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Biased perceptions about momentum: Do comeback teams have higher chances to win in basketball overtimes?

Elia Morgulev*[†‡] Alisa Voslinsky[§¶] Ofer H. Azar[§‖] Michael Bar-Eli[§‡]

Abstract

Momentum is often cited in the media and in other sources as an important factor in performance over time in business, politics, sports and other areas. Yet, academic research on whether momentum actually exists is mixed. This study aims to assess momentum perceptions in a context in which momentum could be relevant, but where empirical data have shown that no momentum exists. In particular, we take the scenario of a basketball game that is tied at the end of regulation time. We designed questionnaires where one of the teams closed a moderate or a large score gap during the last few minutes of the fourth quarter (and in a control treatment, the score was balanced during these minutes). In the first study, 107 fans and 73 practitioners answered these questionnaires. Then, in the second study, 250 additional respondents completed questionnaires containing the same game scenarios but with additional "opposite-framing" versions and a set of questions regarding the reasons for momentum-based beliefs. The respondents also answered several questions about their level of knowledge and interest in basketball, which allowed us to categorize them to fans and laymen. The responses revealed that coming back into the game by reducing a significant score gap during the final minutes of regular time was perceived to increase the teams' chances to win in overtime (which can be interpreted as a positive momentum). Fans exhibit stronger momentum beliefs compared to laymen. Overall, respondents' perceptions contradict the existing empirical evidence that shows that the comeback team does not have higher chances to win the game in overtime. We discuss possible reasons for the discrepancy between the perceptions we observed and the empirical data.

Keywords: success breeds success, momentum, basketball, judgment, perceptions

1 Introduction

Briki (2017) indicates that athletes, coaches, spectators and pundits employ the notion of momentum to comment on sport events, to explain behaviors and situations, and to come up with predictions on the basis of past and/or ongoing performance. But do the empirical data support the success-breeds-success spiral, in which experienced success generates ongoing momentum that boosts subsequent performance? More than four decades of ample scientific effort have provided little supportive evidence thus far.

Notable examples of such evidence include an experiment where bogus bicycle race was manipulated to create a situation where the participant was coming from behind to tie an opponent. Results of this experiment showed that coming from behind elicited changes in perceived momentum, which in turn was associated with a boost in performance (Perreault, Vallerand, Montgomery & Provencher, 1998). Elaborating on the experimental approach, Den Hartigh, Gernigon, Van Yperen, Marin and Van Geert (2014) varied positive and negative momentum in virtual rowing race. Rowing pairs had to compete against a virtual opponent on ergometers, while a screen in front of the team manipulated the race so that the team's rowing avatar gradually progressed (positive momentum) or regressed (negative momentum) relative to the opponent. Positive and negative shifts in collective efficacy and task cohesion were detected under progression and regression setting, respectively. The authors suggested that those shifts indicate the experience of positive and negative momentum.

Exploring perception of momentum, participants in Markman and Guenther's (2007) study were shown two variations of a scenario (momentum condition and steady condition) in which a protagonist was attempting to complete two tasks in a row. The participants were asked to indicate how much

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*Corresponding author: Department of Business Administration, Guilford Glazer Faculty of Business and Management, Ben-Gurion University of the Negev, Beer-Sheva, Israel. Email: eliamorgulev@yahoo.com.

[†]Kaye Academic College of Education, Beer-Sheva, Israel.

[‡]The Academic College of Physical Education and Sport Sciences, Wingate Institute, Israel.

[§]Department of Business Administration, Guilford Glazer Faculty of Business and Management, Ben-Gurion University of the Negev, Beer-Sheva, Israel.

[¶]Department of Industrial Engineering and Management, Sami Shamoon Academic College of Engineering, Ashdod, Israel.

[‖]Laboratory of Economic Behavior of the Center of Psycho-Economic Research, Povolzhsky Institute of Administration named after P.A. Stolypin – branch of RANEPA, Russia.

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momentum the protagonist had going into the second task and how much they thought momentum from the first task would help the protagonist to complete the second task. The results showed that participants believe that if more momentum accumulates during the completion of a task, more residual momentum should carry over to a subsequent task.

In regard to such momentum-based beliefs, Maglio and Polman (2016) have claimed that probability estimates that were revised upwards indicate that a target outcome is coming closer, suggesting that it will eventually occur. That is, when presented with prior trends, people will engage in a process of mental simulation to consider not only where a current value lies, but where it might reasonably be headed.

As for field evidence, Cohen-Zada, Krumer and Shtudiner (2017) took advantage of the unique setting in judo where both contestants reach the bronze medal fight after winning all their previous fights except for one. The first contestant reaches this fight after winning his last fight but losing his second-to-last one, whereas his opponent reaches the same bronze medal fight after losing his last fight but winning his second-to-last one.[1] Thus, the authors claim that the first contestant has a clear momentum advantage. Results of real judo tournaments showed that having such psychological advantage significantly increases the winning probability in men's fights (by around 20 percentage points).

Page and Coates (2017) reported a similar effect in a large sample of closely fought matches in tennis. They found that male winners of a closely fought tie-break had about 60% chance of winning the second set, whereas this positive effect for winners was absent for female winners. In both studies physiological reaction (winner effect) was proposed as the underlying mechanism behind the observed success-breeds-success effect.

In relation to behaviors that are reinforced by momentum, Attali (2013) reported that even a single successful shot in basketball was found to be sufficient in increasing the probability that the player will choose to take the next team's shot and increase the average distance from which this next shot is taken. Such a behavioral change suggests that athletes are quick to embrace momentum, and operate on the basis of these perceptions (Iso-Ahola & Dotson, 2014). Bocskocsky, Ezekowitz, and Stein (2014) created a comprehensive model of shot difficulty using relevant initial shot conditions. They implemented the model to show that players who have exceeded their expectations in recent shots, then shoot from significantly further away, face tighter defense, and are more likely to take their team's next shot, even when it is a more difficult one. In a similar vein, Csapo, Avugos, Raab and Bar-Eli (2014) conducted a two-phase investigation. In phase one, they examined whether shot distance, type, and angle could serve as proxies for shot difficulty. In phase two, streaks of hits and misses in the performance records of the top 10 scorers of the 2009–2010 NBA (National Basketball Association) regular season were analyzed in order to determine whether streaks have an effect on the three aforementioned variables. The data revealed that players attempted more difficult (easier) shots during hits (misses) streaks along the three dimensions. Such evidence suggests that both attackers and defenders recognize momentum and seem to behave according to the momentum belief. Yet, alongside the reported change in behavior, Csapo and Raab (2014) found that shooting percentages of presumably hot players do not increase and that shooting performance is not related to streakiness. That is, across the 26 players in the study, the accuracy was on average lower during hot streaks (mean: 43.86%) than during cold streaks (mean: 49.17%). This finding accentuates once again the paradox around momentum as a phenomenon that can increase the intensity and the frequency of behaviors rather than create a success-breeds-success effect.

