Perceived Momentum Influences Responsibility Judgments

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Author Note

The authors would like to thank Phil Fernbach, the participants in the CB Group at Georgia Tech University, and students in Nicholas Reinholtz's 2017 Ph.D. seminar for their invaluable feedback on this project. Earlier versions of this research, including some of the results presented in this manuscript, were presented at the 2015 Annual Meeting of the Society for Judgment and Decision Making and the 2016 Annual Conference of the Cognitive Science Society. This work has not otherwise been disseminated or shared. The data for all experiments reported herein have been made public on the Open Science Framework at the following URL: https://osf.io/tm9cp/

Abstract

This work examines how people judge the responsibility of sequential events (e.g., correct/incorrect guesses) for overall outcomes (e.g., winning/losing a trivia game). People are found to perceive momentum, even in contexts where it cannot exist (i.e., sequences of independent events), which leads them to expect streaks to continue. Events that break those streaks (e.g., an incorrect guess after a series of correct guesses) are more unexpected and, thus, held more responsible for overall outcomes. How these findings contribute to the contemporary understanding of responsibility judgments is discussed.

Keywords: perceived momentum; responsibility judgments

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Many *outcomes* are the result of a sequence of *events*: Sports championships are determined by the results of games played during the season, final course grades are determined by one's performance on assignments and exams, games of chess are determined by the set of moves each player has made during the match, and sales quotas are met or missed because of the success or failure of sales calls over a span of time. Once an outcome—success or failure, for instance—is realized, there are often reasons to look back to the individual events and assess which event or events was most responsible for the overall outcome. Understanding who, or what, was most responsible for an outcome can inform future behavior (e.g., what to change, what to repeat), decisions (e.g., who to fire, who to promote), and judgments (e.g., who to trust, who to distrust). Whatever the specific motive for forming them, responsibility judgments can serve as the basis for many decisions and, hence, are important to understand.

In sequences such as those described above, one can distinguish events that are "aligned" with the outcome from those that are not. *Aligned events* are discrete events within a sequence whose valence corresponds with that of the sequence's overall outcome and, thus, can be seen as possible causes of the outcome. For instance, a team can either win or lose a trivia game (the outcome) and this outcome is determined by the team members' answers to the trivia questions (the events). If the team wins, the correctly answered questions are the aligned events. Whereas if the team loses, the incorrectly answered questions are the aligned events. When assessing what (or who) caused the outcome of the game, one will tend to focus on the aligned events: incorrect answers in the case of the loss and correct answers in the case of a win. In this manuscript, we ask whether perceptions of inter-event momentum influence which aligned events are held most responsible for the overall outcome.

Responsibility judgments are partly derived from causal beliefs (Chockler & Halpern, 2004), which themselves tend to be strongly influenced by counterfactual reasoning (Lagnado, Gerstenberg, & Zultan, 2014; Pearl, 2000) and the perceived mutability of events (Gerstenberg, Halpern, & Tenenbaum, 2015; Kahneman & Miller, 1986; Miller & Gunasegaram, 1990). The more easily an aligned event can be imagined to have had a different result (i.e., the more easily a counterfactual comes to mind) the more "mutable" the event is and the more responsible it will be held for the outcome. This is especially true if changing the event would change the outcome (McGill & Tenbrunsel, 2000), as is often the case for aligned events.

One factor that reliably influences the perceived mutability of an aligned event is the individual's expectations of what should have happened. Be it in the context of moral actions (Alicke, 1992), voting scenarios (Gerstenberg et al., 2015), or mundane workplace occurrences (Knobe & Fraser, 2008), the more unexpected an event is the easier it is to imagine it being different, and the more responsible it will be held for an outcome (Halpern & Hitchcock, 2014; Hitchcock & Knobe, 2009; Kominsky et al., 2015). We propose a new mechanism that can contribute to the unexpectedness and perceived mutability of events that occur in a sequence: perceived inter-event momentum.

Perceiving momentum implies that something should continue along its current path. This can be conceptualized as a belief that the mechanism generating the events' results is path dependent: In other words, people may reason about the sequential events as if they were determined by a Markovian process, where a streak of the same result (e.g., wins) makes that result (win) more likely in the next event (Oskarsson et al., 2009). In fact, people often expect even objectively independent streaks of similar results to continue (often called the "hot hand"; Ayton & Fischer, 2004; Gilovich, Vallone, & Tversky, 1985), especially when they believe the mechanism generating the results is nonrandom (Gronchi & Sloman, 2008).

