**Late-Action Effect: Heightened Counterfactual Potency and Perceived Outcome
Reversibility Make Actions Closer to a Definitive Outcome Seem More Causally
Impactful**

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Abstract

We report a consistent effect in the evaluation of actions: later actions – specifically, actions that are closer to a final, positive outcome - are considered as contributing more to that outcome, compared to earlier actions. Twelve experiments (total $n = 5658$, six pre-registered, with U.S. American and British participants, manipulating action timing both within-subjects and between-subjects) provide evidence in support of a late-action effect. This effect extends to different domains, from sports to business to academics. Further, this effect is disproportionately larger when actions are closer to the end of an event. We identify two mediators. The first is a heightened tendency to imagine negative alternative scenarios when the action is closer to an outcome, that is, higher counterfactual potency for later actions. The second is perceived outcome reversibility – lower for later actions, when there is less time for the provisional outcome to change. The effect is mitigated if people are instructed to imagine counterfactual outcomes (consistent with the notion of a counterfactual potency mediation), and if the action does not produce a provisional outcome change. We discuss theoretical implications for the psychological understanding of timing, causality attributions, and counterfactual thinking, as well as future research directions for goal-gradient (the tendency to give more weight to the last steps towards goal completion).

Keywords: timing, outcome effect, perceived impact, causation, reversibility, counterfactual potency.

Late-Action Effect: Heightened Counterfactual Potency and Perceived Outcome Reversibility

Make Actions Closer to a Definitive Outcome Seem More Impactful

In the fourth game of the 2020 NBA playoff series against the Los Angeles Clippers, Luka Dončić, of the Dallas Mavericks, shot a three-point basket just as the time was running down in an overtime. His team was trailing the Clippers by one point (133-132). While the ball was in the air, the “buzzer” that signals the end of the overtime went off. Dončić scored the “buzzer-beater”, and the Mavericks won the game, 135-133. Dončić, his teammates, the game commentators, and the fans at home all became extremely excited right after he scored the three-pointer, as if he did something very special, even for a player of that calibre. However, Dončić had scored three more three-pointers earlier in the same game, which were just as difficult, and, for those, he had neither showed nor received anything close to the same amount of enthusiasm. Yet, when looking at the game as a whole, had Dončić missed *even just one* of those three earlier three-pointers, his team would have lost the game. In fact, the Mavericks would not even have been able to take the game to the five-minute overtime, and would have lost the game in regulation, after the typical forty-eight minutes of an NBA game. Why, then, did everyone involved seem to think that this last basket had such a special effect on the game?

The present research investigates how the timing of an action affects its perceived impact on an overall outcome. We asked participants to compare actions that have the same quantitative effect on an outcome, but differ in their timing and their distance from the endpoint of an event, and find that people believe that later actions have a larger causal impact on an overall outcome compared to earlier ones, just like Dončić and his teammates. We call this phenomenon “late-action effect”. We propose that the late-action effect is caused by two psychological mechanisms: a higher potency of counterfactual thinking for later actions, (that is, people are more likely to imagine an alternative outcome in which the action did not

happen for actions closer to the end of an event), and a lowered perceived reversibility of the provisional outcome attained through the later action. Further, we propose that the late-action effect is mitigated if participants consider what would have happened if the earlier action had not taken place, and that the late-action effect is reduced for actions that do not cause a change in the overall outcome.

Time in Causality Judgments

People are often attempting to identify the impact of a cause on an effect, often involving an intricate succession of diverse events. Such causality judgments are crucial for human functioning, and this shows early in human development: infants are able to discriminate between causal and non-causal events as early as 10-months old (Oakes & Cohen, 1990). Causal inference depends on the presence of temporal contiguity and on an incontestable temporal order (Lagnado & Sloman, 2006). Although lay beliefs about what sequences and temporal contiguity mean can be manipulated in order to influence causality judgments (Bramley et al., 2018; Hagmayer & Waldmann, 2002; Stephan et al., 2020), in general, to conclude that event A is the cause of event B, one needs to observe that they happen relatively closely in time (temporal contiguity) and one typically needs to see event A happen before event B (temporal order).

However, is the sequence of events enough? Previous research either did not investigate this aspect (Miller & Gunasegaram, 1990) or found that earlier actions draw more attention and evoke stronger emotional reactions based on the structure of the task (Segura et al., 2002; Walsh & Byrne, 2004). It remains unclear whether “sequence” (i.e., whether one event precedes another) matters, or rather closeness to the end of the event. In other words, prior research does not exclude the possibility that actions that are closer to an outcome, rather than just coming after another action have a disproportionately higher perceived causal impact on the overall outcome.

Interestingly, people are more likely to perceive the time between an event and an outcome as shorter when the relationship is considered to be causal, in a process called “intentional binding” (Buehner, 2012; Faro et al., 2013; Ruess et al., 2017, 2018). Underscoring the close psychological relationship between timing and perceived causality, people report shorter time intervals between causally related historical events compared to causally unrelated events, suggesting that causality is simply viewed as key in assessing temporal distance (Faro et al., 2010). It is less clear what happens when people have to judge the impact of one action on an overall outcome. Previous research proposed that people judge causality based on the overall contribution to the outcome, and that the contribution of single actions or events depends on how much they increase the probability of a successful outcome (Spellman, 1997). Other research suggests that later events could possibly be considered more causally related to an outcome, as they cause higher praise and blame attribution (Miller & Gunasegaram, 1990), but people would rather change the first event in a causal chain rather than later ones (Wells et al., 1987). Given that people tend to think that two events that are closer are also more likely to be causally related, it is possible that they see an action closer to the end of an overall event as more impactful for the outcome of the event.

Further, imagine asking people to judge the causal impact of four baskets on a 40-minute basketball game result. One is scored on the 10th minute of the game, one on the 20th, one on the 30th, and one on the 40th. If mere sequence is responsible for our effect, one should expect a fairly linear pattern of results, such that the difference between the 10th and the 20th minute basket would be roughly similar to the difference between the 30th and the 40th minute basket. However, if closeness to the end result matters most, one should observe a much larger difference between the 30th and the 40th minute basket than between the 10th and the 20th minute basket. We argue that a disproportionate pattern of results is more likely. Therefore,

H1: Perceived causal impact disproportionately increases with closeness to the outcome

The Roots of Late-Action Effect: Counterfactual Potency and Perceived Reversibility

Why would people think that later actions have more impact on an outcome? We propose two mechanisms may cause it. First, later actions may spur more counterfactual thought than earlier ones. Counterfactual thoughts vary in intensity, or potency, and are typically composed of two parts: the IF-part and the THEN-part (Petrocelli et al., 2011). For instance, a student may think, “IF I had studied more, THEN I would have passed the test”, and a basketball player could say, “IF I had missed that shot, THEN our team would have lost”. The more likely the IF-part or the THEN-part of the counterfactual thought are perceived to be, the stronger the intensity of the counterfactual thinking, a phenomenon termed “counterfactual potency” (Petrocelli et al., 2011).

