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Present Bias and Short-Form Content Addiction on Social Media Platforms: A Game-Theoretic Model

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Abstract

The video length limit is an important operational design decision made by social media platforms. Many students and young adults are drawn to short-form videos on social media platforms such as TikTok and Instagram. This study explores the role of present bias played in developing addiction. Through building and analyzing economic models, we theoretically demonstrate that present bias contributes to addiction. Viewers with a high present bias are more likely to be addicted. Furthermore, we investigate how the short form of videos on TikTok interacts with present bias and impacts addiction. We find that the short form extends addiction to viewers with a lower present bias. Our analytical model and results provide a theoretical explanation for empirical observations of short-form video addiction.

Keywords
Videos, TikTok, Addiction, Short-form, Present Bias

1. Introduction
In this digital age, industrial engineering and operations management (IE/OM) extends to new decisions. On social media platforms, the design of digital platforms involves a series of operational decisions that shape how users interact with the system. Among these decisions, the length limit of video content is one of the most important operational design decisions. Similar to service design, queue design, or product design decisions studied in IE/OM, platform designers determine the video length limit that influences user behavior and system performance. In short-form video platforms, video length is intentionally constrained to encourage rapid and continuous consumption. For example, videos on TikTok were originally limited to 15 seconds, while Instagram introduced Reels with videos typically around 15–30 seconds, and YouTube launched Shorts with a maximum length of about 60 seconds. These limits allow users to receive entertainment rewards more frequently within a given time horizon and quickly move to the next piece of content. In this sense, video length functions as a key design variable in the platform's content delivery system. Studying how such operational design choices interact with human behavioral biases, therefore, leads naturally to a behavioral operations perspective on digital platform design.

Teens and young adults are increasingly drawn to platforms that provide short-form videos, such as TikTok, Instagram Reels, and YouTube Shorts. A survey of 11,267 Chinese university students shows that 80.32% watched short videos frequently and 26.48% spent $2-5$ hours daily on such content (Jiang & Li, 2022). Excessive time spent on short videos can delay important tasks, such as studying or completing assignments, and lead to poor academic performance (Devakumar & Swathi, 2020). Over time, this cycle can foster patterns of addiction.

We aim to understand the psychology behind the addiction to short-form entertainment content. Suppose a student is choosing between watching TikTok videos and doing homework. Watching TikTok videos offers immediate rewards, e.g., enjoyment from the entertainment, but doing homework generates a greater delayed reward later, e.g., getting a good grade. A person addicted to TikTok would choose watching TikTok over doing homework, even though doing homework generates greater rewards.

In psychology, present bias (Laibson, 1997; O'Donoghue & Rabin, 1999) refers to the systematic tendency for individuals to place disproportionate weight on immediate rewards relative to future benefits, even when the delayed rewards are larger. This bias is often modeled through quasihyperbolic discounting, in which the present is valued more heavily than any point in the future, leading to time-inconsistent preferences. Present bias has been widely documented in contexts such as savings behavior, health decisions, and media consumption.
This paper explores the role that present bias played in short-form video addiction and the impact of videos being short form. Specifically, we ask: How does present bias influence the consumption patterns of short-form videos among students and young adults? How does shortening the duration of the videos impact the likelihood of addictive consumption?

We built two models: a benchmark model and an updated model with shortened duration for videos. We show that present bias contributes to addictive consumption of immediate-rewarding activities such as TikTok videos. Viewers with high present bias are more likely to be addicted. Furthermore, through analyzing and comparing the two models, we find that reducing the duration of videos increases addiction for viewers with lower present bias. Thus, short form expands the set of addicted viewers.

Our study provides a formal analytical economic model that demonstrates how present bias and short form interact to influence an individual's decision-making process. The findings of our research offer a psychological and theoretical explanation for the commonly observed short-form video addiction.

2. Literature Review

Our research is related to two literature streams. One is related to present bias and the other is about addiction to short-form videos.

2.1. Literature Review of Present Bias

Standard economic models usually assume time-consistent intertemporal preferences, which means that a person's preferences or choices remain stable over time (O'Donoghue and Rabin 2001). In reality, a lot of evidence shows that preferences can be time-inconsistent. An individual may initially plan to choose a larger but later reward compared to a smaller but sooner reward. However, this choice may be reversed when the smaller but sooner reward becomes immediate as time goes by (Sayman and Öncüler 2009). Such a time-inconsistent preference reflects present bias, which is the tendency to prefer immediate rewards (O'Donoghue and Rabin 2015).