From this, it holds that perceived momentum, which influences expectations for the results of particular events, is likely to influence responsibility judgments: Specifically, a given event should be held more responsible for an outcome if it disrupts perceived momentum (e.g., a loss after a series of wins) than if it does not. We tested this prediction in six experiments (with an additional experiment reported in the appendix). We had no prior estimate of effect size, so following Nelson (2014) we targeted a sample size in Experiment 1A that seemed reasonably large and sustained this approximate level or greater throughout the remaining experiments. Data were collected in a single batch for all studies except for Experiment 2, in which we increased the sample size by approximately 200% after the initial data collection to increase power. We report all manipulations, collected variables, and data exclusions in each experiment. Data, code, and materials for all studies are available on Open Science Framework: https://osf.io/tm9cp/.

Pilot Experiment

We conducted a pilot experiment with 112 Amazon Mechanical Turk (AMT) participants, who were assigned to either the *positive-momentum* or *negative-momentum* condition. All participants read, “Imagine a basketball player is taking the final shot of the game. If he makes it, his team wins. If he misses it, his team loses.” Those in the positive (vs. negative) momentum condition were told, “Prior to this moment, his team has made (missed) 8 shots in a row.” We suggest that the streaks of made or missed shots should give the perception of the team having either positive or negative momentum.

All participants were then asked two perceived-responsibility questions that both used 1 (=none) to 7 (=a great deal) scales: (i) “How much credit will he receive for the team’s win if he makes the shot,” and (ii) “How much blame will he receive for the team’s loss if he misses the shot?" Thus, the experiment used a mixed design with momentum (positive vs. negative) being the between-subjects factor and outcome (win vs. loss) being the within-subjects factor.

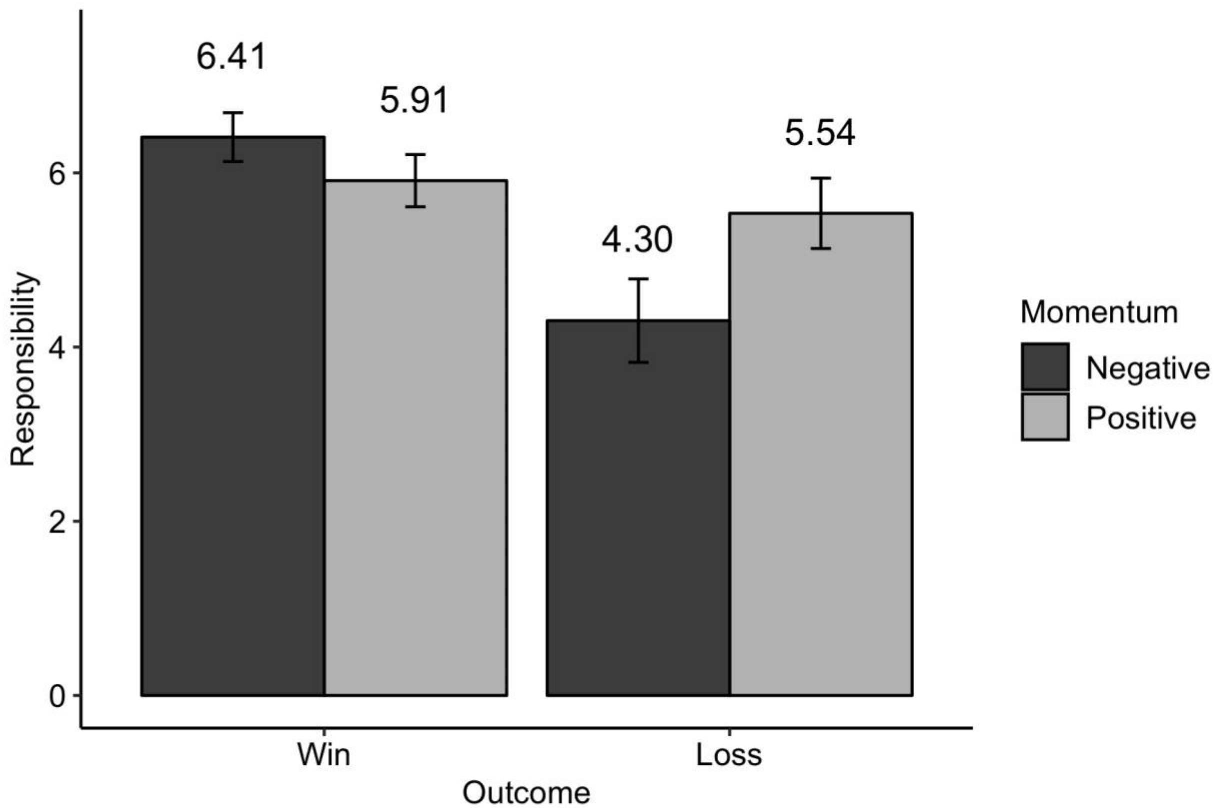

Fig. 1.
Perceived credit ("win" condition) and blame ("loss" condition) in the pilot experiment. Errors bars represent 95% CIs.