Counterfactual potency is obtained by *multiplying* the perceived IF-likelihood and the perceived THEN-likelihood, meaning that if one of the two imagined events that constitute the counterfactual is considered very unlikely or even impossible, counterfactual potency is very low or even zero. For example, if a basketball player who has never made a three-point basket misses a three-point shot late in a game, it would be very hard for his teammates to imagine an alternative outcome. Therefore, even if a made basket would have changed the outcome, the counterfactual potency would be low due to the low IF-likelihood part. Conversely, if a team were trailing by four points, it would be impossible that a last three-point shot would alter the outcome, even if taken by the best shooter on the team. Despite a high IF-likelihood, in this case the counterfactual potency would be low due to the zero likelihood of the THEN-part of the counterfactual.

The more potent a counterfactual is perceived to be, the higher the causal impact an event is perceived to have (Petrocelli et al., 2011). Counterfactual potency, for instance, seems to be the reason why people with knowledge of a problem (for instance, a fabrication flaw) receive more causal responsibility for the event itself (for instance, a lawnmower breaking down) (Gilbert et al., 2015). We propose that later actions generate counterfactuals that are more potent. In general, the IF-part of the counterfactual may not be very much affected by the how early the action takes place, but the THEN part clearly changes (as the probability that the outcome would have been different is easier to compute the later the action took place). We have previously argued that perceived causal impact disproportionately increases with closeness to the outcome. We surmise that this is because the salience of the end of an event makes counterfactual thoughts much more potent and accessible. Therefore, we should expect counterfactual potency to also disproportionately increase during the course of an event. Going back to the example that we made earlier in this paper, one should observe a larger difference in counterfactual potency between the 30th and the 40th minute basket than between the 10th and the 20th minute basket. Formally,

H2: Counterfactual potency is especially strong for actions closer to the end of an event (rather than for actions that simply happen later than others), and it drives the late-action effect.

If our hypothesis is correct, we should be able to moderate late-action effect by increasing the potency of a counterfactual connected to a specific action. More precisely, instructing participants to think of *how the total outcome would have changed if an action had not happened* should increase the perceived impact of earlier actions more than the perceived impact of later actions, since later actions are closer to an outcome and therefore already more likely to evoke potent counterfactuals.

H3: Inducing counterfactual thinking moderates late-action effect by increasing the perceived impact of earlier actions.

Counterfactual potency may not be the only mediator between timing and perceived impact. We propose that perceived outcome reversibility could also play a role in the late-action effect. As a definition of “perceived outcome reversibility”, we propose: “the perception that the final outcome can change in valence compared to the provisional outcome”. If subsequent actions can undermine the perceived impact of an action, then the fewer actions that can follow a focal action, the higher the perceived impact of a focal action should be. In the absence of information on the number of intervening actions, the time between an action and a definitive outcome serves as a proxy. That is, the less time between a focal action and the definitive outcome, the less reversible the outcome provoked by an action will be deemed to be, and, as a result, the more impactful. The notion that an outcome will be similar to a provisional outcome the closer these are in time is reflected in the live-updating betting odds of bookmakers. For instance, for games of the 2018 Soccer World Cup, live odds of winning in favor of the team that was ahead increased almost linearly with the passage of time (e.g., Boice et al., 2018). A goal that puts one’s team ahead is less likely to be countered as time progresses and so, a provisional outcome seems less reversible as it draws closer to the definitive outcome. We propose that perceptions of reversibility play a key role in perceived action impact. In other words, people judge impact not only by the objective impact an action has on the provisional outcome at that time, but also by the likelihood that that provisional outcome may be changed. Therefore, even though scoring a goal early has the same objective impact as scoring a goal late, we propose that because the latter may be perceived as less reversible, it will be deemed as more impactful.

H4: Perceived outcome reversibility is a mediator of the late-action effect

Late-Action Effect and Outcome Change

The categorical difference of reaching versus not reaching a goal (e.g., reaching a desired SAT score or falling short) has a disproportional effect on perceptions of impact and motivation (Medvec & Savitsky, 1997). An action is also considered more impactful if it helps reach a discrete objective – whether real, imposed, or imagined (Heath et al., 1999; Kivetz et al., 2006), perhaps because it causes more potent counterfactual thinking (Medvec et al., 1995). We therefore propose that observing whether an action does or does not change the outcome in a *desirable* way will moderate the effect of temporal position on perceived impact. Considerations of counterfactual potency and perceived outcome reversibility both motivate this hypothesis. If people know that the action was followed by a positive change in outcome, then they can imagine a negative counterfactual outcome, compare it with the actual positive outcome, and make judgments of impact based on this comparison, which will favor later actions. However, if an action did not change the provisional outcome, and the overall outcome was negative, then people will compare a counterfactual negative outcome to a real negative outcome. For instance, they may compare a situation in which their basketball team was trailing in score during the game to the overall outcome, which is a loss for their team. Since the contrast will not be as stark, the late-action effect may be moderated. Similarly, it may be harder for people to think that the provisional outcome becomes less reversible if a late action does not change the provisional outcome. If a later action changes the provisional outcome in favourable way, it should be easier for people to think of the outcome as less reversible, and therefore consider the later action as having had a larger causal effect on the overall outcome.

H5: The late-action effect is stronger if the action changes the provisional outcome valence compared to when it does not change it (e.g., only affects the size of a loss).

Study Overview

We present twelve experiments (summarized in Table 1), in which we show that people prefer later action to earlier ones, that this effect is mediated by counterfactual potency and perceptions of outcome reversibility, and moderated by outcome change. Studies 1a and 1b show the main effect in participants from two different countries (U.K. and U.S.A. respectively), using a within-subjects experimental design and two different scenarios. Study 1c tests how closeness to the end of an event increases perceived causal impact. Studies 2a-2c test whether counterfactual potency can be considered a mediator of the late-action effect. In study 2a, we show that the same disproportionate increase in perceived action causal impact observed in study 1c is observed for counterfactual potency. In study 2b, we replicate the main effect using a between-subjects design and show that the late-action effect is due to the higher counterfactual potency of events are closer to the end. In study 2c, we show that inducing counterfactual thinking increases the perceived impact of earlier actions. In study 3, we show that perceptions of impact are also driven by perceptions of outcome reversibility – higher for later actions. Study 4 shows that late-action effect is stronger when it leads to a provisional outcome change. In studies S1a and S1b in the Supplementary Online Materials (SOM), we show that participants prefer getting involved in actions closer to the end of an event compared to earlier ones, and in study S2 we show that later actions are more likely to be considered impactful if they lead to a positive change in outcome, but if they do not, or if an intervening action leads to a negative overall outcome, the late-action effect is attenuated. Finally, Study S3 reports results from a failed intervention instructing participants *not* to think of the counterfactual outcome.