Prior literature examines present bias from various perspectives: Laibson (1997) models savings behavior, showing how commitment devices can curb overconsumption. O'Donoghue and Rabin (1999, 2001) demonstrate that present bias leads to procrastination. Brunnermeier et al. (2017) develop a structural theory connecting time-inconsistent beliefs to commitment preferences. Gao and Guo (2024) analyze optimal contracts for screening consumers with heterogeneous beliefs on time preferences.

We contribute to the present bias literature by adding one more perspective: addiction. Through economic modeling, we formally demonstrate that present bias contributes to addiction. Our result helps to explain the commonly observed addiction phenomenon among students and young adults, since they are not mature enough and likely to have a high present bias.

2.2. Literature Review of Short-form Content Addiction

Quite a few papers study short video addiction using empirical methods. Caponnetto et al. (2025) provide a systematic review on studies related to TikTok addiction. One group of studies use experiments and survey to explore the motivational factors for TikTok addiction from various perspectives such as algorithm, social network, humor, and so on (Xing et al. 2019, Bossen & Kottasz 2020, Bhandari & Bimo 2020, Omar & Wang 2020, Meng & Leung 2021, Gu et al. 2022, Qin et al. 2022, Yao et al. 2023, Guilu et al. 2023). Another group studies the consequences of TikTok addiction in young people from the perspectives of academic performance, mental health, depressions, and family environment (Devakumar & Swathi 2020, Chao et al. 2023, Rogowska & Cincio 2024).

The above papers are empirical studies. As far as we know, we are the first analytical study to explore the interaction between short-form and present bias in short-form video addiction. We show that short form extends addiction to viewers with a lower present bias and thus expands the set of viewers who become addicted. Our result partially explains why so many people become addicted to viewing short videos, whereas they may not be addicted to long videos.

3. Model Framework

Consider a student facing a sequence of choices that yield either immediate or delayed rewards. For example, she may watch short videos on social media, which provide instant enjoyment, or complete her homework, which offers no immediate payoff but generates benefits in the future. Suppose there are three periods. Watching a video in a given period delivers an immediate reward at the end of that period, while doing homework produces a delayed reward at the end of the following period. The student selects what to do in periods 1 and 2. In the third period, no action is required, but a reward is realized if she completes homework in the second period.
Let the reward in period t be denoted u_t, where $t \in \{1,2,3\}$, and let rewards depend on the chosen action. If the student watches TikTok in period 1, she receives $u_1 = v$ at the end of that period. Alternatively, if she completes homework in period 1, she obtains $u_1 = 0$ at the end of that period and $u_2 = a$ at the end of period 2, where $a > v$. The student aims to maximize the total utility over time.

The student is present-biased, that is, she weighs the present reward more than the future rewards. Hence, total utility is not the simple sum of per-period rewards; Instead, future rewards are discounted. Following literature (Laibson 1997 and O'Donoghue and Rabin 2001), we adopt the quasihyperbolic discounting formulation, i.e., the (β, δ)-model, with parameters $0 < \beta \leq 1$ and $0 < \delta \leq 1$, to capture the total utility from period t to T.

$$u_t + \beta \sum_{s=t+1}^{T} \delta^{s-t} u_s,$$

In the total utility function, δ represents the time-consistent discount factor that captures standard time depreciation, while β reflects the time-inconsistent discount factor arising from present bias. When there is no present bias, $\beta = 1$. When a person has present bias, $0 < \beta < 1$. In this paper, we focus on the time-inconsistent discount caused by present bias. To isolate the effect of present bias, we set $\delta = 1$, thereby abstracting from time-consistent discounting[1].

At the start of period 1, the total utility is

$$u_1 + \beta(u_2 + u_3).$$

The future rewards in periods 2 and 3 are discounted by β, a reverse index for present bias, where a higher β indicates weaker present bias (i.e., greater rationality). The decision maker chooses the action that maximizes $u_1 + \beta(u_2 + u_3)$. For example, suppose the student watches TikTok videos in period 1 and studies in period 2. The resulting total utility is

$$v + \beta(0 + a)$$

consisting of an immediate reward v at the end of period 1, no reward after studying in period 2, and a delayed reward a at the end of period 3.