We expected the player would be considered more responsible for the team's outcome when his shot had a different result than the preceding eight shots (i.e., when it went against momentum)—the win × negative-momentum and lose × positive-momentum conditions—than if his shot had the same result as the preceding eight shots—the win × positive-momentum and lose × negative-momentum conditions. We found this pattern of results (Figure 1; no data were excluded). A mixed-model ANOVA revealed a significant main effect of the within-subjects factor, outcome (M_{win}=6.16, M_{lose}=4.92, $F(1,110)$=44.92, p<.001, 95% CI of difference: [.874, 1.608]; η_p^2=.29), but not the between-subjects factor, momentum ($M_{negative}$=5.36, $M_{positive}$=5.72,

$F(1,110)=3.61$, $p=.060$, 95% CI of difference: [-.748, .016]; $\eta_p^2=.03$). Most critically, the expected interaction was significant ($F(1,110)=21.87$, $p<.001$; $\eta_p^2=.17$), and planned contrasts supported our predictions. The player received significantly more credit for his team's *win* if his *made* shot followed a series of missed shots (i.e., deviated from the current streak) versus made shots (i.e., continued the current streak; $F(1,110)=5.83$, $p=.017$, 95% CI of difference: [.090, .910]; $\eta_p^2=.05$). Likewise, the player received significantly more blame for his team's *loss* if his *missed* shot followed a series of made versus missed shots ($F(1,110)=15.19$, $p<.001$, 95% CI of difference: [.606, 1.859]; $\eta_p^2=.12$).

An alternative account of the pilot experiment's results is that events that deviated from the momentum of the game (i.e., broke the streak) were more distinctive than events that conformed to the momentum of the game (i.e., sustained the streak). While it is not inherently clear how event distinctiveness would translate into responsibility judgments (at least absent other theoretical mechanisms such as the one proposed here), the remaining experiments were designed to mitigate the distinctiveness of the focal, aligned events.

Experiments 1A and 1B

Participants (AMT; $N=202$ for 1A, 199 for 1B) were told of a hypothetical team of ten players playing a guessing game. In the game, each player guessed sequentially and in secret (i.e., the guesses were objectively independent) which of two colors a computer had randomly chosen before the game began. These characteristics of the game render it inherently and objectively stochastic: a quality that typically results in the belief that streaks will end rather than persist (i.e., the gambler's fallacy; Tversky & Kahneman, 1971). However, Ayton and Fischer (2004) found that while people recognize that binary outcomes of roulette spins are stochastic, they concurrently believe that the outcomes of bets placed on those spins are not because the latter rely on human agency, which is not random. When a streak is believed to have a nonrandom generating source, people tend to expect positive recency (Gronchi & Sloman, 2008) or, in other words, perceive momentum. In the current experiments, while the winning color is ostensibly randomly chosen by a computer, the player's guesses rely on human agency (much like bets placed on a roulette spin). Hence, we expected that participants would be likely to perceive inter-event momentum despite the inherently stochastic nature of the events.

Participants in Experiment 1A (1B) were told the team would win if it made fewer than four incorrect guesses (more than three correct guesses). They were then told that four players had made incorrect (correct) guesses and the team had lost (won) the game. Note that the four incorrect (correct) guesses aligned with the loss (win) outcome in Experiment 1A (1B), and that the outcome of the game would have been reversed by changing the result of any one of these guesses in both experiments. Hence, pivotality is constant for all aligned events in both cases.

Participants were randomly assigned to one of two sequence conditions (Table 1) and shown the complete set of event results listed in the order in which the players had ostensibly made their guesses. They were then asked which of the four players with incorrect (correct) guesses deserved the most blame (credit) for the team's loss (win). Participants could indicate equal/no responsibility by choosing an option labeled "other," and entering the explanation of their preference.

Table 1.
Examined sequences of event results. Aligned events are bolded in each sequence ("A" = aligned, "N" = non-aligned)

All-Late	N_1	N_2	N_3	N_4	N_5	N_6	**A_1**	**A_2**	**A_3**	**A_4**
One-Late	**A_1**	**A_2**	**A_3**	N_1	N_2	N_3	N_4	N_5	N_6	**A_4**

Prior research suggests that people are likely to hold the final aligned event (A_4) most responsible in both sequences, either because it is seen as more mutable (Miller & Gunasegaram,

1990) or because it has the greatest impact on the conditional probability of the observed outcome occurring (Spellman, 1997). We additionally predicted that aligned events that disrupted a streak of results—and, hence, perceived momentum—would be held more responsible for the outcome. Thus, people should be more likely to consider the first aligned event (A_1) most responsible in the all-late (vs. one-late) sequence. Conversely, people should be more likely to consider the last aligned event (A_4) most responsible in the one-late (vs. all-late) sequence. The proportion of people judging the interim aligned events (A_2 and A_3) most responsible should be low and uninfluenced by the sequence of events since neither event (i) breaks a streak nor (ii) is the final aligned event.