No participant took part in more than one study. For every study, we decided the sample size and the alpha-level of 5% in advance. We report all measures and conditions either in the main paper or in the SOM. In order to maximize statistical power, we decided to use within-subjects designs first, which provide higher statistical power than between-subjects

design keeping alpha, sample size, and effect size constant, and then extend our investigation to between-subjects designs, which provided convergent evidence in favour of our hypotheses. Further, we employed attention checks in several studies to make sure that participants understood instructions and were attentive, and we excluded participants who failed them from analyses. Materials, data and analyses are available at <https://osf.io/ubmyj>.

Table 1

Study overview

Study	N (sample)	Result	Timing factor
1a	199 (Prolific)	Main effect	Within-subjects
1b	406 (MTurk)	Main effect	Within-subjects
1c	151 (MTurk)	Closeness to the end-result has a disproportionate effect on perceived causal impact	Within-subjects
2a	200 (MTurk)	Closeness to the end-result has a disproportionate effect on counterfactual potency	Within-subjects
2b	303 (Prolific)	The effect is mediated by counterfactual potency	Between-subjects
2c	800 (MTurk)	The effect is moderated by inducing counterfactual thinking	Between-subjects
3	588 (MTurk)	The effect is mediated by perceived outcome reversibility	Between-subjects
4	804 (MTurk)	The effect is stronger if the action leads to an outcome change	Between-subjects
S1a	303 (MTurk)	Main effect, choice paradigm	Between-subjects
S1b	299 (MTurk)	Main effect, choice paradigm	Between-subjects
S2	804 (MTurk)	Moderation by intervening action and negative outcome, choice paradigm	Between-subjects
S3	801 (MTurk)	Failed moderation by instructions not to think of counterfactual	Between-subjects

Studies 1a to 1c – Testing Late-Action Effect Within-Subjects

Methods

These three studies followed similar procedures, with the objective of testing our main effect. Study 1a was preregistered at https://aspredicted.org/YEK_BEX but Study 1b and Study 1c were not preregistered.

Study 1a. In Study 1a, 198 participants¹ (British residents recruited from Prolific; 92 males, 104 females, 2 other, $M_{age} = 36.30$, $SD_{age} = 13.47$) were shown a scenario in which a basketball player named Ann scored her only 2-point basket in the 7th minute of a 40-minute basketball game, whereas a player named Barbara scored her only 2-point basket in the 40th minute of a 40-minute basketball game (names were counterbalanced).

Study 1b. In Study 1b, 368 participants² (U.S. residents recruited from Mechanical Turk; 224 male, 142 female, 2 other; $M_{age} = 37.19$, $SD_{age} = 12.36$) read about two salespeople, Ann and Barbara, who were presented as participating in a sales competition lasting 30 days. Both of them made only one sale, worth \$1,000, and their team outcomes were identical, but Ann made her sale on the first day of the competition and Barbara on the 30th and last day of the competition. In Study 1a and 1b, participants were subsequently asked what the impact of Ann's action and of Barbara's action (i.e., the basket or the sale) were on the outcome of the competition, on two items anchored at 1 (*very small*) and at 7 (*very large*). Participants also completed manipulation checks, indicating how early in the competition did Ann and Barbara

¹We preregistered collecting 200 participants, but we only received 199 responses. One participant failed the attention check at the end of the survey, replying "Yes" to the question "Have you ever been to your own funeral?" leaving 198 valid responses.

²We collected 406 responses, but 38 participants failed an attention check (they selected "Yes" as an answer to the question "Have you ever had a fatal heart attack?") and were excluded from analyses.

enact their actions (i.e., the basket or the sale), on an item anchored at 1 (*very early*) and at 7 (*very late*).

Study 1c. In Study 1c, 151 U.S. American participants recruited from MTurk (89 males, 59 females, 3 preferred not to disclose, $M_{age} = 39.63$, $SD_{age} = 12.29$) were presented a scenario describing a basketball player who scored four baskets of equal value in a basketball game (in the 10th, 20th, 30th, and 40th minute). Then, they were asked about the causal impact of each of the four baskets shown below (“What do you think was the causal impact of each basket scored by this player (Andrew Johnson) on the overall outcome of the game?”), on a scale anchored at 1 (*very little*) and 7 (*very large*), and to rate their agreement with the statement “The basket in [10th/20th/30th/40th minute] causes Andrew's team to win the game”, on a scale anchored at 1 (*Totally disagree*) and 7 (*Totally agree*). These two items were averaged per each basket, resulting in four perceived causal impact measures, as all four pairs showed a Pearson’s r higher than .50.

Results

Study 1a. Participants in Study 1a rated the later basket ($M = 6.17$, $SD = 1.29$) as more impactful than the earlier basket ($M = 4.75$, $SD = 1.64$), $t(197) = -10.47$, $p < .001$, $d = 0.74^3$, 95% CI [0.59, 0.90]. Participants rated the later basket ($M = 6.76$, $SD = 0.81$) as coming later in the game compared to the earlier basket ($M = 2.02$, $SD = 0.96$), $t(197) = -47.60$, $p < .001$, $d = 3.38$, 95% CI [3.02, 3.74] confirming the success of our manipulation.

Study 1b. Participants in Study 1b rated Barbara’s sale (closer to the end of the competition, $M = 4.69$, $SD = 1.97$) as more impactful than Ann’s sale (earlier on in the

³A mixed-model ANOVA with counterbalancing as between-subjects factor and timing as within-subjects factor showed that counterbalancing had neither a statistically significant main effect on impact judgments, $F(1, 196) = 1.07$, $p = .30$, $\eta^2 = 0.002$, nor did it significantly interact with timing, $F(1, 196) = 1.98$, $p = .16$, $\eta^2 = 0.005$.

competition, $M = 4.40$, $SD = 1.92$), $t(367) = -3.47$, $p < .001$, $d = 0.18$, 95% CI [0.08, 0.28].

Participants rated Ann's sale ($M = 2.22$, $SD = 1.90$) as coming earlier than Barbara's sale ($M = 6.16$, $SD = 1.45$), $t(367) = -25.68$, $p < .001$, $d = 1.34$, 95% CI [1.20, 1.48] confirming the success of our manipulation.

Study 1c. In Study 1c, a within-subjects ANOVA found an effect of timing on perceived causal impact, $F(3, 450) = 220.06$, $p < .001$, $\eta^2 = .345$. Tukey-corrected post-hoc comparisons showed no statistically significant difference between the perceived causal impact of the 10th minute basket ($M = 3.58$, $SD = 1.59$) and the 20th minute basket ($M = 3.82$, $SD = 1.44$), $p = .14$, $d = 0.38$, 95% CI [0.21, 0.54]; a statistically significant difference between the 20th minute basket and the 30th minute basket ($M = 4.37$, $SD = 1.40$), $p < .001$, $d = 0.69$, 95% CI [0.51, 0.87]; and a larger, statistically significant difference between the 30th minute basket and the 40th minute basket ($M = 6.20$, $SD = 1.20$), $p < .001$, $d = 1.18$, 95% CI [0.97, 1.39]. In favour of a closeness-to-the-outcome account of the effect, the difference between the 30th and the 40th minute basket was larger than all other difference, as shown by the non-overlapping 95% confidence intervals around the standardized effect size for the differences (Cohen's ds). Results for Studies 1a, 1b, and 1c are depicted in Figure 1.