Gauriot and Page (2018) stressed that scoring just before the end of period (first half in football) is perceived to be momentum facilitator, and if that holds true, then for similar scorelines at half-time, the timing of the last score will matter for how the game unfolds in the following period. Gauriot and Page analyzed data from 18,232 football matches and used non-goal shots that landed on the goal posts as counterfactuals to the scoring shots, so the comparison was made between very similar scoring opportunities. They did not find evidence that the timing of a goal at any moment in the first half leads to an advantage in the second half.

Yet, ever since Gilovich, Vallone and Tversky (1985) seminal research, the perception of the "success breeds success" phenomenon, both by performers and spectators, has been documented numerous times. Iso-Ahola and Blanchard (1986) demonstrated a shift in self-perceptions and perceptions of the opponent among competitive racquetball players; the players were questioned during the game break. Burke and Houseworth (1995) elicited momentum perceptions by surveying volleyball players and comparing their responses to structural game dynamics' charts.

Raab, Gula and Gigerenzer (2012) found that players and coaches were not only able to detect momentum, but also to use it in their tactical and strategic decisions. In handball Moesch and Apitzsch (2012) used semi-structured interviews to explore coaches' perceptions of momentum. Redwood-Brown, Sunderland, Minniti and O'Donoghue (2018) investigated elite soccer players' perceptions and experiences of momentum, and conducted interviews and focus groups with elite male football players. In addition, professional male players completed a questionnaire about their experiences of momentum. Scoring and conceding goals were the most frequently reported match variables associated with positive and negative momentum respectively. "Feeling

[1]More specifically, the first contestant loses in the quarterfinal and then wins against one of the other losers of the quarterfinal to get the chance to fight for bronze, while his opponent in the bronze medal fight first wins in the quarterfinal stage but then loses in the semifinal.

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confident", "having a positive attitude" and "being cohesive as a team" were reported as important aspects of positive momentum. Avugos and Bar-Eli (2015) pointed out that it is commonly accepted that perceptions of momentum do exist, and that they shift in response to success or failure.

1.1 Comeback before overtime as a momentum catalyst

Morgulev, Azar and Bar-Eli (2019) identified all the games that went to overtime during 11 seasons in the NBA and examined whether the team that came back to tie the game by the end of fourth quarter indeed won more often in overtime. They found that the comeback team won in 372 of the 742 games in the sample (50.1%) whereas the opposite team won in 370 games (49.9%). This stands even for games where the comeback was dramatic (closing 8 points or more during the last minutes of regulation) and thus presumably should have prompted intense momentum.

The lack of momentum in this situation is surprising, because intuitively one could think that coming from behind should give the team a positive momentum and result in higher chances to win the game in overtime. This leads to an interesting question about momentum perceptions: will basketball fans and practitioners (players, coaches and referees) have this wrong intuition about momentum resulting from coming from behind, or will their experience of watching and participating in numerous games, result in correct beliefs and no perceptions of momentum in this situation? In other words, do experienced subjects still perceive momentum to exist even where it is absent, or do they correctly update their perceptions and they realize there is no momentum?

The current study aims to obtain perceptions about momentum in this situation and to answer the above question. To do so, we study how fans and various basketball practitioners perceive the winning chances of the teams in a situation of playing in overtime after a comeback of one of the teams by the end of fourth quarter. Without a belief in momentum, given that the teams' abilities in the game led to a tie after regulation time, a reasonable expectation should be for equal winning chances of the two teams. However, given the widespread belief in momentum, we hypothesize that respondents evaluate the chances of comeback teams to win in overtime as higher than their opponent's chances. We also hypothesize that the perceptions are affected by the magnitude of the comeback, such that a larger comeback (closing a higher score gap) results in more perceived momentum and then in a higher winning probability of the comeback team than after a smaller comeback.

In addition, we want to learn about the possible reasons for momentum-based beliefs. Therefore, in the second study we added a control group of laymen respondents and asked the respondents to rate their level of agreement with a series of statements such as "The team that comes back from a deficit is more likely to play more energetically."

2 Study 1

2.1 Method

In order to evaluate the prevalence of the belief in the "coming back from behind" effect (positive momentum created after closing a large score gap to tie the game), we used questionnaires presenting different game dynamics at the end of the fourth quarter (see Appendix 1): (1) Team A holds a moderate advantage (8 points) and maintains it until Team B comes back to tie the game towards the end of fourth quarter; (2) the game is balanced without a significant score gap between the teams over the last few minutes of the last quarter, and Team A is just the last one to score and tie the game; and (3) Team A holds a large score advantage (16 points) when Team B comes back to tie the game towards the end of fourth quarter. Scenario (2) was added to serve as a control treatment – the minimal comeback situation. When we refer to the comeback team, this means team B in the moderate and extreme comeback questions but team A in the minimal comeback question.

In the first study we used the Qualtrics online platform to obtain answers to the questionnaires from 107 respondents who defined themselves as fans and 73 additional respondents who presented themselves as former or current practitioners, that is, players, referees, or coaches.

All participants were first shown three detailed score reports from the fourth quarter ending with a tie and representing three degrees of comeback performed: minimal, moderate and extreme. In the second part of the questionnaire, all participants were presented with short textual descriptions of games ending with a tie, again with the same three degrees of comeback. We used the score reports and the textual descriptions to ask the participants two types of questions: (1) which of the teams is more likely to win (a multiple-choice question, including an option of "The teams' chances are equal"); and (2) what are the chances of the two teams to win (probability-prediction question).

In the first version of the questionnaire participants were first shown the score reports and answered the open probability-prediction questions and then moved on to read the textual descriptions scenarios and to answer the multiple-choice questions. In the second version of the questionnaire subjects proceeded in the opposite sequence between multiple-choice and probability-prediction questions: they were shown score reports, answered the multiple-choice questions, and then moved on to the textual scenarios with probability-prediction questions.