We excluded participants who failed attention checks from the following analyses (16 removed in 1A and 11 removed in 1B). Table 2 presents the responsibility-judgment results from Experiments 1–3. Table 3 presents the 95% confidence intervals around the proportion differences for the first and last aligned events.

As in prior research, the last aligned event (A_4) was rated most responsible in both sequences in all our experiments. Since this pattern has been previously documented and is not focal to our hypotheses, we do not discuss it further. More importantly, the overall pattern of responsibility judgments was as predicted. Specifically, significantly more participants indicated that the first aligned event (A_1) was the most responsible in the all-late sequence, where it followed a series of non-aligned events (i.e., broke a streak), than in the one-late sequence, where it did not. And, significantly more participants indicated that the last aligned event (A_4) was the most responsible in the one-late sequence, where A_4 followed a series of non-aligned events (i.e., broke a streak), than in the one-late sequence, where it followed a series of other aligned events. The proportion of participants judging the interim aligned events (A2 and A3) most responsible was nearly zero and did not differ significantly between sequences. In sum, the pattern of results was as expected across the aligned events regardless of whether the outcome was negative (loss) or positive (win).

Table 2.
Proportion of respondents holding each of the aligned events (A_x) most responsible, Experiments 1- 3

	Sequence		A_1	A_2	A_3	A_4	Equal/No
Exp. 1A	All-Late	[n = 95]	**.25**[a]	.02	.03	**.44**[b]	.25
	One-Late	[n = 91]	**.01**[a]	.02	.08	**.65**[b]	.24
Exp. 1B	All-Late	[n = 92]	**.16**[c]	.00	.01	**.68**[d]	.14
	One-Late	[n = 96]	**.00**[c]	.01	.01	**.83**[d]	.15
Exp. 1C	All-Late	[n=120]	**.14**[e]	.01	.03	**.54**[f]	.28
	One-Late	[n=123]	**.07**[e]	.01	.02	**.70**[f]	.20
Exp. 2	All-Late	[n = 136]	**.38**[g]	.06	.01[h]	**.37**[i]	.18
	One-Late	[n = 148]	**.12**[g]	.02	.08[h]	**.60**[i]	.18
Exp. 3	All-Late	[n = 96]	**.34**[j]	.01	.02	**.51**[k]	.11
	One-Late	[n = 99]	**.14**[j]	.02	.04	**.71**[k]	.09

Note: Target comparisons highlighted in paper are bolded. Within each column, target comparisons that differed significantly ($p < .05$) are noted via shared superscript, and those without superscripts do not differ significantly ($p > .05$).

Table 3.
95% confidence intervals around proportion differences between sequences within the first (A_1) and last (A_4) aligned events, Experiments 1-3

		A_1	A_4
Exp. 1A	Difference	-.24	.21
	95% CI	[-.338, -.151]	[.063, .338]
Exp. 1B	Difference	-.16	.15
	95% CI	[-.239, -.088]	[.028, .269]
Exp. 1C	Difference	-.08	.24
	95% CI	[-.153, -.001]	[.037, .278]
Exp. 2	Difference	-.25	.23
	95% CI	[-.350, -.156]	[.121, .347]
Exp. 3	Difference	-.20	.20
	95% CI	[-.320, -.085]	[.062, .331]

Note: Difference = proportion in one-late condition – proportion in all-late condition (proportions taken from Table 2).

These results are consistent with the pilot experiment, which features a different, more-naturalistic context (a basketball game) and a continuous dependent measure (rating perceived responsibility) rather than choosing the most responsible person. We further explore robustness of these results to context and our choice of dependent measures in Experiment 3 and Experiment A1 (presented in the appendix).

One may wonder, however, whether the fact that the sequence ends with aligned events influences the observed results. To assess this question, we conducted Experiment 1C.

Experiment 1C

Experiment 1C was a direct replication of Experiment 1A (loss outcome) with only one difference: each sequence was modified to have twelve events. The last two events in both sequences were non-aligned, so each sequence ended with two correct guesses. The other ten events were identical to those in Table 1. Participants (AMT; *N*=299, of which 56 were removed from analysis for failing attention checks) read the same scenarios as Experiment 1A and indicated which of the four players with incorrect guesses deserved the most blame or the team's loss. Participants could, again, indicate equal/no responsibility by choosing an option labeled "other," and entering the explanation of their preference.

Replicating the previous results, participants again showed an increased likelihood of assigning responsibility to the event that broke the momentum: those in the all-late condition were more likely to indicate that the first aligned event (A_1) was most responsible, and those in the one-late condition were more likely to indicate the last aligned event (A_4, which was no longer the final event) was most responsible (Table 2). Thus, the perceived moment effect we document does not seem to rely on the sequence ending in a cluster of aligned events.