[1] Our results and insights remain the same qualitatively if there exists time-consistent discounting, i.e., $\delta < 1$.

At the beginning of period 2, the decision maker re-optimizes by choosing the action for that period to maximize the remaining total utility,

$$u_2 + \beta u_3.$$

Due to present bias, this evaluation differs from the previous period's perspective, where the continuation reward was assessed as $\beta(u_2 + u_3)$. The difference arises because period 2 has now become the present, so its reward is no longer discounted.

This shift generates time inconsistency in preferences and may lead to a revision of plans. In the above example, the student initially planned to study in period 2, anticipating zero payoff at the end of period 2, but a delayed reward a in period 3. However, once period 2 arrives, the student may reconsider: period 2 reward is no longer discounted, and having zero reward in period 2 may not seem optimal in maximizing the total utility $u_2 + \beta u_3$. Instead, the student may switch to watching TikTok videos rather than planned studying so that she can receive an immediate reward $\mu_2 = v$. This creates time-inconsistent decisions. If the student keeps watching TikTok videos, addiction occurs.

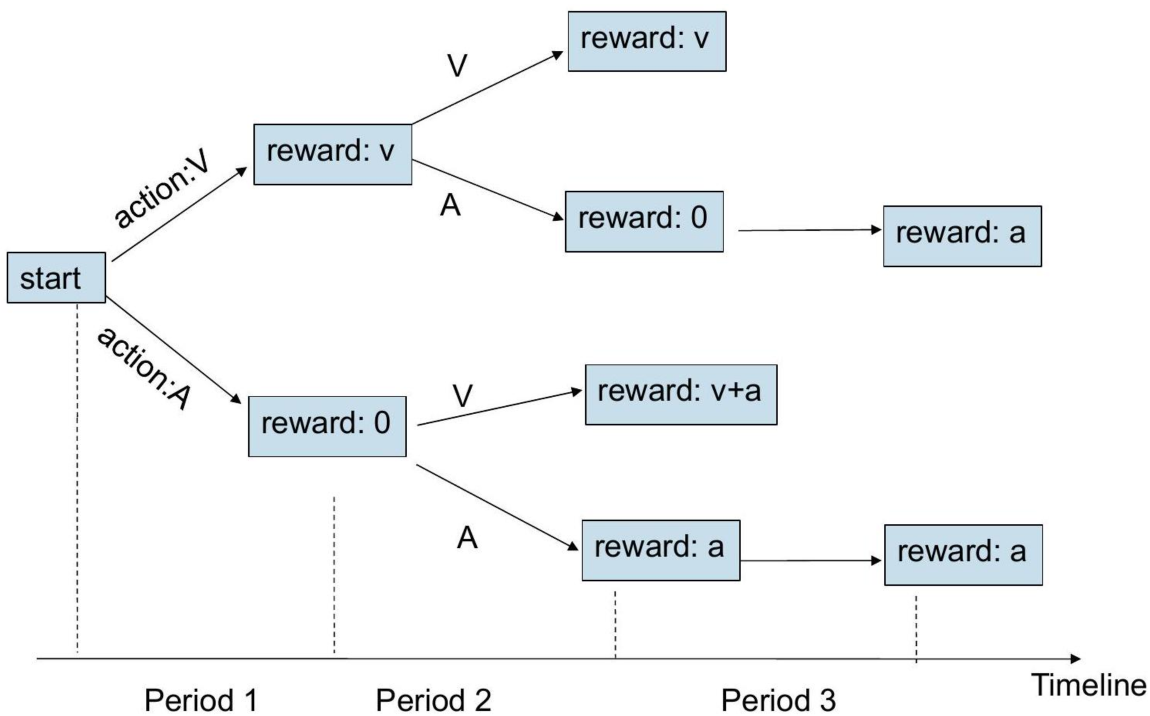

Figure 1. Actions and corresponding rewards in the benchmark model

4. Analysis of the Benchmark Model

To help our presentation, we focus on the previous example where the action with immediate reward v is watching an entertaining video, denoted by V; the action with a delayed reward is denoted as A (abbreviating for alternatives such as doing homework), with a reward of a realized at the end of the following period. That is, the reward for A is always delayed by one period. A decision maker (e.g., a student) decides between actions V and A at the beginning of the first two periods. Period 3 is treated as a terminal period where no action needs to be taken, but delayed rewards may be realized. For example, if a student studies in period two, the reward a will be received at the end of period three. Figure 1 summarizes all potential outcomes based on different actions.