We hypothesized that participants would assign higher win probabilities for teams that came back from behind to tie the game. The reason for this hypothesis is that a team

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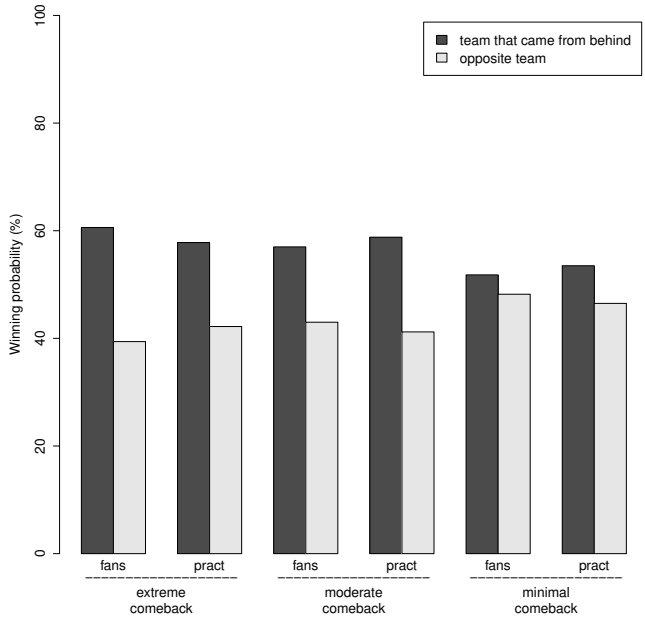

FIGURE 1: Win probabilities assigned by practitioners and fans in textual description probability-prediction questions (Version 2 Part B).

that comes back from behind is supposedly better in the last few minutes and therefore enjoys a positive momentum that may carry over into the time extension. In addition, we hypothesized that participants would be sensitive to differences between game dynamics and in particular perceive a more significant positive momentum (increasing the chances to win in overtime) when the team closed a large score gap compared to teams that erased a moderate score deficit. We also wanted to compare between the predictions of practitioners and fans, to see whether false momentum perceptions may be present only among fans but not among practitioners.

2.2 Results

Altogether 107 fans and 73 practitioners completed the survey. Of those, 33 fans and 26 practitioners answered the first version of the questionnaire whereas the remaining 74 fans and 47 practitioners received the second version. First, we present the responses to the textual scenarios followed by probability-prediction questions. Figure 1 depicts the win probabilities assigned by practitioners and fans to the two teams in the three scenarios.

Analysis of variance showed that the win probabilities assigned to the comeback team are significantly higher than those assigned to the opposite team (F(1,119) = 48.240, p < 0.001). These differences were found to be significant across all the three comeback scenarios (p < 0.001), and they varied across the three comeback scenarios, with significant interaction between the comeback scenario and the team effects (F(2,238) = 9.632, p < 0.001).

TABLE 1: Probabilities assigned in textual description probability-prediction questions (Version 2 Part B).

Comeback scenario	Team	Mean	S.E.	95% C.I.
Minimal	Comeback	52.66	0.71	51.25–54.08
	Opposite	47.33	0.71	45.91–48.75
Moderate	Comeback	57.91	1.28	55.36–60.46
	Opposite	42.20	1.27	39.69–44.71
Extreme	Comeback	59.24	1.75	55.77–62.71
	Opposite	40.76	1.75	37.30–44.22

Group-effect test revealed no significant differences between practitioners and fans (F(1,119) = 0.544, p = 0.462). Additionally, no significant interaction between comeback scenarios and respondents' background (practitioners versus fans) was found (F(2,238) = 1.053, p = 0.351). Consequently, fans and practitioners responses were grouped together as presented in Table 1.

We can learn from the data presented in Table 1 that the probabilities assigned to the comeback team in the minimal comeback scenario are significantly lower than those in the moderate and extreme scenarios given the 95% confidence intervals reported.

Respondents who addressed the score reports version (Version 1 Part A) exhibited similar patterns. The win probabilities assigned to the comeback team were significantly higher than those assigned to the opposite team (F(1,57) = 24.195, p < 0.001). These differences varied across the three comeback scenarios, with significant interaction between the comeback scenario and the team effects (F(2,114) = 11.978, p < 0.001). The differences between win probabilities assigned to the comeback team and the opposite team in the moderate and extreme comeback scenarios were found to be significant (p < 0.001), whereas no significant differences were found in the probabilities assigned in the minimal comeback scenario. A group-effect test revealed no significant differences between practitioners and fans (F(1,57) = 1.474, p = 0.230). Additionally, no significant interaction between comeback scenarios and respondents' background (practitioners versus fans) was found (F(2,114) = 0.528, p = 0.591).

We proceed to analyze the participants' responses in the textual description multiple-choice questions. This section uses the same logic as the first one but includes multiple-choice questions, where respondents were required to choose which of the teams had a higher winning chance.

Figure 2 presents the results of this section. The results show a striking belief that after a moderate or extreme comeback, the comeback team has higher chances to win the game than its opponent. This effect disappears in the min-

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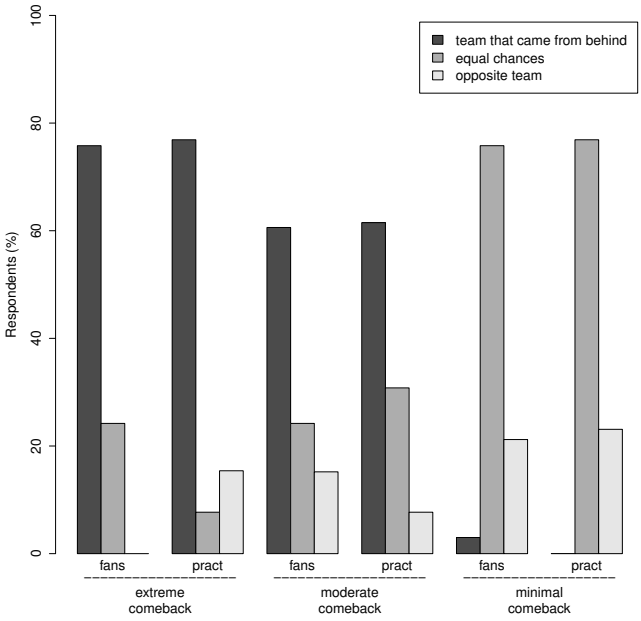

FIGURE 2: Which team is more likely to win the game? Practitioners' and fans' responses in textual description multiple-choice questions (Version 1 Part B).