Experiment 2

Experiment 2 explicitly measured perceptions of momentum and tested whether these correspond with responsibility judgments. The methodology was identical to Experiment 1A—

the outcome was a loss and, hence, the aligned events were incorrect guesses—with the exception that participants (AMT; *N*=294 collected in two batches of 103 and then 191, of which 10 were removed from analysis for failing attention checks) additionally indicated how much momentum they felt the team had *after* each player's guess (-4=strongly negative momentum, 0=no momentum, +4=strongly positive momentum) prior to identifying which aligned event (incorrect guess) was most to blame for the outcome (loss). It was expected that each incorrect guess (i.e., aligned event) would generate perceptions of less positive (more negative) momentum, with the sharpest changes in perceived momentum occurring at points where streaks of correct or incorrect guesses were ended.

Replicating the previous experiments, a greater proportion of participants considered the first aligned event (A_1) most responsible in the all-late sequence than in the one-late sequence. This pattern was reversed for the final aligned event (A_4; Table 2). As expected, the pattern of responsibility judgments aligned with the maximum changes in perceived momentum (Figure 2).

A series of regressions examined the mediating role of perceived momentum on the likelihood of blaming the final aligned event (the tenth event in both sequences). First, a logistic regression indicated sequence (one-late vs. all-late; effect coded 1 and -1, respectively) predicted blame (b=.48, z=3.90, p<.001, 95% CI: [.236, .716]). Second, a linear regression indicated sequence predicted the *change* in perceived momentum associated with the final aligned event relative to the preceding event (b=-1.84, t=-13.26, p<.001, 95% CI: [-2.108, -1.563]). Finally, a logistic regression with both sequence and change-in-momentum as predictors indicated change-in-momentum was a significant predictor of blame (b=-.18, z=-3.28, p=.001, 95% CI: [-.284, -.072]) while sequence was not (b=.17, z=1.07, p=.285, 95% CI: [-.138, .468]), supporting the expected mediating role of perceived momentum on responsibility judgments.

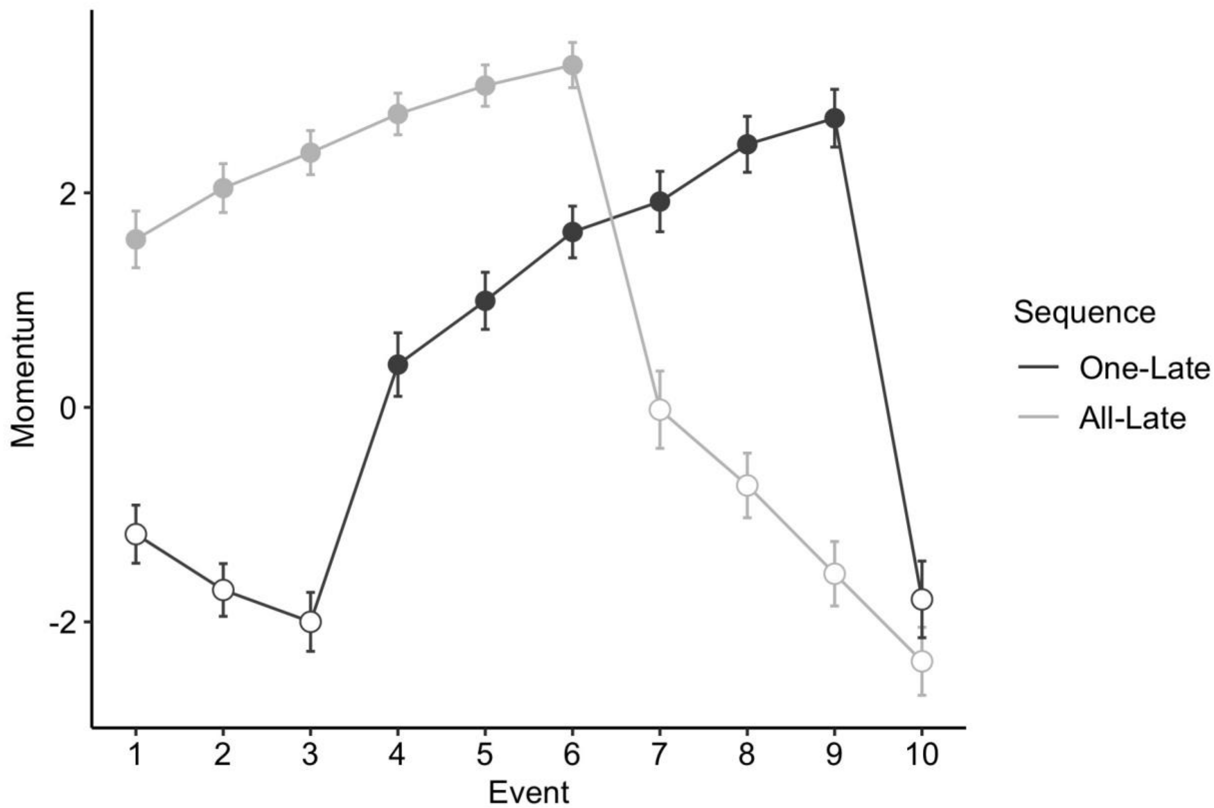

Fig. 2.
Perceived momentum following each event in Experiment 2. Non-solid circles indicate incorrect guesses (aligned events). Errors bars represent 95% CIs.

