

What do you think your team's chances of success would be in this situation? That is, on all occasions your team might try this—at the end of the game when your team goes for the 2-point conversion to **win the game/tie the game**—what percentage of the time do you believe they will succeed?

In the space below, enter the percentage of time you believe a **typical/your favorite** NFL team will succeed in converting a 2-point conversion to **win/tie** at the end of the game:

_____