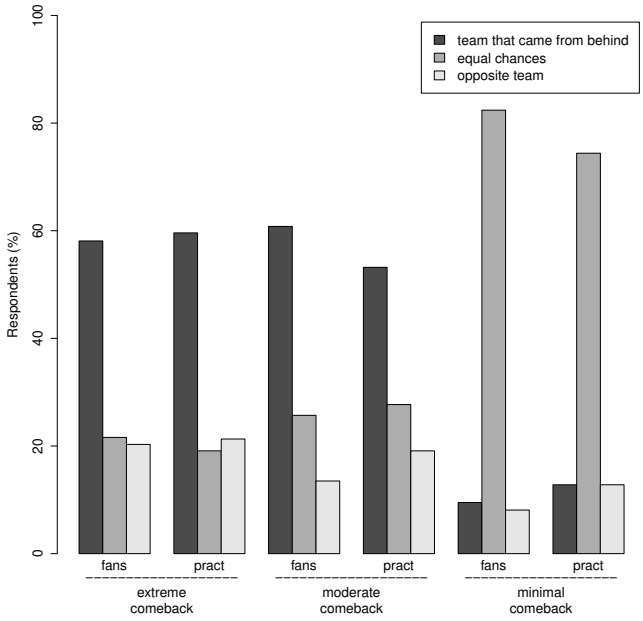

FIGURE 3: Which team is more likely to win the game? Practitioners' and fans' responses in score reports multiple-choice questions (Version 2 Part A).

imal comeback scenario. The number of participants who selected the "equal chances" option decreased dramatically in the extreme and moderate comeback scenarios compared to the minimal comeback scenario. The McNemar test was used to assess whether probabilities assigned were different across the three comeback scenarios, showing a significant difference between the minimal and moderate comeback scenarios (McNemar value (3, N = 59) = 25.925, $p < 0.001$). The difference between the minimal and extreme comeback scenarios was also significant, with McNemar value (3, N = 59) = 29.947 ($p < 0.001$). The difference between the moderate and extreme scenarios was not significant, with McNemar value (3, N = 59) = 4.286 ($p = 0.232$). The differences between the practitioners' and fans' responses were analyzed using a Likelihood Ratio test: minimal comeback (2, N = 59) = 1.188, $p = 0.552$; moderate comeback (2, N = 59) = 0.941, $p = 0.625$; extreme comeback (2, N = 59) = 9.124, $p = 0.010$.

The same procedures were applied for analyzing fans' and practitioners' responses for the score reports version of the multiple-choice questions (Version 2 Part A). Figure 3 summarizes the answers provided.

As Figure 3 shows, the team that came from behind was assigned higher chances to win the game by a large majority in the extreme and moderate comeback scenarios, but not in the minimal comeback scenario. The number of participants who selected the "equal chances" option decreased dramatically in the extreme and moderate comeback scenarios compared to the minimal comeback scenario. The McNemar test was used to assess whether the probabilities assigned were different across the three comeback scenarios. We found a significant difference between the minimal and moderate comeback scenarios (McNemar value (3, N = 121) = 64.946, $p < 0.001$). The difference between the minimal and extreme comeback scenarios was also significant with McNemar value (3, N = 121) = 73.273 ($p < 0.001$). The difference between the moderate and extreme scenarios was not significant, with McNemar value (3, N = 121) = 5.856 ($p = 0.119$).

The differences between practitioners' and fans' responses were analyzed using a Likelihood Ratio test. There were no significant or near significant differences between the two groups of respondents at the .05 significance level: minimal comeback (2, N = 121) = 1.132, $p = 0.568$; moderate comeback (2, N = 121) = 0.903, $p = 0.637$; extreme comeback (2, N = 121) = 0.110, $p = 0.946$.

3 Study 2

3.1 Method

In Study 2 we aimed to learn about the reasons for momentum-based beliefs that we observed in Study 1 and to examine whether changing which team is described in the textual scenarios (the comeback team or its opponent) creates framing effects. We also wanted to study a more general population (not only basketball fans and practitioners) and to analyze how basketball background affects momentum-

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TABLE 2: Overall evaluation of chances to win – probability-prediction questions.

	Mean probability of comeback team	Mean probability of opposite team	Standard Error (it is the same for both means)	*p*-value (2-tailed)
After score reports				
Extreme comeback	45.18	54.82	2.29	0.037
Moderate comeback	45.53	54.47	2.02	0.029
Minimal comeback	49.75	50.25	0.83	0.761
After textual descriptions				
Extreme comeback	59.05	40.95	1.64	0.000
Moderate comeback	53.63	46.37	1.32	0.007
Minimal comeback	51.87	48.13	0.78	0.018

based beliefs. We used again the questionnaires of Study 1 with some additions (Appendix 2). After answering the game scenario questions, respondents also answered questions about their basketball background (question 8, see the last page of Appendix 2). We wanted to ask whether perception of momentum is something that is being "inculcated" into one's mind as one "grows" into the game of basketball. Answers that include a range of values were coded with successive values, for example in response to question 8b about years playing basketball, the answer 6–10 got the value 6, the answer 11–15 got the value 7 and so on. Because the purpose is to evaluate familiarity with basketball, this approach helps to capture the diminishing returns nature of these aspects of familiarity (e.g., one learns much more about basketball by playing one year versus not at all, than by playing one more year after seven years of playing).

To analyze how familiarity with basketball affects the responses we employed three different approaches as robustness checks. One approach was to take only the self-reported level of familiarity (question 8a). Another approach was to sum the answers for the seven sub-questions in question 8 and use this composite variable as a proxy for familiarity with basketball. A third approach was to divide the sample to "Fans" and "Laymen". Fans were defined as respondents who stated that they are at least six on the 1–9 scale of familiarity with the game (question 8a) and in addition either watch a full basketball game on an average year (on television or at an arena) or reported being involved in basketball as a player, referee or coach on amateur or professional level (i.e., in the questions 8b, 8c, 8d, and 8e at least one of the answers is above 0). Respondents who did not satisfy the criteria to be categorized as "Fans" were categorized as "Laymen".

Another aspect that we addressed in Study 2 is framing. In Study 1 we described the end of the fourth quarter from the perspective of the comeback team, for example, "Team B comes back from an eight-point deficit during the final minutes of the game and is able to force an overtime seconds to the end." In Study 2 we used the same wording for half the sample (we refer to it as the regular framing), but for the other half we told the same story from the perspective of the opposite team (the opposite framing), for example "Team A gave up an eight-point lead during the last minutes of the game and was forced into an overtime seconds from the end" (and similarly in the other two questions; see Appendix 2 for more details). We wanted to check if the different framing would produce different perceptions of the comeback effect.

3.2 Overall perception of comeback

We start by examining the overall perception of comeback in the data by considering the responses to the six first questions, at this point aggregating over framing and over basketball background of the respondents. (We will consider these later.) For the probability-prediction questions, we test (using a t-test) whether the probability assigned to the two teams is identical (and report the two-tailed p-value). This is also equivalent to testing whether the probability of the comeback team to win is different from 50%. Table 2 presents the results.

The large difference between the results after score reports and after textual descriptions are very surprising. The textual scenarios describe situations that are equivalent to the score reports, and yet the two types of questions produce completely different results. After textual descriptions, there is a strong belief that the comeback team has a higher probability to win, which is statistically significant in all three comeback scenarios. After score reports, on the other hand, the results are in the opposite direction: the comeback team is given lower chances to win, and this is statistically significant in the extreme and moderate comeback scenarios. Our conjecture for what explains this difference is that the textual description makes the comeback very prominent, since it is a very short scenario with the comeback description at its core. Then people employ their perception that a comeback

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TABLE 3: Overall evaluation of chances to win – multiple-choice questions.