Experiment 3

Experiment 3 was designed to combine the more naturalistic nature of the pilot experiment with the tighter internal validity of Experiments 1A–C and 2, while concurrently generalizing the effect to an additional context (Monin & Oppenheimer, 2014). Specifically, we used the same sequences of events used in Experiments 1A–B and 2, but did so in a scenario more familiar to participants. Participants (AMT; N=200, of which 5 were removed from analysis for failing attention checks) were told of a contestant on a fictional reality TV show, *Shredding for the Wedding*. Participants were given a brief description of the contestant, Valerie, told that this contestant had 10 weeks to lose 20 pounds and that, if she did, she would win the wedding and honeymoon of her dreams.

Participants were then shown a table of the contestant's weekly weigh-in results. All participants were shown that the contestant had (i) lost weight in six of the ten weeks, (ii) gained weight in four of the ten weeks, and (iii) lost 19 total pounds at the end of the 10-week period (i.e., missed her goal by one pound and did not win the prize). Additionally, participants were told that every week the contestant had gained weight (i.e., the aligned events), she had taken a business trip and had gained exactly 1 pound (i.e., all the aligned events were equally pivotal). The sequence of events was manipulated, with participants being randomly assigned to one of two sequence conditions used in Experiments 1A–B and 2 (Table 1). They were then asked to indicate which "business trip you feel is most responsible for Valerie missing her weight loss goal." Participants could again indicate equal/no responsibility by choosing an option labeled "other," and entering the explanation of their preference.

As in Experiments 1A–1C and 2, a greater proportion of participants considered the first aligned event (A_1) most responsible in the all-late sequence than in the one-late sequence. This pattern was reversed for the final aligned event (A_4; Table 2). Thus, once more and in a new context, we find that events which break perceived momentum tend to be held more responsible for outcomes.

General Discussion

Across six experiments, we find that perceptions of inter-event momentum influence expectations for the results of events which follow a streak, and violations of expectations generated by perceived momentum influence responsibility judgments. Simply put, a streak of wins (losses), for instance, leads to the belief that winning (losing) should be more likely on the next event. When that belief is violated, it is more unexpected and, per previous research, likely seen as more mutable. The event is therefore held more responsible for the overall outcome. To the best of our knowledge, this is the first work to demonstrate that perceptions of momentum influence responsibility judgments.

These findings complement and extend two streams of research. The first stream has identified a reliable link between expectation violations and responsibility judgments (Halpern & Hitchcock, 2014; Hitchcock & Knobe, 2009). The current work suggests that perceived momentum also informs expectations and, thus, responsibility judgments. The second stream argues that the perceived impact of a given aligned event on the probability of the observed outcome guides how responsible that event is held for the outcome (Spellman, 1997): the greater the impact on the probability of the outcome occurring, the more responsible the event is held. Results consistent with this reasoning were found in the current research to the extent that the final aligned event in each sequence, which always had the greatest objective impact on conditional probability of the outcome occurring, received the highest proportion of credit/blame across the experiments. However, it is difficult to explain the difference between the one-late and all-late conditions using Spellman's crediting causality model alone. Indeed, the fundamental premise of that model—that responsibility judgments are based on the extent to which events are perceived to change the conditional probability of the outcome occurring—would predict a greater share of responsibility assigned to the intermediary aligned events (A_2 and A_3) than A_1 regardless of sequence, and we do not observe this in any of our experiments. Thus, while the crediting causality model accounts for a portion of our findings, it cannot parsimoniously explain the full pattern of results.

Of course, it is important to consider the limits of the effect found here. For instance, Experiments 1A–C and 2 all used sequences containing inherently stochastic events. Rationally, people should not perceive momentum in such contexts but, as we discussed, they are likely to represent the guessing games used in those experiments as involving human agency (Ayton & Fischer, 2004) and, thus, expect a degree of positive recency or momentum (Gronchi & Sloman, 2008). However, being pressed to more explicitly consider the nature of the events generating the outcome before judging who is most to blame should attenuate this effect. This is exactly what we found in an experiment reported in the appendix (Experiment A1). Explicitly asking participants to first consider whether *anyone* should be considered most responsible before asking them *who* was the most responsible resulted in the majority of participants indicating that no player was the most to blame in the guessing game context used in Experiments 1A–C and 2. In contrast, simply asking participants who was the most to blame and giving them the option to indicate nobody was (the DV used in our main experiments) generated the expected pattern of results. When the results were generated by a mechanism that seemed non-random (attempting to solve math problems), the pattern of results was consistent with previous studies regardless of whether people were first asked whether anyone should be held responsible or not.