The Effect of Timing on Perceived Causal Impact

Estimated means and 95% confidence intervals are depicted

Figure 1. Results of Study 1a, 1b, and 1c. Means and 95% confidence intervals are depicted.

Discussion

Studies 1a, 1b, and 1c show that later actions are considered more causally impactful than earlier ones, across different participants and situations. In addition, Study 1c shows that *closeness to the outcome* is crucial in increasing perceived causal impact as perceived causal impact increases disproportionately – rather than linearly – with closeness to the end-result. Studies S1a and S1b in the supplementary materials conceptually replicate this finding with a choice paradigm. Next, we investigate the psychological roots of this effect.

Study 2a – Closeness to the Outcome Evokes Disproportionately Higher Counterfactual Potency

The objective of this study was to test if counterfactual potency – an explanation for the late-action effect – becomes increasingly strong as an action takes place close to the outcome. Study 2a was preregistered at https://aspredicted.org/VJG_LRK.

Methods

Participants and procedure. We recruited 201 participants from MTurk (116 males, 83 females, 1 other, 1 preferred not to disclose, $M_{age} = 39.47$, $SD_{age} = 11.29$). No participants failed the attention check at the end of the survey, by replying “Yes” to the question “Have you ever been on the planet Mars?” Participants were presented with same scenario as in Study 1c.

Measures. Participants were asked the same questions about the causal impact of each of the four baskets that we asked in Study 1c (What do you think was the causal impact of each basket scored by this player (Andrew Johnson) on the overall outcome of the game?), on a scale anchored at 1 (*very little*) and 7 (*very large*), and (The basket in [10th/20th/30th/40th minute] causes Andrew's team to win the game), on a scale anchored at 1 (*Totally disagree*) and 7 (*Totally agree*). As a measure of counterfactual potency for each of the baskets, we asked participants “How easy is it to think “what would have happened if Andrew had not scored this basket?” on a scale anchored at 1 (*very hard*) and 7 (*very easy*). Participants completed the measures in random order.

Results

Perceived causal impact. All the correlations between the two measures of causal impact were above a Pearson’s r of .60. We therefore averaged the four couples of items in four causal impact items, as we preregistered. A within-subjects ANOVA with timing as independent variable revealed an effect of timing, $F(3, 600) = 248.77$, $p < .001$, $\eta^2 = .312$. Tukey-corrected post-hoc tests found no statistically significant difference between the causal

impact of the basket in the 10th minute ($M = 3.43$, $SD = 1.64$) and the basket in the 20th minute ($M = 3.67$, $SD = 1.51$), $t(600) = 2.31$, $p = .096$, $d = 0.41$, 95% CI [0.27, 0.55]; a statistically significant difference between the basket in the 20th minute and the basket in the 30th minute ($M = 4.10$, $SD = 1.46$), $t(600) = 4.21$, $p < .001$, $d = 0.54$, 95% CI [0.39, 0.69]; and a statistically significant difference between the basket in the 40th minute ($M = 5.97$, $SD = 1.33$) and the basket in the 30th minute, $t(600) = 18.06$, $p < .001$, $d = 1.14$, 95% CI [0.96, 1.31]. In line with a closeness-to-the-outcome account of the effect, the 95 % confidence intervals around the standardized effect size for the last two differences (Cohen's d s) did not overlap, and a visual inspection of the data in graphical form (Figure 2) shows a marked acceleration of the trend between the 30th and the 40th minute basket causal impact.

Figure 2. The effect of timing on perceived causal impact and counterfactual potency, Study 2a. Estimated means and 95% confidence intervals are depicted.

Counterfactual potency. A within-subjects ANOVA with timing as the independent variable found a significant effect, $F(3, 600) = 58.21$, $p < .001$, $\eta^2 = .099$. Tukey-corrected post-hoc hypotheses found that the counterfactual potency was similar for the 10th minute basket ($M = 3.83$, $SD = 1.96$) and the 20th minute basket ($M = 3.91$, $SD = 1.82$), $t(600) = 0.60$, $p = .93$, $d = 0.09$, 95% CI [-0.04, 0.23]; that there was also no statistically significant

difference between the 20th and the 30th minute basket ($M = 4.15$, $SD = 1.79$), $t(600) = 1.80$, $p = .27$, $d = 0.21$, 95% CI [0.07, 0.35]; but that there was a statistically significant difference between the 30th and the 40th minute basket ($M = 5.37$, $SD = 1.93$), $t(600) = 9.19$, $p < .001$, $d = 0.58$, 95% CI [0.43, 0.73]. As in the case of perceived causal impact, we found a marked acceleration of the trend at the very end of the game, which can be seen both by looking at the 95 % confidence intervals around the standardized effect size for the last two differences (Cohen's d s), which did not overlap, and the data plotted in graphical form (Figure 2).

Exploratory within-subjects mediation analysis⁴. We chose to run mediation with only the last two conditions (30th and 40th basket), as we had not observed statistically significant effects between the other baskets on counterfactual potency. We ran a within-subjects mediation analysis with the MEMORE macro for SPSS (Montoya & Hayes, 2017) with timing as the pseudo-independent variable, counterfactual potency as the mediator, and perceived causal impact as the dependent variable. The analysis yielded a statistically significant indirect effect, $ab (SE) = -0.41$, (0.10), 95% CI [-0.62, -0.23]. This analysis provides support for our theoretical model, as it shows that counterfactual potency mediates the late-action effect.

Discussion

This study shows that closeness to an outcome increasingly impacts both perceived causal impact and counterfactual potency. While counterfactual potency may not be the only cause of the present effect, it seems that nonetheless it contributes greatly to it. This study shows that counterfactual potency walks in lockstep with timing and with perceived causal impact, nuancing the interpretation of this effect's theoretical underpinnings.

⁴ We did not preregister this analysis, unlike the other ones in this study.

Study 2b – Counterfactual Thinking of Alternative Negative Scenarios Mediates Late-Action Effect

The objective of this study is to test whether the effect of later temporal position on perceived impact is mediated by heightened likelihood of counterfactual thought in a between-subjects design. That is, we test if actions closer to the end of an event are more likely to elicit counterfactual thoughts and are therefore perceived as more impactful. Study 2b was preregistered at https://aspredicted.org/ZNR_UVX.

Method

We recruited 303 participants on Prolific (146 male, 155 female, 2 other/prefer not to disclose; $M_{age} = 31.12$, $SD_{age} = 10.05$). Participants were randomly assigned to one of two conditions, early and late action timing. In each condition, they read three scenarios in random order (hockey, investment, and sale), in which we varied the point in time in which an action was performed (in the hockey scenario, a goal was scored in the 10th vs the 60th minute of the game; the investment was secured 95 or 1 business day(s) before a deadline; the sale was completed 30 or 1 business day(s) before a deadline). In each scenario, participants were asked what the impact of the action was on the overall outcome, anchored at 1 (*very small*) and 7 (*very large*) and to what extent they thought about what could have happened if the action had not been performed, anchored at 1 (*not at all*) and 7 (*very much*), as a measure of counterfactual potency⁵. Participants completed the measures in random order.