Proposition 1. The decision maker's actions depend on the rewards and the present bias level:

(1) *If* $0 \leq a \leq v$*, the decision maker chooses* V *in both periods, leading to time-consistent behavior.*

(2) *If* $v < a \leq \frac{v}{\beta}$*, the decision maker chooses* V *in period 1 and plans to choose* A *in period 2, but when period 2 arrives, chooses* V *instead. This leads to time-inconsistent behavior.*

(3) *If* $a > \frac{v}{\beta}$ *(equivalently* $\beta > \frac{v}{a}$ *), the decision maker chooses* A *in both periods, leading to time-consistent behavior.*

Proof. There are four possible action combinations in periods 1 and 2: VV, VA, AV, and AA, with corresponding present-biased payoffs:

$$VV: v + \beta v, VA: v + \beta a, AV: \beta(a + v), AA: \beta(a + a).$$

Thus, in period 1, the decision maker solves

$$\max\{v + \beta v, v + \beta a, \beta(a + v), \beta(2a)\}. \quad (1)$$

<u>Case 1:</u> $0 \leq a \leq v$. We have $v + \beta v \geq v + \beta a \geq \beta(2a)$ and $v + \beta v \geq \beta(a + v)$. Hence the maximizer of (1) is VV. Thus, the decision maker executes V in period 1 and plans V in period 2. In period 2, the choice set is $\max\{v, \beta a\} = v$ since $a \leq v$ and $\beta < 1$. Hence V is chosen and executed.

<u>Case 2:</u> $v < a \leq \frac{v}{\beta}$. We have $v + \beta a \geq \beta(2a), v + \beta a \geq \beta(a + v)$, and $v + \beta a > v + \beta v$. Thus, the maximizer of (1) is VA. Hence, the decision maker executes V in period 1 and plans A in period 2. However, when period 2 arrives, the relevant problem is $\max\{v, \beta a\} = v$, since $a \leq v/\beta$. Thus, the decision maker executes V which is different from the plan in period 1.

<u>Case 3:</u> $a > \frac{v}{\beta}$. We have $\beta(2a) > v + \beta a > v + \beta v$ and $\beta(2a) \geq \beta(a + v)$, since $a > v/\beta \geq v$ (given $\beta \leq 1$). Thus, the maximizer of (1) is AA. The decision maker executes A in period 1 and plans A in period 2. When period 2 arrives, the choice is $\max\{v, \beta a\} = \beta a$, since $a > v/\beta$. Hence, the decision maker executes A as planned.

■

Propositions 1(1) and 1(2) demonstrate that the decision maker cannot resist immediate rewarding activities, even when she initially intends to pursue delayed rewards. Proposition 1(3) further shows that the decision maker will avoid persistently watching videos if and only if her present bias is sufficiently low. In particular, the condition

$$a > \frac{v}{\beta}$$

is equivalent to

$$\frac{1}{\beta} < \frac{a}{v}.$$

Since a higher β corresponds to lower present bias, the term $\frac{1}{\beta}$ naturally serves as an index of present-bias severity.

If we define addiction as choosing V (watching videos) in both periods, then Propositions 1(1) and 1(2) both characterize addictive outcomes. The combined condition for Propositions 1(1) and 1 (2) is $\frac{1}{\beta} > \frac{a}{v}$. Therefore, we have the following corollary.

Corollary 1. A viewer is more likely to be addicted if she/he is more present-biased.

Proof. The condition $\frac{1}{\beta} > \frac{a}{v}$ is more likely to be satisfied if a person is more present-biased, i.e., the present bias index $\frac{1}{\beta}$ is higher.

■

In this section, we provide the microfoundation and demonstrate that present bias contributes to time-inconsistent decisions and addiction. In the next section, we explore the interaction between short-form content length and present bias to examine the impact of shortening entertainment video length on addiction behavior.