	Mean of ComWin	Standard Error	*p*-value (H_0: ComWin=0.5)
After score reports			
Extreme comeback	0.480	0.043	0.649
Moderate comeback	0.473	0.040	0.501
Minimal comeback	0.434	0.026	0.013
After textual descriptions			
Extreme comeback	0.795	0.032	0.000
Moderate comeback	0.721	0.031	0.000
Minimal comeback	0.537	0.020	0.072

yields momentum and express beliefs that give the comeback team a higher probability to win. On the other hand, when the subject sees a table with the score development, the comeback is less observable. It is somewhat obscured by the large amount of data in the score table. Moreover, in the moderate and extreme comeback scenarios of the score report questions, the comeback team has a lower score almost throughout the score table (see Appendix 1). This may create the impression that the comeback team is a weaker team (even though at the end it was able to tie the game) and lead respondents to assign it lower chances to win.

For the multiple-choice questions we define a variable that captures whether the comeback team is the one chosen as being more likely to win. We denote it by ComWin and it is equal to 1 if the comeback team was chosen, 0 if the opposite team was chosen, and 0.5 if the respondent chose that the two teams have equal chances to win. We test (using a t-test) whether the null hypothesis that ComWin is equal to 0.5 can be rejected. Table 3 presents the results.

The results of the multiple-choice questions, presented in Table 3, are to a large extent similar to those of the probability-prediction questions in Table 2. After textual descriptions, there is a strong belief in the superior chances of the comeback team to win, consistent with positive momentum (in the minimal comeback scenario this is much weaker and not statistically significant but recall that this is not a real comeback scenario but rather a control treatment, as the score was described to be balanced over the last minutes). As in Table 2, here also there is no belief in higher chances of the comeback team to win after score reports. However, the results differ from Table 2 in the exact pattern following score reports; here in the extreme and moderate comebacks the chances of the teams are roughly equal (in Table 2 the comeback team was given lower chances to win) and in the minimal comeback the comeback team is given lower chances (in Table 2 it was about equal chances).

3.3 Effect of framing and background in basketball on the perception of comeback

We proceed to examine how the framing and the background in basketball affect the perception of momentum. Table 4 presents the summary statistics of the responses to the basketball background questions.

We can see in Table 4 that the laymen respondents possess little knowledge about basketball (3.43 out of 9), they had almost no experience in the game on either amateur or professional level, they watch on average about one game per year, almost never attend games and exhibit very little interest in basketball highlights or articles. We can also see that the characteristics of fans differ significantly from those of laymen (except for Years of experience as professional, which is positive for only 4 respondents in the sample).

We proceed to analyze the effect of basketball background and framing. In order to include in the same regressions all versions of the questionnaire and yet to control for whether a certain question followed score reports or textual scenarios, we define the variable ScPr. ScPr is equal to 1 if the probability-prediction questions followed the score reports (versions 1, 3) and 0 if the probability-prediction questions followed the textual scenarios (versions 2, 4). The variable OpFram is equal to 1 in the opposite-framing textual scenarios, where the perspective of the team that lost the lead is taken (versions 3, 4) and to 0 in the regular framing that uses the perspective of the comeback team (versions 1, 2).

We use regressions that analyze the predictors of the probability-prediction questions. We have three sets of regressions, for the extreme comeback, the moderate comeback, and the minimal comeback. In each set the dependent variable is the probability that the comeback team wins in the corresponding scenario. In addition to analyzing three different dependent variables that capture the three scenarios, for robustness we also examine three different ways to measure familiarity with basketball (as explained earlier): the self-reported familiarity level with basketball (question 8a, denoted as Familiar); the combined score for questions 8a-8g, denoted as BBS (Basketball Background Score); and our categorization of fans versus laymen (a dummy variable Fan). Due to the correlation between these three measures, and in order to provide a robustness check, each regression includes only one of the three measures, so in total we report nine regressions. It is important to remember when considering the (unstandardized) regression coefficients that these three variables have completely different ranges. Familiarity ranges between 1–9 (mean of 5.29), BBS ranges between 1–66 (the quartile values are 5, 11, 29, and the mean is 17.99), and Fan is either 0 or 1 (mean of 0.49). Table 5 presents the results of the nine regressions analyzing the probability-prediction questions.

Table 5 shows that in the minimal comeback scenario, no variable is statistically significant at the 5% level, which

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TABLE 4: Summary statistics - questions about level of engagement in basketball. (The *p*-value reported in the right column is the two-tailed *p*-value of the t-test for difference in means between laymen and fans.)

	Overall Mean (N=250)	Std. Dev.	Laymen Mean (N=127)	Fans Mean (N=123)	*p*-value Laymen vs. Fans
Level of familiarity (1-9)	5.29	2.33	3.43	7.21	0.000
Years of experience as amateur	1.71	2.70	0.29	3.18	0.000
Years of experience as professional	0.05	0.48	0.00	0.11	0.079
Full games watched on TV in a year	4.14	4.69	1.32	7.05	0.000
Games attended in a year	0.89	1.84	0.25	1.54	0.000
Highlights watched in a month	3.13	4.40	0.70	5.63	0.000
Read about basketball in a month	2.78	4.29	0.71	4.93	0.000
BBS: Basketball background score (sum of answers to 8a-8g)	17.99	16.75	6.70	29.65	0.000

TABLE 5: Regressions analyzing the probability-prediction questions. The first line is the comeback type. The dependent variable is the probability assigned to the comeback team to win. The *p*-values refer to the coefficients of the variable in the line above. All regressions are based on the entire sample of 250 respondents.

	Comeback								
Indep. Var.	Extreme			Moderate			Minimal		
OpFram	3.700	3.775	3.599	1.769	1.751	1.688	0.643	0.703	0.670
p-value	0.178	0.170	0.194	0.457	0.465	0.481	0.573	0.536	0.555
ScPr	−14.136	−14.038	−13.836	−8.283	−8.185	−8.090	−2.147	−2.164	−2.115
p-value	0.000	0.000	0.000	0.001	0.001	0.001	0.061	0.057	0.063
Familiar	1.889			1.218			0.196		
p-value	0.002			0.018			0.425		
BBS		0.256			0.121			0.062	
p-value		0.002			0.093			0.071	
Fan			6.504			3.693			1.871
p-value			0.019			0.124			0.100

is a reasonable outcome given that this was intended to be a control treatment and it does not represent a substantial comeback but rather a balanced game where one team happens to be the one that makes the final basket that ties the game. In the moderate and extreme comeback scenarios, we can see several patterns. First, the variable ScPr is always negative and highly statistically significant (with *p*-value 0.000–0.001). This means that the probabilities of winning for the comeback team are perceived as much higher following textual scenarios than following score report tables, a finding that we also discussed earlier. Second, the three alternative variables that capture familiarity with basketball are always positive, always statistically significant in the extreme comeback scenario (with *p*-values < 0.02) and sometimes statistically significant in the moderate comeback scenario. That is, people who are more familiar with basketball tend to estimate the comeback team chances to win as higher than those less familiar with basketball. This is consistent with the idea that basketball commentary (e.g., on TV or in print) promotes the perception that making a comeback creates positive momentum, and therefore those who are more involved in basketball, watch more games or highlights and read more about it, are more exposed to this belief in momentum and therefore also express it more in their own answers in the survey.