Results

Perceived impact. A mixed-model ANOVA with scenario as within-subjects factor and timing as between-subjects factor found a within-subjects effect of scenario ($F(2, 602) =$

⁵In our preregistration, we referred to this measure as “counterfactual thinking”. Reviewing the literature suggested that this measure is very similar to counterfactual potency of the THEN-part in its conceptualization and effects, and we decided to change it accordingly.

18.24, $p < .001$, $\eta^2 = .028$), no effect of the interaction between scenario and timing ($F(2, 602) = 18.24$, $p = .084$, $\eta^2 = .004$), and an effect of timing ($F(1, 301) = 31.98$, $p < .001$, $\eta^2 = .049$). On average, participants thought that later actions ($M = 6.00$, $SD = 0.94$) had a higher impact than earlier actions ($M = 5.32$, $SD = 1.16$), $d = 0.65$, 95% CI [0.41, 0.89], replicating the results of Study 1a and 1b using a between-subjects experimental design.

Counterfactual potency, preregistered analyses. A mixed-model ANOVA with scenario as the within-subjects factor and timing as the between-subjects factor found an effect of scenario ($F(2, 602) = 19.46$, $p < .001$, $\eta^2 = .021$), an effect of the interaction between scenario and timing ($F(2, 602) = 3.27$, $p = .039$, $\eta^2 = .004$), and no effect of timing ($F(1, 301) = 2.93$, $p = .088$, $\eta^2 = .006$). The interaction between scenario and timing was due to the investment scenario, which in hindsight does not report a series of events as the other two, and is possibly qualitatively different. We therefore conducted exploratory analyses excluding the investment scenario.

Counterfactual potency, exploratory analyses. A mixed-model ANOVA with scenario as the within-subjects factor and timing as the between-subjects factor (excluding the investment scenario) found no effect of scenario ($F(1, 301) = .15$, $p = .70$, $\eta^2 < .001$), no statistically significant effect of the interaction between scenario and timing ($F(1, 301) = .62$, $p = .43$, $\eta^2 < .001$), and an effect of timing ($F(1, 301) = 5.68$, $p = .018$, $\eta^2 = .014$). On average, participants reported a higher degree of counterfactual thinking in the later condition ($M = 4.54$, $SD = 1.65$) compared to the earlier condition ($M = 4.10$, $SD = 1.55$), $d = 0.27$, 95% CI [0.05, 0.50].

Preregistered mediation analysis. A mediation including all scenarios (PROCESS macro for SPSS, 5000 bootstraps, Hayes 2013) found no indirect effect of action timing on perceived impact through reported counterfactual potency, ab (SE) = 0.03 (.022), 95% CI [-0.004; 0.08]. This is not surprising, in light of the fact that we observed a significant effect for

perceived impact, but no significant effect for counterfactual thinking. Again, we proceeded to run an exploratory mediation analysis excluding the investment scenario.

Exploratory mediation analysis. A mediation analysis excluding the investment scenario (PROCESS macro for SPSS, 5000 bootstraps, Hayes 2013) did find an indirect effect of action timing on perceived impact through counterfactual potency, ab (SE) = 0.049 (0.030), 95% CI [0.004; 0.119].

Figure 3. The effect of action timing on perceived impact and counterfactual thinking per scenario, Study 2b. Means and 95% confidence intervals are depicted.

Discussion

This study replicated the effect of timing on perceived impact, using a between-subjects experimental design. Exploratory analyses showed that later actions induce a higher degree of counterfactual potency, and supported the notion that the effect of time on perceived

impact is mediated by the degree of counterfactual potency. Overall, these results indicate a psychological cause of late-action effect: imagining what would have happened if the action had not been completed is higher for later actions than earlier ones. Next, we sought to find additional evidence for this notion going beyond a statistical test of mediation (Fiedler et al., 2018; Spencer et al., 2005).

Study 2c – Inducing Counterfactual Thinking Moderates the Late-Action Effect

The objective of this study is to replicate the mediation of late-action effect by counterfactual thinking, and to test whether inducing counterfactual thinking in a moderation-of-mediation design (Spencer et al., 2005) can increase the perceived impact of earlier actions. Study 2c was preregistered at https://aspredicted.org/HID_JNO.

Method

We recruited 800 participants from Amazon Mechanical Turk (428 male, 372 female, $M_{age} = 38.21$, $SD_{age} = 12.40$). We orthogonally manipulated two factors, timing (early vs. late) and counterfactual thinking induction (induced vs. not induced), thereby randomly assigning participants to one of four conditions. Participants read a scenario in which a player named Andrew had scored his only basket of a game in either the 13th minute (early condition) or the 40th minute (late condition) of a 40-minute basketball game. In all cases, participants were told that in the end, Andrew's team had won the game by one point. Then, about half of the participants (those who were induced into counterfactual thinking) were instructed to "Please stop and think what would have happened if Andrew did not score that basket", whereas the other half was not given any additional instructions and continued with the study. As a measure of perceived impact, we asked people what the impact of Andrew's basket was, on a 7-point item anchored at 1 (*Very Small*) and 7 (*Very large*); as a measure of counterfactual potency, we asked participants whether they considered what would have happened if Andrew

had not scored that basket, on a 7-point item anchored at 1 (*Not at all*) and 7 (*Very much*). Finally, as a manipulation check, we asked participants how late in the game did Andrew score, also on a 7-point item anchored at 1 (*Very early*) and 7 (*Very late*).

Results

Manipulation check, timing. An independent-samples t-test using timing as the independent variable revealed a statistically significant effect and a large effect size, as the earlier action was considered earlier in time ($M = 3.36$, $SD = 1.60$) compared to the later action ($M = 6.54$, $SD = 0.96$), Welch's $t(661.79) = -34.15$, $p < .001$, $d = 2.40$, 95% CI [2.22, 2.58].

Counterfactual potency. A 2 X 2 between-subjects ANOVA with timing and counterfactual thinking induction as factors revealed a main effect of timing ($F(1, 796) = 15.86$, $p < .001$, $\eta^2 = .019$), indicating that later actions induced higher levels of counterfactual potency and a main effect of counterfactual thinking induction ($F(1, 796) = 27.69$, $p < .001$, $\eta^2 = .033$), indicating that participants reported higher levels of counterfactual potency when they were asked to do so. Importantly, we found the predicted timing by counterfactual thinking induction interaction ($F(1, 796) = 7.24$, $p = .007$, $\eta^2 = .009$), indicating that asking people to engage in counterfactual thinking significantly increased counterfactual potency in the early condition (not induced: $M = 4.34$ $SD = 2.00$; induced $M = 5.37$, $SD = 1.74$, $p < .001$, $d = 0.54$, 95% CI [0.34, 0.74]), but not in the late condition (not induced $M = 5.20$, $SD = 1.77$; induced $M = 5.53$, $SD = 1.69$, $p = .27$, $d = 0.19$, 95% CI [-0.01, 0.39]). Results are depicted in Figure 4.