Still, it is important to note that the focus of the current work is not about if or when people should perceive inter-event momentum. Instead, the research question asks how perceived momentum—be it difficult to justify rationally (Experiments 1A–C and 2) or somewhat easier to justify (the pilot experiment and Experiment 3)—impacts responsibility judgments. To that end, we find that the judged responsibility of aligned events is reliably predicted by the extent to which they disrupt perceived momentum. Thus, future work might examine other factors the can moderate perceptions of momentum, such as disruptions or delays in the sequence (Gold & Hester, 2008), which should also attenuate the documented effect.

It is noteworthy that the results of the pilot experiment and Experiments 1A–B suggest that people may be more hesitant in levying blame for failure than credit for success. Although our goal in those experiments was to demonstrate that the effect of perceived momentum on responsibility judgments generalizes to both positive and negative outcomes, which it does, these results suggest that people may require a greater preponderance of evidence before blaming someone for failure than crediting them for success in group contexts. Intuitively, it might seem that people would generally prefer crediting, a positive judgment or proclamation, over blaming, a negative judgment or proclamation. This might even be particularly true for cases of placing explicit and overt blame on another (i.e., publicly announcing that another is to blame), versus maintaining a private judgment of responsibility. But the preference for crediting over blaming is not as lopsided as one might think. On the contrary, the willingness to credit and blame others for group outcomes is influenced by factors such as the other's position within an organizational hierarchy (Gibson & Schroeder, 2003), one's age (Hamilton, Blumenfeld, & Kushler, 1998), and whether success or failure was expected *a priori* (Parker & Cheatham, 2019). Whatever proclivities people may have for blaming versus crediting others in a given context, the current work finds that perceived momentum can inform either type of responsibility judgment.

In closing, it is important to note that the underlying abstract qualities of these experiments are found in many real-world contexts. For instance, firms often fail to meet revenue goals and sports teams fail to make the playoffs. Other times, success is achieved by the collective efforts of the group or team. These outcomes are frequently the consequence of a series of events (e.g., sales calls over time, games over a season). The current work indicates that observers and participants in such contexts are likely to view aligned events that broke momentum, and the individuals who generated those events, as being more responsible for the overall outcome. Yet, the decision to act on such responsibility judgments (e.g., firing or promoting a person) will often, with good reason, require more than a single piece of evidence (i.e., the individual being judged responsible for more than a single positive or negative group outcome). We merely maintain that events generating results that deviate from perceived momentum influence responsibility judgments for a specific outcome. Such judgments may be part of a larger body of evidence drawn from numerous outcomes that is used to assess an individual's broader contributions or damage to a group and make decisions regarding that individual's future within the group. Thus, while it would be erroneous to claim that responsibility judgments arising from any single event will spur consequential action, it is nonetheless our opinion that the results presented here are insightful regarding how responsibility will be judged in real-world contexts with meaningful consequences.

Context of the Research

This specific idea arose from an observation made by the first author while watching a professional American football game and was fleshed out via repeated discussions among the authors. Collectively, it was agreed that although perceptions of momentum have been a topic of interest in various academic circles, their impact on responsibility judgments was notably absent from the literature. While debating the normativity of perceived momentum is certainly important (Gilovich, Vallone, and Tversky, 1985; Green and Zweibel, 2013; Miller and Sanjurjo, 2015), we felt that examining the consequences of this seemingly innate tendency was also important. The findings in this manuscript have additionally motivated two additional projects by the first author. The first examines the how the greater apparent willingness to give credit than to assign blame arises. The second examines how causal beliefs influence the preference for risk.

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Appendix

Experiment A1: Exploring the Boundaries of the Effect

This experiment examined the boundaries of the observed effect by manipulating two additional factors. First, we explore the role of the generating mechanism for individual events, with the prediction that responsibility attributions will be held with greater conviction if participants perceive the event results to be determined by non-random rather than a stochastic mechanism (Gronchi & Sloman, 2008). Second, we manipulate the explicitness of the "no blame" option in our response measure. For half the participants, we first ask whether any particular event is most to blame (the outcome examined in this study is a loss, as in Experiment 1A), and only ask which event if they answer in the affirmative. We expect that explicitly focusing participants on the appropriateness of blaming any event will direct their attention to the nature of the events being considered. Explicitly recognizing that the events are inherently stochastic (vs. non-random) should attenuate the documented effect.