5. Analysis of the Updated Model with Shortened Time Periods

In practice, Youtube Shorts, TikTok, and Instagram Reel all provide short-length video content. In this section, we examine how reducing the duration of instantly rewarding activities interacts with present bias and affects decision making. We cut the duration of videos in half. That is, each benchmark period is divided into two mini-periods, with proportionally smaller rewards. We denote the action of watching a shortened video by $\underline{V}$, which yields reward $\underline{v} \le v$.

In this setting, action $\underline{V}$ takes one mini-period to complete and delivers its reward immediately, whereas action A requires two consecutive mini-periods to complete and produces a delayed reward one period later after completion. As a result, the original two-period problem is transformed into four mini-periods, plus a final dummy period that allows any remaining delayed rewards to be realized. Thus, the problem now spans five periods in total.

We keep the setting of action A unchanged. Thus, action A takes two continuous periods to complete and cannot be abandoned halfway. Since action A takes two periods to complete, it has to be taken prior to the fourth period if chosen. Figure 2 provides all the potential outcomes in this scenario.

Proposition 2. The decision maker's actions depend on the rewards and the present bias level again:

1. *When $0 \le a \le 2\underline{v}$, the decision maker plans and executes action $\underline{V}$ in all periods, leading to time-consistent behavior;*
2. *When $2\underline{v} < a \le \left(1 + \frac{1}{\beta}\right)\underline{v}$, the decision maker chooses action $\underline{V}$ in the first period while plans a sequence of actions $AA\underline{V}$ for the remaining periods. However, when the second period arrives, the decision maker chooses action $\underline{V}$ and plans the next action AA, which again cannot be executed when the time comes. The final executed action sequence is $\underline{VVVV}$.*
3. *When $a > \left(1 + \frac{1}{\beta}\right)\underline{v}$, the decision maker plans and executes action A in all periods, leading to time-consistent behavior.*

Proof. There are five total combinations of actions: $\underline{VVVV}, \underline{VV}AA, \underline{V}AA\underline{V}, AA\underline{VV}$ and $AAAA$, with corresponding payoffs $\underline{v} + \beta(\underline{v} + \underline{v} + \underline{v}), \underline{v} + \beta(\underline{v} + a), \underline{v} + \beta(a + \underline{v}), \beta(a + \underline{v} + \underline{v})$, and $\beta(a + a)$, respectively. Thus, in period one, a decision maker with present bias faces the problem

$$\max\{\underline{v} + \beta(\underline{v} + \underline{v} + \underline{v}), \underline{v} + \beta(\underline{v} + a), \underline{v} + \beta(a + \underline{v}), \beta(a + \underline{v} + \underline{v}), \beta(a + a)\}. \quad (2)$$

<u>Case 1</u>: consider $0 \le a \le 2\underline{v}$. In this case, we have $\underline{v} + \beta(\underline{v} + \underline{v} + \underline{v}) \ge \underline{v} + \beta(\underline{v} + a)$, and $\underline{v} + \beta(\underline{v} + \underline{v} + \underline{v}) \ge \underline{v} + \beta(a + \underline{v})$. Furthermore, since $a \le 2\underline{v} \le (1 + \beta)\underline{v}/\beta$ when $\beta \le 1$, we have $\underline{v} + \beta(\underline{v} + \underline{v} + \underline{v}) \ge \beta(a + \underline{v} + \underline{v}) \ge \beta(a + a)$. As a result, the decision maker shall execute action $\underline{V}$ and also has action $\underline{V}$ in the plan for the remaining periods.