Perceived impact. A 2 X 2 between-subjects ANOVA with timing and counterfactual thinking induction as factors revealed a main effect of timing ($F(1, 796) = 109.88$, $p < .001$, $\eta^2 = .119$), indicating that later actions were considered more impactful; a

main effect of counterfactual thinking induction ($F(1, 796) = 12.30, p < .001, \eta^2 = .013$), indicating that participants reported higher levels of action impact when they were asked to engage in counterfactual thinking; and the predicted position by counterfactual thinking interaction ($F(1, 796) = 6.76, p = .009, \eta^2 = .007$), indicating that inducing counterfactual thinking significantly increased perceived impact in the early condition (not induced $M = 4.14, SD = 1.89$; induced $M = 4.87, SD = 1.79, p < .001, d = 0.40, 95\% CI [0.20, 0.60]$) but not in the late condition (not induced $M = 5.71, SD = 1.34$; induced $M = 5.81, SD = 1.58, p = .92, d = 0.07, 95\% CI [-0.13, 0.27]$). Results are depicted in Figure 4.

Figure 4. The effect of timing and counterfactual thinking induction on counterfactual potency and perceived causal impact, Study 2c. Means and 95% confidence intervals are depicted.

Moderated mediation analysis. We conducted a moderated mediation analysis using model 7 of the PROCESS macro of SPSS (5,000 bootstraps, Hayes, 2013), with timing as the independent variable, reported counterfactual potency as the mediator, perceived impact as the dependent variable, and counterfactual thinking induction as the moderator of the relationship between timing and reported counterfactual potency⁶. We found a moderated mediation effect, $ab (SE) = -0.19 (0.08)$, 95% CI $[-0.34; -0.05]$, indicating that the indirect effect of timing on perceived impact, mediated by counterfactual potency, was reduced when participants were instructed to think about what would have happened if the basket had not been scored. The indirect effect of timing on perceived impact through counterfactual potency was statistically significant when counterfactual thinking was *not* induced, $ab (SE) = 0.23 (0.06)$, 95% CI $[0.12; 0.36]$, but it was smaller and not statistically significant when counterfactual thinking was induced, $ab (SE) = 0.05 (0.05)$, 95% CI $[-0.05; 0.14]$.

Discussion

Using both mediation analysis and a moderation-of-mediation experimental design, this study shows that inducing counterfactual thinking increases the perceived impact of earlier action, but not of later actions. These results are consistent with the notion that counterfactual potency is stronger for later actions than earlier ones, and therefore a cause of the late-action effect. Consequently, later actions are considered more impactful than earlier actions because they elicit higher counterfactual potency. Next, we tested evidence for our second proposed mediator, perceived outcome reversibility.

Study 3 - Perceived Outcome Reversibility as a Mediator of the Late-Action Effect

⁶ While it could be argued that the counterfactual potency measure can be considered a manipulation check (specifically, in the condition where participants were instructed to think about the counterfactual), we nonetheless performed these preregistered analyses because counterfactual potency is the mediator between action timing and perceived action impact that we proposed in our theorizing.

This study tests whether actions later in a timeframe are considered of higher impact compared to actions coming earlier because the provisional outcome that they produce seems more irreversible. We test this idea across two situations – software sales and basketball games.

Method

This study consisted of two broadly similar parts, where participants were exposed to similar conditions. We analyze and report the study parts separately in the SOM. We recruited 588 participants on Mechanical Turk (327 female, 261 male, $M_{age} = 39.68$, $SD_{age} = 14.87$). They were randomly assigned to one of two timing conditions (early vs. late). Participants read a scenario where Robert, a software salesman, participated in a sales competition lasting 30 days, and he either completed a sale that put his team in first position at the 10th day (early condition) or at the 29th day (late condition).

Participants then had to evaluate the reversibility of the provisional outcome (“Can Robert's team still lose after Robert completed his sale?”, anchored at 1 (*Not at all*) and 7 (*Very much*)), and the impact of Robert’s sale on the total outcome (“What is the impact of Robert's action on the total outcome?”, anchored at 1 (*Very small*) and 7 (*Very large*)). Further, participants rated Robert on other dimensions, which we report in full in the supplementary materials. For the Basketball scenario, participants were assigned to the same (early or late) condition as in the Software scenario. Those who read the early (late) version of the Software scenario were shown the early (late) version of the Basketball scenario. They read a scenario where Andrew, a basketball player, scored a basket either in the 13th minute (early condition) or the final minute (late condition) of a basketball game. Participants then had to evaluate the reversibility of the outcome, by answering the question “Can Andrew’s team still lose after Andrew made his basket?” on a 7-point item anchored at 1 (*Not at all*) and 7 (*Very much*), and Andrew’s impact on the total outcome by answering the question “What is

the impact of Andrew's action on the total outcome?" on a 7-point item anchored at 1 (*Very small*) and 7 (*Very large*). Further, participants had to rate Andrew on other dimensions. We report and analyse them in the supplementary materials.

Results

Perceived outcome reversibility. A 2 (timing: early vs. late, between-subjects) X 2 (scenario: basketball vs. software sales, within-subject) mixed-model ANOVA found an effect of scenario ($F(1, 586) = 26.30, p < .001, \eta^2 = .011$), a scenario by timing mixed interaction ($F(1, 586) = 85.49, p < .001, \eta^2 = .034$), and an effect of timing ($F(1, 586) = 102.40, p < .001, \eta^2 = .107$). Overall, in both scenarios (sales: $d = 0.36$, 95% CI [0.20, 0.52]; basketball: $d = 1.01$, 95% CI [0.84, 1.18]), participants thought that the later actions implied a less reversible outcome, although the effects were stronger in the basketball scenario than in the software sales scenario. Results are summarized in Figure 5.

Perceived impact. A 2 (timing: early vs. late, between-subjects) X 2 (scenario: basketball vs. software sales, within-subject) mixed-model ANOVA found an effect of scenario ($F(1, 586) = 13.67, p < .001, \eta^2 = .006$), a scenario by timing mixed interaction ($F(1, 586) = 13.67, p < .001, \eta^2 = .047$), and an effect of timing ($F(1, 586) = 107.70, p < .001, \eta^2 = .108$). Overall, in both scenarios (sale: $d = 0.24$, 95% CI [0.08, 0.40]; basketball: $d = 1.21$, 95% CI [1.03, 1.39]), participants thought that the later actions were more impactful, albeit the effect was stronger in the basketball scenario. Results are summarized in Figure 5. Next, we conducted two mediation analyses (for each scenario separately) to test whether perceived outcome reversibility is a possible cause of the late-action effect.

Mediation analyses. For each scenario, we conducted a mediation analysis using model 4 of the PROCESS SPSS macro v3.0 (Hayes 2013) with timing as the independent variable, outcome reversibility as the mediator, and impact as the dependent variable. This

yielded a significant bootstrap interval, indicating an indirect effect of timing on perceived impact through perceived outcome reversibility, for both scenarios (sales: ab (SE) = 0.07 (0.03), 95% CI [0.02; 0.13]; basketball: ab (SE) = 0.39 (0.08), 95% CI [0.24; 0.55]) Both mediation analyses provide support for the notion that differences in perceived outcome reversibility for early versus late actions causes the late-action effect.