The variable OpFram is always positive, but never statistically significant (even at the 10% level). This means that the wording that talks about the team that lost its lead tends

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to increase the win probability assigned to the comeback team compared to the wording that talks about the comeback team. It should be remembered, however, that OpFram is relevant only when the probability-prediction questions follow the textual scenarios (because in the score tables there is no opposite framing), which happens in about half the sample, so the coefficients we see underestimate the true magnitude of OpFram. To overcome this limitation, we also ran regressions that are similar to the ones reported in Table 5 but apply only to observations with ScPr = 0, in which the opposite framing is meaningful because the probability-prediction questions follow the textual scenarios (and the variable ScPr is obviously omitted from the regression). The sample size is then 128. The resulting coefficient of OpFram in the regression with Familiar is 5.786 (p = 0.074); with BBS it is 5.69 (p = 0.084); and with Fan it is 5.277 (p = 0.111). That is, on the one hand the coefficient is not statistically significant at the 5% level (but it is significant at the 10% level in two cases). On the other hand, the findings are consistent across the three variables and the coefficient is large. Notice that a coefficient of 5.7 means that the probability given to the comeback team increases by 5.7%, which increases the win-probability difference between the two teams by 11.4% (because the two probabilities sum to 100% and therefore any increase in one also reduces the other by the same amount). So, while we cannot unequivocally conclude that the opposite framing has an effect, there is some non-conclusive evidence that talking about the team that lost its lead reinforces the belief in the superior chances of the comeback team. In the moderate comeback scenario we can see that the coefficients of OpFram in Table 5 are lower than in the extreme comeback (and with higher p-values) and the entire effect of the scenario is much lower (e.g., in Table 2 we see after textual descriptions 53.63 for moderate comeback versus 59.05 for extreme comeback). Therefore we expect to see a weak effect of OpFram in the regressions that are limited to ScPr = 0, and indeed the coefficients of OpFram in the three regressions of the moderate comeback are small (between 0.453-0.928), with p-values of 0.729–0.866. In the minimal comeback regressions these coefficients are negative and not statistically significant.

3.4 Reasons for momentum-based beliefs

We used the question that followed the textual description scenario (recall that in some versions it is a probability-prediction question and in the other versions it is a multiple-choice question) in the case of an extreme comeback as a criterion to identify respondents who believe in the comeback effect. Respondents who indicated that the comeback team has higher chances to win in overtime were categorized as momentum believers whereas respondents who stated that the chances are equal or that the comeback team's chances to win are lower were denoted as non-believers in momentum. We asked the respondents to rate their level of agreement on a 1–9 scale (from strongly disagree to strongly agree) with 13 statements describing various effects that could be caused either by a comeback or by giving up the lead.[2] Additionally, we asked the respondents to rate the relevance (from 1 — not relevant, to 5 — highly relevant) of each statement to their decisions on the teams' chances to win in overtime (see Appendix 2). Table 6 presents the summary statistics and compares momentum believers and non-believers. Notice that most statements represent an advantage for the comeback team, except for statements i, j, and k, which are written in italics to designate this difference.

When we consider the combined responses of all respondents, the three statements that have the highest average score (all with an average above 7 on the 1–9 scale) are c, e, and m (The team that comes back from a deficit is more likely to play more aggressively by "playing to win"; "The team that comes back from a deficit is more likely to play more energetically"; "A large comeback leads to intense momentum that energizes the comeback team in the overtime"). The statements with the least support (all with an average between 4–5) include h (The players of the team that comes back from a deficit are probably less tired) and the three statements that are against the comeback team, i, j, and k ("The team that comes back from a deficit has probably made many fouls during the comeback, giving it a disadvantage in the overtime"; "The team that comes back from a deficit has probably exhausted their mental and physical resources during the comeback"; "The team that comes back from a deficit is more likely to experience a psychological hype (sort of relief), which would hinder their ability to mobilize themselves in the overtime"). The result that the statements against the comeback team are the ones with the least support (in addition to statement h about being tired) is in line with the general belief in momentum of the comeback team that we observed in the first part of the questionnaire.

When we compare the responses of momentum believers and non-believers (based on responses to the extreme comeback scenario, as explained above), we observe differences that are in line with what we expect, and usually these differences are also statistically significant. In all ten statements that are in favor of the comeback team (a-h, l-m), including the responses to the relevance questions, the responses of the momentum believers are higher on average than those of the non-believers. In the three statements that are against the comeback team (i, j, k) and the associated relevance questions, the responses of the momentum believers are lower on average than those of the non-believers. That is, we see consistency between the different parts of the questionnaire: respondents who agree more with reasons why the comeback team may have an advantage, and agree less with reasons why

[2]Responses of "I don't know" where coded for the analysis as mid-range, i.e., received a value of 5.

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TABLE 6: Reasons for momentum-based beliefs. (*p*-values are 1-tailed.)