Method

Participants (N = 598, of which 19 were removed from analysis for failing attention checks; recruited from AMT) were randomly assigned to one of eight conditions in a 2 (context: guessing game vs. math game) × 2 (responsibility DV: implicit vs. explicit) × 2 (sequence: all-late vs. one-late) between-subjects design. The *guessing game* conditions used the same scenario and stimuli as Experiment 1A. The *math game* conditions modified the scenario such that the players in the game were not guessing which of two random colors had been selected. Instead, participants in the math game conditions were told that the game's players were tasked with solving math problems and that, unbeknownst to the players, they were being judged on the number of problems they attempted, not the number they solved. If more than 7 players attempted more than 75% of the problems, the team would win. Otherwise, they would lose.

While the number of math problems a person can solve may be outside of his control (i.e., because he could be assigned very easy or very difficult problems), the number of problems attempted is purely volitional. Hence, while the event results in the math-game scenario were still independent, participants should view these as less stochastic compared to the guessing-game scenario.

The *implicit-DV* conditions used the same dependent measure used in Experiments 1A–C and 2. Thus, the implicit-DV, guessing-game condition was identical to Experiment 1A. In contrast, participants in the *explicit-DV* conditions were first asked, “Considering the above results, is someone most responsible for the team's loss?” If participants responded “yes” to this question, they then indicated which player they believed was most responsible.

We expected that explicitly focusing participants on the question of whether someone was most responsible or not (as opposed to simply asking who was most responsible) would attenuate the effect more in the purely stochastic and independent-results guessing-game context than in the more volitional (non-random) math-game context.

Results

Table A1 presents the responsibility-attribution results across all conditions. Table A2 presents the 95% confidence intervals around the proportion differences for the first and last aligned events. The results were as expected, with one exception discussed below. Specifically, the focal effect was replicated in the guessing-game, implicit-DV condition, which was identical to Experiment 1A. And, as expected, the effect was attenuated in the guessing-game condition when participants were first asked to explicitly consider whether someone was “most” to blame.

The result was also replicated in the math-game, implicit-DV condition, indicating that this dependent measure is reliable using yet another context (Monin & Oppenheimer, 2014). A similar pattern also emerged in the math-game, explicit-DV condition where responsibility attributions to the first aligned event (A_1) were significantly influenced by the sequence. However, responsibility attributions to the last aligned event (A_4) were not significantly influenced by the sequence, in contrast to previous results.

Further, a binary logistic regression examining the proportion of participants assigned equal or no blame as a function of the type of game (math = 1 vs. guessing = -1) and DV (implicit = 1 vs. explicit = -1) revealed the expected pattern**.** Using the explicit (vs. implicit) DV increased the proportion of respondents indicating no/equal blame, as indicated by a significant main effect (b = -.698, z = -7.45, p < .001). However, this effect was attenuated in the math-game (vs. guessing-game) context, as indicated by a significant interaction (b =.211, z = 2.25, p = .025). When the explicit DV was used in the guessing-game condition, 30% of participants blamed somebody “most”, but this percentage increased to 59% in the math-game context, where the pattern of results is similar to those in the preceding studies.

Table A1.
Proportion of respondents holding each of the aligned events (A_x) most responsible, Experiment A1

DV	Sequence		A_1	A_2	A_3	A_4	Equal/No
Guessing-game (Stochastic Event) Context							
Implicit	All-Late	[n = 76]	**.22^a**	.00	.00	**.49^b**	.29
	One-Late	[n = 71]	**.00^a**	.00	.00	**.73^b**	.27
Explicit	All-Late	[n = 71]	**.13**	.00	.00	**.24**	.63
	One-Late	[n = 71]	**.07**	.01	.01	**.13**	.77
Math-game (Non-Random Event) Context							
Implicit	All-Late	[n = 69]	**.23^c**	.01	.01	**.49^d**	.25
	One-Late	[n = 70]	**.00^c**	.00	.00	**.83^d**	.17
Explicit	All-Late	[n = 72]	**.21^e**	.01	.03	**.43**	.32^f
	One-Late	[n = 69]	**.00^e**	.01	.00	**.48**	.51^f

Note: Target comparisons highlighted in paper are bolded. Within each column, target comparisons that differed significantly (p < .05) are noted via shared superscript, and those without superscripts do not differ significantly (p > .05).

Table A2.

95% confidence intervals around proportions differences between sequences within the first (A_1) and last (A_4) aligned events, Experiment A1

Guessing-game (Stochastic Event) Condition			
DV		**A_1**	**A_4**
Implicit	Difference	-.22	.24
	95% CI	[-.317, -.130]	[.093, .398]
Explicit	Difference	-.06	-.11
	95% CI	[-.154, .041]	[-.239, .013]
Math-game (Non-Random Event) Condition			
Implicit	Difference	-.23	.34
	95% CI	[-.331, -.132]	[.188, .483]
Explicit	Difference	-.21	.05
	95% CI	[-.302, -.115]	[-.116, .212]

Note: Difference = proportion in one-late condition – proportion in all-late condition (proportions taken from Table A1).