Figure 5. The effect of timing on perceived impact and perceived outcome reversibility, Study 3. Means and 95% confidence intervals are depicted.

Discussion

This study shows that actions closer to the endpoint of a time window are perceived as more impactful because the temporal closeness to an endpoint makes a provisional (i.e. intermediate) outcome seem less reversible. Next, we sought to reduce the late-action effect by introducing a moderator: outcome change.

Study 4 – Late-Action Effect is stronger if the Action Leads to an Outcome Change

The objective of this study is to test whether a provisional outcome change (vs. no outcome change) moderates the impact of timing on perceived impact. Across two different scenarios, we manipulate whether the action leads to a positive change in outcome valence (from negative to positive) or no change in outcome valence (from negative to negative). We expect a bigger effect of timing on the perceived impact of an action when there is a positive change in outcome valence, since outcome reversibility should be higher if the later action provokes a change in the provisional outcome, but not so much if the action does not provoke a change. Similarly, counterfactual potency for late actions should also be higher if the action corresponded to a provisional outcome change, as it may make it easier for participants to vividly imagine alternative scenarios. This study, consisted of two broadly similar parts, where participants were exposed to different scenarios (software sales and basketball, as in Study 3). We collected additional measures after both scenarios, which we present and analyse in the supplementary materials.

Method

Participants. We recruited 804 participants on Mechanical Turk (396 male, 408 female, $M_{age} = 37.10$, $SD_{age} = 13.57$). Thirty out of 804 participants (3.7%) failed an attention check by replying “Yes” to the question “Have you ever had a fatal heart attack?”. We excluded them from subsequent analyses, which left a sample of 774 participants (373 male, 401 female, $M_{age} = 36.57$, $SD_{age} = 16.63$).

Procedure

Sales scenario. Participants were shown a scenario similar to those employed in study 3. We manipulated two factors between-subjects: timing (early vs. late) and outcome change (positive change vs. no change). In the positive outcome change condition, participants were

told that Robert's action would lead to his team jumping to first position; in the no change condition, his team would stay in second position. After they read the scenario, participants were asked: "What is the impact of Robert's action on the competition outcome?" anchored at 1 (*Very small*) and 7 (*Very large*), and "How impactful is Robert's sale on the competition outcome?" anchored at 1 (*Not at all*) and 7 (*Very much*). These items showed high reliability (Cronbach $\alpha = .89$) and were therefore averaged in a perceived impact index.

Basketball scenario. In the positive outcome change condition, participants were told that Andrew's basket would put his team ahead in the score; in the no change condition, his team would keep trailing even after he scored the basket. After they read the scenario, participants were asked: "What is the impact of Andrew's action on the game outcome?", anchored at 1 (*Very small*) and 7 (*Very large*), and "How impactful is Andrews' basket on the competition outcome?" anchored at 1 (*Not at all*) and 7 (*Very much*). These items showed a high Cronbach α (.92) and were therefore averaged in a perceived impact index.

Results

Perceived impact. We conducted a 2 (timing: early vs. late, between-subjects) X 2 (outcome change: positive change vs. no change, between-subjects) X 2 (scenario: basketball vs. software salesman, within-subjects) mixed-measures ANOVA, which found an effect of scenario, indicating an overall higher impact in the basketball scenario ($F(1, 770) = 63.96, p < .001, \eta^2 = .010$); a scenario by timing mixed interaction ($F(1, 770) = 80.60, p < .001, \eta^2 = .013$); a scenario by outcome change mixed interaction ($F(1, 770) = 10.03, p < .001, \eta^2 = .002$); and a three-way scenario by outcome change by timing mixed interaction ($F(1, 770) = 5.85, p = .016, \eta^2 = .001$). Importantly, we found main effects for timing ($F(1, 770) = 78.62, p < .001, \eta^2 = .027$), for outcome change ($F(1, 770) = 19.91, p < .001, \eta^2 = .007$), and the predicted timing by outcome change interaction ($F(1, 770) = 26.23, p < .001, \eta^2 = .009$). The late-action effect was larger when the action had changed the outcome favorably (sale: $d =$

0.38, 95% CI [0.15, 0.58]; basketball: $d = 1.27$, 95% CI [1.05, 1.49]), compared to when it did not change the provisional outcome favorably (sale: $d = 0.04$, 95% CI [-0.16, 0.24]; basketball: $d = 0.46$, 95% CI [0.26, 0.66]), in both the basketball and the salesman scenarios, albeit the effect sizes were larger in the basketball scenario. Notably, these results were driven by a decrease in the perceived impact of the later action in the “no change” condition, while the perceived impact of the earlier action was not visibly affected by outcome change. These results are presented in Figure 6.

Figure 6. The effect of timing and outcome change on perceived impact, Study 4. Means and 95% confidence intervals are presented.

Discussion

This study found that later actions are more likely to be considered more impactful if they lead to a positive outcome change, compared to no change. We found that change in the provisional outcome is a moderating factor of the late-action effect. This study therefore complements previous ones in showing that outcome valence change is a crucial component of this effect. Note that one possible limitation of this study is that we did not present participants with a negative outcome change (for instance, from a winning or tie situation to a losing situation). However, we expect similar effects on the overall causal contribution, albeit negative in valence. For instance, a basketball player making a grave mistake may be considered more responsible for their teams' loss later on in the game rather than earlier in the game.

General Discussion

In a set of twelve experiments, we presented a late-action effect and we explored its causes, consequences, and boundary conditions. Study 1a and 1b showed the main effect using a within-subjects experimental design, and study 1c showed that closeness to the end of an event increasingly drives judgments of causal impact. Study 2a shows that counterfactual potency, like judgments of causal impact, is increasingly affected by closeness to a result, and likely drives the late-action effect. In Study 2b, we replicated the main effect with a between-subjects design and suggested that this effect is caused by the higher potency of counterfactuals for later actions. In Study 2c, we moderated the late-action effect by inducing counterfactual thinking, such that earlier actions would evoke more potent counterfactuals and inch closer to later actions in terms of perceived impact. In Study 3, we showed that perceived outcome reversibility also mediates the late-action effect. Study 4 showed that the late-action effect is reduced if the late action does not cause a temporary outcome change. Studies S1a and S1b in the SOM replicated Studies 1a-1b with a choice paradigm and in several other

contexts, and Study S2 showed that the late-action effect is reduced if another action intervenes between the late action and the final, unfavorable outcome, strengthening both the perceived reversibility and the counterfactual potency explanation of this phenomenon. In Study S3, we unsuccessfully attempted to instruct participants *not* to think of a counterfactual in order to moderate the effect.