	Overall Mean (N=250)	Std. Dev.	Non-Believers Mean (n=80)	Believers Mean (n=170)	Believers Mean - Non-Believers Mean	*p*-value Believers vs. Non-Believers
a. Comeback team plays better in overtime than during the game	6.63	1.63	5.41	7.20	1.79	0.000
Relevance	3.78	1.09	3.26	4.02	0.76	0.000
b. Team that gave up the lead plays worse in overtime than during the game	6.21	1.82	5.29	6.64	1.35	0.000
Relevance	3.48	1.05	3.14	3.64	0.50	0.000
c. Comeback team plays more aggressively by playing to win	7.16	1.53	6.49	7.48	0.99	0.000
Relevance	3.61	1.07	3.24	3.79	0.55	0.000
d. Team that gave up the lead plays more conservatively by playing not to lose	5.46	2.03	5.19	5.59	0.40	0.073
Relevance	2.91	1.15	2.73	2.99	0.27	0.042
e. Comeback team plays more energetically	7.08	1.67	6.16	7.51	1.35	0.000
Relevance	3.62	1.09	3.20	3.82	0.62	0.000
f. Comeback team plays more confidently	6.80	1.84	5.90	7.22	1.32	0.000
Relevance	3.56	1.09	3.05	3.81	0.76	0.000
g. Team that gave up the lead plays with lack of confidence	6.25	2.00	5.40	6.65	1.25	0.000
Relevance	3.43	1.19	3.03	3.62	0.59	0.000
h. Comeback team players are less tired	4.13	1.94	3.90	4.24	0.34	0.097
Relevance	2.61	1.19	2.50	2.66	0.16	0.163
i. Comeback team players made many fouls during the comeback	*4.34*	*1.82*	*4.66*	*4.19*	*-0.47*	*0.029*
Relevance	*2.26*	*1.08*	*2.50*	*2.15*	*-0.35*	*0.009*
j. Comeback team exhausted itself during the comeback	*4.46*	*1.94*	*5.04*	*4.18*	*-0.86*	*0.001*
Relevance	*2.83*	*1.14*	*2.94*	*2.78*	*-0.16*	*0.149*
k. Comeback team experience hype and relief after the comeback	*4.62*	*2.19*	*4.93*	*4.48*	*-0.44*	*0.068*
Relevance	*2.68*	*1.21*	*2.69*	*2.68*	*-0.01*	*0.488*
l. Last-seconds equalizer mentally breaks the team that gave up the lead	5.79	1.77	5.30	6.02	0.72	0.001
Relevance	3.09	1.12	2.85	3.20	0.35	0.010
m. Large comeback leads to momentum that energizes the team in overtime	7.38	1.59	6.44	7.82	1.38	0.000
Relevance	3.87	1.06	3.24	4.16	0.93	0.000

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it may have a disadvantage, also tend to assign the comeback team higher chances to win.

4 Discussion and Conclusions

Momentum is considered by many as an important factor in performance over time in business, politics, sports and other areas, despite mixed findings in the academic literature. We aim to evaluate momentum perceptions in the context of basketball games that go to an overtime after one team closed a substantial gap. This is a context in which momentum could be relevant, but where empirical data have shown that no momentum exists; the comeback team's empirical chances to win are not higher than its opponent's chances. We used questionnaires where one of the teams closed a moderate or a large score gap during the last few minutes of the fourth quarter (and in a control treatment, the score was balanced during these minutes). In the first study, 107 fans and 73 current and former practitioners (players, coaches, and referees) answered these questionnaires. In the second study, 250 additional respondents completed questionnaires containing the same game scenarios but with additional versions that differ in their framing (the comeback team's perspective is replaced with its opponent's perspective). In addition, the second study includes questions regarding possible reasons why the comeback team or its opponent may have an advantage. The respondents also answered several questions about their level of knowledge and interest in basketball, which allowed us to categorize them to fans and laymen.

The results of the first study show across different elicitation methods (multiple choice or assigning a probability) and different description methods (textual description or numerical development of the score) a strong and significant belief of both fans and practitioners that the comeback team has higher chances to win the game, in the case of a moderate or an extreme comeback.

This strong perception of a positive momentum after a comeback seems intuitive, but it is surprising given that the respondents were fans and practitioners who watched or participated in numerous basketball games, and the reality is that there is no positive momentum for the comeback team and its chances to win are the same as its opponent chances (Morgulev et al., 2019). Practitioners were not more accurate in their perceptions than fans.

In the second study we aimed to shed more light on the reasons for momentum-based beliefs. First, we recruited respondents from a general population (not only basketball fans and practitioners as in the first study), some of them with very little prior knowledge about basketball. We hypothesized that because notions of momentum became an integral part of basketball jargon and perception of momentum is a common wisdom, basketball fans may be more prone than laymen to incorrect beliefs in positive momentum due to a comeback. Our results affirmed this prediction, which is in line with MacMahon, Köppen and Raab (2014), who showed that experience with a specific sport is positively correlated with the perception of momentum. Another interesting finding is the difference in interpretation of textual descriptions and score reports. As reported in Tables 2 and 3, respondents exhibited momentum-based beliefs only after reading textual descriptions of the comeback. Such descriptions bring to life an image of a team that found itself in a dire situation but was able to fight its way back into the game. This corresponds with the principle of "intentionality", which is crucial in interpretation of streaks (Burns & Corpus, 2004). A sequence is expected to continue if it is generated by deliberate and motivated agents (e.g., basketball players), and to reverse if it is generated by a random process (e.g., a roulette) (Caruso, Waytz & Epley, 2010). The results in Table 6 showed that respondents who assigned the comeback team higher chances to win (presumably due to a positive momentum) endorsed various statements about the advantages of being the comeback team more strongly. Among other things, they were more supportive of the statements that the comeback team is expected to exhibit more aggressive, confident and energetic game during the overtime. Such views correspond with early conceptualizations of momentum (Iso-Ahola & Mobily, 1980; Taylor & Demick; 1994).

All in all, our results document a gap between perceptions and reality about momentum in sports, and in particular a bias of perceptions towards the intuitive belief in momentum and away from the empirical evidence. The intriguing question is why experienced respondents are biased in their perceptions. First, we should not overlook the fact that success in competitive environments is related to physiological responses, which are being repeatedly documented in the biological and physiological literatures (Geniole, Bird, Ruddick & Carré, 2017; Wood & Stanton, 2012). Second, people may be evolutionary predisposed to detect successful competitors via nonverbal communication (e.g., erect posture, assertive facial gestures, etc.) (Casto & Edwards, 2016; Furley & Schweizer, 2020). This suggestion implies that biological mechanisms are underlying and contributing to the perception of momentum.

As for psycho-cognitive reasons behind momentum-based beliefs, we conjecture that there are two main reasons. The first reason is that basketball games that go to an overtime are not very common. This means that even for someone who watches or reads about many basketball games, there are not so many cases in which he can observe the outcome of an overtime and update his beliefs based on empirical evidence.

Another reason for the biased perceptions may be inferred from Festinger (1957), who proposed that people strive for cognitive consistency or a drive to produce consistent relations among cognitions. It was shown that people find it extremely easy to form beliefs about human behavior and to continue to hold to those beliefs even after learning that

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the information on which those beliefs were based was fictitious (Ross, Lepper & Hubbard, 1975). Furthermore, when one has formed an initial opinion, one's natural inclination is to search memory for supportive evidence, overlooking information that contradicts one's belief (i.e., selective recall) (Koriat, Lichtenstein & Fischhoff, 1980; Stangor & McMillan, 1992). Such behavioral patterns imply that individuals tend to interpret, favor, and recall information in a way that confirms their preexisting beliefs, a psychological mechanism that was denoted the confirmation bias (Oswald & Grosjean, 2004 p. 79; for a review see Nickerson, 1998).