Theoretical Contribution

Our research contributes to the understanding of the psychological underpinnings of causality (Faro et al., 2010; Spellman, 1997). Specifically, we contribute to the understanding of action timing on its perceived contribution on an overall outcome (Henne et al., 2021; Lagnado et al., 2013; Miller & Gunasegaram, 1990; Stephan et al., 2020; Zultan et al., 2012). We show that later actions are perceived to be more impactful than earlier ones. In fact, timing looms so large in causal impact judgments that people view later actions as having a larger causal impact than objectively more impactful, earlier actions. This is a novel addition to a long line of research which has looked at the effect of different types of timing on the perceived causal effect of actions on total outcomes, but not at their closeness to the end of an event. Further, previous research suggested that actions coming later in a sequence may evoke stronger emotional reaction, but did not distinguish sequence from closeness to an end-outcome (Miller & Gunasegaram, 1990) or yielded results that are consistent with both accounts (Segura et al., 2002). We show that is not just “sequence” (i.e., whether one event precedes another) that matters, but rather closeness to the end of the event. Our research therefore fills this theoretical gap by clarifying this important distinction.

Counterfactual thinking and counterfactual potency are often cited as a major contributors to causality evaluation (e.g., Spellman & Mandel, 1999; Petrocelli et al., 2011). The present work shows that action timing is an antecedent of counterfactual potency (Petrocelli et al., 2011), such that later actions elicit higher counterfactual potency than earlier

ones, and therefore have a higher perceived causal contribution on an overall outcome. This is an addition to a large stream of research that identifies factors contributing to counterfactual thinking and counterfactual potency, such as rarity (Kahneman & Miller, 1986; MacRae, 1992; Parker et al., 2020) and emotional valence (Epstude & Roese, 2008; Roese & Hur, 1997). Again, it is important to note that counterfactual potency of later actions is due to closeness to the end of an event rather than a mere later position in a sequence.

Previous research had not measured the extent of counterfactual thinking or counterfactual potency, but rather relied on proxies such as feelings of blame and guilt (Miller & Gunasegaram, 1990), which event participants would mutate (Walsh & Byrne, 2004) or would focus on (Segura et al., 2002). The present investigation, both by measuring and by manipulating counterfactual thinking and counterfactual potency, filled this gap in the literature. We showed that counterfactual potency tracks timing and therefore closely influences causality judgments. Further, we showed it is possible to manipulate causality judgments by inducing participants into thinking of a specific counterfactual, that is, what would have happened to the outcome (e.g., a basketball game) had the action in question (e.g., a three-point basket) not happened. This result contributes to the literature about counterfactual thinking and counterfactual potency by introducing an easy way to manipulate it.

We show that when an action makes a provisional outcome seem less reversible, people believe it has a larger effect on an overall outcome. In doing so, we introduce perceived outcome reversibility as a consequence of action timing and a cause of its heightened causal impact. This adds to the research about the antecedents of perceived contribution of single actions to an overall outcome, which has considered causal forces such as faulty information integration (Alves & Mata, 2019), the sequencing of pleasant and unpleasant experiences (Ariely, 1998; Fredrickson & Kahneman, 1993; Kahneman,

Fredrickson, Schreiber, & Redelmeier, 1993), and the “pivotal” character of the actions (Lagnado et al., 2013; Zultan et al., 2012) but has neglected to investigate factors like perceived outcome reversibility.

Future Research and Limitations

The goal-gradient literature has found that people are more likely to act when they are closer to a goal compared to when they are far away (Cryder et al., 2013; Kivetz et al., 2006). The explanation of this phenomenon has hinged on the higher relative value that actions closer to the end-goal have compared to actions farther away, but has neglected to investigate whether people’s thoughts are different about actions further or closer to a goal. The present work hints at a psychological mechanism underlying this phenomenon: people may be more likely to act closer to a goal because they are more likely to generate counterfactual thoughts about a failed goal when the goal is closer rather than farther, and because they perceive the overall outcome as less reversible. Future research may therefore investigate whether inducing counterfactual thinking or perceived outcome reversibility can attenuate or amplify the goal-gradient effect.

The late-action effect that we document in this paper may affect various everyday life judgments. For instance, in basketball, players that are considered ‘clutch’ are the ones that seem to have the ability of deciding close games in their favor. Yet, statistical analysis shows that most of the ‘clutch’ performance can be explained by previous skill, is highly affected by sheer luck and not predictive of future success (Solomonov et al., 2015), may even be worse than normal performance (Bar-Eli & Tractinsky, 2000; Solomonov et al., 2015), and it does not seem to be predicted by age or experience (Gómez et al., 2018) indicating an overvaluation of ‘clutch’ players. Similarly, in collective decision processes (e.g., brainstorm), suggestions close to a final decision may be viewed as more consequential to reach that decision. Having “the last word” is a commonly used saying to signify deciding or

putting an end to a discussion. Our paper explains the reverence of ‘closers’ in sports, business, and other domains, in terms of a perception of the impact of late actions on favorable outcomes. It is unclear whether such perception is accurate or biased. While this goes beyond the scope of the present paper, we believe that investigating whether and when the late-action effect is harmful to performance and may therefore be considered a bias is an exciting direction for future research. For instance, one may investigate whether people who exhibit the late-action effect to a larger extent are better or worse performers than people who exhibit it to a smaller extent.

We recruited participants from the U.S.A and the U.K. for this study. We are not aware of research showing marked differences in research about timing and perceived causality that are caused by culture or country of origin of the participants. Nonetheless, we hope future research attempts to extend our results to other countries and cultures. Another limitation pertains to the type of scenarios we used, which were always retrospective and followed a controlled experimental paradigm (as is common in research about causality attributions; see e.g., Henne et al., 2021; Spellman, 1997). Future research may investigate how changing the specifics of the experimental situation may affect late-action effect. For instance, where would participants spend their limited if they have to choose between early and late actions in “live” action (e.g., buying a stamp earlier rather than later when finishing their collection)? We also used exclusively a third-person perspective. An extension of this work could compare a third-person perspective with a first-person perspective to test potential moderators of the late-action effect.

Conclusion

We opened this paper with the description of Luka Doncic’s three-point basket. Why was it such an exciting event? After all, it still counts the same number of points as a similar basket scored, say, in the second quarter of a basketball game. At this point, we may offer an

answer. “Buzzer-beaters” and other late-actions seem so arresting because they make people think “what could have happened if...” much more than second-quarter baskets and other earlier actions, and because they seem to make the general outcome irreversible.

Open Practices

Materials, data and analyses are available at <https://osf.io/ubmyj>.

Study 1a was preregistered at https://aspredicted.org/YEK_BEX, but Study 1b and Study 1c were not preregistered. Study 2a was preregistered at https://aspredicted.org/VJG_LRK. Study 2b was preregistered at https://aspredicted.org/ZNR_UVX. Study 2c was preregistered at https://aspredicted.org/HID_JNO. Study 3 and 4 were not preregistered. Study S1a and S1b were not preregistered. Study S2 was preregistered at <https://aspredicted.org/4eh6i.pdf>. Study S3 was preregistered at https://aspredicted.org/XIX_HRU.

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