In our case, if one's intuition is that the comeback team has higher chances to win in overtime, he will remember more vividly the games in which his intuition was correct than the games where it proved wrong. Then, even after watching many games that ended with an overtime, in which the comeback team lost in half of the games, the belief in a positive momentum after a comeback may remain. This process is also related to the availability heuristic (Tversky & Kahneman, 1974), a tendency of people to heavily weigh their judgments toward information that stands out in their memory. Existence of the confirmation bias and the availability heuristic imply that games in which the comeback team won in overtime are better remembered than games in which the comeback team lost in overtime. Therefore these games come to mind more easily, and create the wrong perception that the comeback team wins in most games.

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Appendix 1: Questionnaires of Study 1

Study 1, Version 1, Part A

Hello,

In front of you are three tables that describe the score development during the last six minutes of three NBA basketball games that reached an overtime. You are kindly requested to assess in each of these three games which team has a higher chance to win in overtime.

1.

Team A	Team
64	72
66	72
66	73
66	74
68	74
68	76
70	76
70	78
71	79
73	79
74	79
75	79
77	79
79	79

The chances of team A to win are _____%

The chances of team B to win are _____%

2.

Team A	Team B
78	78
81	78
81	80
81	83
83	83
83	84
85	84
85	85
87	85
87	87
87	89
89	89
89	90
89	91
91	91

The chances of team A to win are _____%

The chances of team B to win are _____%

3.

Team A	Team B
91	75
91	78
91	80
91	82
93	82
93	84
96	84
96	85
96	87
96	88
96	90
96	93
96	96
98	96
98	98

The chances of team A to win are _____%

The chances of team B to win are _____%

Study 1, Version 1, Part B

4. Please state your opinion about the following scenario:

Team B comes back from an eight-point deficit during the last minutes of the game and is able to force an overtime, seconds from the end.

Which team has a higher chance to win in overtime?

* Team A
* Team B
* The teams' chances are equal.

5. Please state your opinion about the following scenario:

Team A is able to force an overtime seconds from the end of the game after balanced game during the last minutes (2-3 points lead going from side to side).

Which team has a higher chance to win in overtime?

* Team A
* Team B
* The teams' chances are equal.

6. Please state your opinion about the following scenario:

Team B comes back from a 16-point deficit during the last minutes of the game and is able to force an overtime seconds from the end.

Which team has a higher chance to win in overtime?

* Team A
* Team B
* Teams' chances are equal

7. Could you please elaborate on the considerations that guided your answers to questions 4, 5, 6?

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8. A few details about your background:
How are you related to basketball? (you may mark more than one option)
* Active coach
* Former coach
* Active player
* Former player
* Active referee
* Former referee
* Recreational player
* Fan/Spectator
Years of experience as coach/player/referee in the field?_____
Age____
Gender: Male / Female

Thank you very much for your cooperation!

Study 1, Version 2, Part A

Similar to Version 1 except that the score tables are followed by the multiple-choice questions as in Part B of version 1 (Which team has a higher chance to win in overtime? Team A / Team B / The teams' chances are equal).

Study 1, Version 2, Part B

Similar to Version 1 except that the textual descriptions of comeback situations are followed by the probability estimating questions as in Part A of version 1 ("The chances of team A to win are _____%" and "The chances of team B to win are _____%").

From question 7 until the end, Version 2 is identical to Version 1.

Appendix 2: Questionnaires of Study 2

Study 2, Versions 1 and 2

Questions 1–6 are similar to Versions 1 and 2 of Study 1.

Study 2, Versions 3 and 4

Similar to Versions 1 and 2 except that in the textual descriptions of comeback situations the team that lost the lead is mentioned instead of the comeback team. The descriptions in Questions 4-6 then become (the rest of the questions are unchanged and omitted for the sake of brevity):

4. Team A gave up an eight-point lead during the last minutes of the game and was forced into an overtime seconds from the end.

5. Team B is forced into an overtime seconds from the end of the game after balanced game during the last minutes (2-3 points lead going from side to side).

6. Team A gave up a 16-point lead during the last minutes of the game and was forced into an overtime seconds from the end.

After question 6 Study 2 is different from Study 1 and includes the following (in all versions of Study 2):

7. Please rank each of the following statements on two scales. First, please rank on a 1-9 scale to what extent you agree with the statement, or "I don't know" (1 – strongly disagree, 9 – strongly agree). Second, please rank on a 1-5 scale to what extent this statement represents a consideration that guided your responses to the questions about the teams' chances to win (1 – this was not a relevant consideration, 5 – this was a highly relevant consideration).

a. The team that comes back from a deficit is more likely to play better in overtime than during the game
b. The team that gave up the lead is more likely to play worse in overtime than during the game
c. The team that comes back from a deficit is more likely to play more aggressively by "playing to win"
d. The team that gave up the lead is more likely to play too conservatively by "playing not to lose"
e. The team that comes back from a deficit is more likely to play more energetically

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f. The team that comes back from a deficit is more likely to play more confidently

g. The team that gave up the lead is more likely to play with lack of confidence

h. The players of the team that comes back from a deficit are probably less tired

i. The team that comes back from a deficit has probably made many fouls during the comeback, giving it a disadvantage in the overtime

j. The team that comes back from a deficit has probably exhausted their mental and physical resources during the comeback

k. The team that comes back from a deficit is more likely to experience a psychological hype (sort of relief), which would hinder their ability to mobilize themselves in the overtime

l. Receiving an equalizer in the last seconds of the fourth quarter and going to overtime instead of winning mentally breaks the team that lost the lead

m. A large comeback leads to intense momentum that energizes the comeback team in the overtime

8. A few details about your background:

a. How familiar are you with the game of basketball? (1-9 scale, 1 – I don't know anything about basketball, 9 – I know a lot about basketball)

b. How many years have you played basketball on an amateur level? (0, 1, 2, 3, 4, 5, 6–10, 11–15, 16–20, more than 20)

c. How many years have you been a collegiate or professional basketball player / coach / referee? (0, 1, 2, 3, 4, 5, 6–10, 11–15, 16–20, more than 20)

The following questions refer to an average year:

d. How many times do you watch a full basketball game on TV in an average year? (0,1,2,3,4,5,6,7,8,9,10, 11–20, 21–30, more than 30) [i.e., 14 possible answers]

e. How many times do you attend a real basketball game in an average year? (0,1,2,3,4,5,6,7,8,9,10, 11–20, 21–30, more than 30) [i.e., 14 possible answers]

The following questions refer to an average month:

f. How many times do you watch highlights from basketball games in an average month? (0,1,2,3,4,5,6,7,8,9,10, 11–20, 21–30, more than 30) [i.e., 14 possible answers]

g. How many times do you read about basketball games in the newspapers or online in an average month? (0,1,2,3,4,5,6,7,8,9,10, 11–20, 21–30, more than 30) [i.e., 14 possible answers]

Age____

Gender: Male / Female

Thank you very much for your cooperation!

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