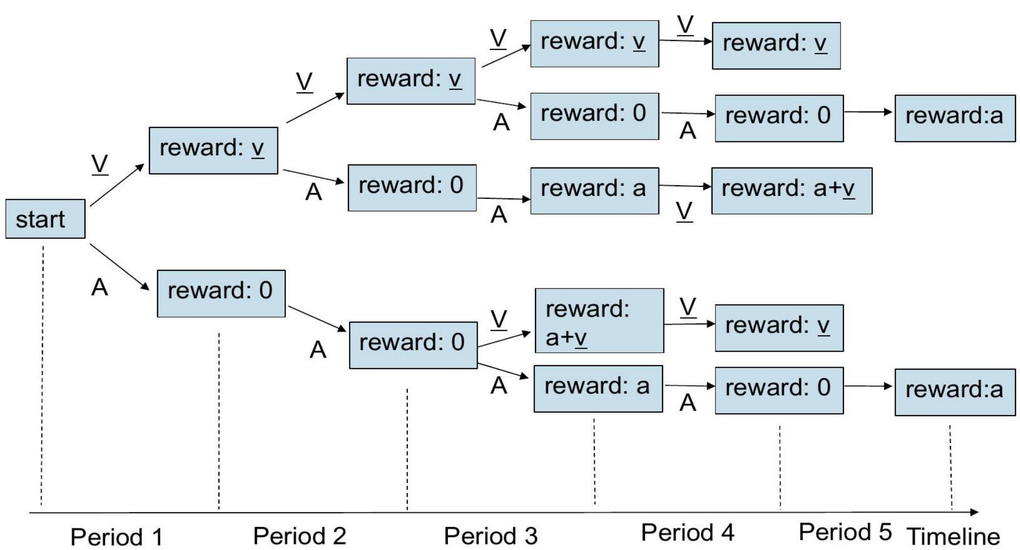

Figure 2. Decision Process with Shorter Period Durations for Immediate Rewards

When time goes by, in the second period, the decision maker faces the following maximization problem.

$$\max\{\underline{v} + \beta(\underline{v} + \underline{v}), \underline{v} + \beta \underline{a}, \beta(a + \underline{v})\}. \tag{3}$$

Since $a \leq 2\underline{v}$, we have $\underline{v} + \beta(\underline{v} + \underline{v}) \geq \underline{v} + \beta a$.. Furthermore, since $a \leq 2\underline{v} \leq (1 + \beta)\underline{v}/\beta$ when $\beta \leq 1$, we also have $\underline{v} + \beta(\underline{v} + \underline{v}) \geq \beta(a + \underline{v})$. Thus, the decision maker should choose action $\underline{V}$ in this period and plans $\underline{VV}$ for the remaining periods.

When the third period arrives, the decision maker faces maximization $\max\{\underline{v} + \beta\underline{v}, \beta a\} = \underline{v} + \beta\underline{v}$, since $a \leq 2\underline{v} \leq (1 + \beta)\underline{v}/\beta$ when $\beta \leq 1$. Thus, the decision maker executes action $\underline{V}$ in this period and also plans/executes action $\underline{V}$ in the next period since there is not enough time to complete action$A$ anymore.

<u>Case 2</u>: consider $2\underline{v} < a \leq \frac{1+\beta}{\beta}\underline{v}$, which implies $\underline{v} + \beta(\underline{v} + a) > \underline{v} + \beta(\underline{v} + \underline{v} + \underline{v}), \underline{v} + \beta(\underline{v} + a) = \underline{v} + \beta(a + \underline{v})$, immediately. Furthermore, we have $\underline{v} + \beta(a + \underline{v}) \geq \beta(a + a) > \beta(a + \underline{v} + \underline{v})$, because $a \leq \frac{1+\beta}{\beta}\underline{v}$ and $2\underline{v} < a$. Thus, the decision maker executes action $\underline{V}$ in this period and plans actions $AA\underline{V}$ or $\underline{V}AA$.

When the second period arrives, the decision maker faces a maximization problem in (3). Since $a > 2\underline{v}$, we have $\underline{v} + \beta(\underline{v} + \underline{v}) < \underline{v} + \beta a$. Furthermore, we have $\underline{v} + \beta a \geq \beta(a + \underline{v})$. Thus, the decision maker executes action $\underline{V}$ in this period instead, and plans actions AA.

When the third period arrives, the decision maker faces maximization $\max\{\underline{v} + \beta\underline{v}, \beta a\}$. Since $a \leq \frac{1+\beta}{\beta}\underline{v}, \underline{v} + \beta\underline{v} > \beta a$. Therefore, the decision maker executes action $\underline{V}$ and plans for action $\underline{V}$ in the next period, which has to be executed since there is not enough time for action A.

<u>Case 3</u>: consider $a > \frac{1+\beta}{\beta}\underline{v}$, which implies $\beta(a + a) > \underline{v} + \beta(\underline{v} + a)$. Note that from previous cases, we know that the sequence of actions $\underline{V}AA\underline{V}$ dominates $\underline{VVVV}$ and $\underline{VV}AA$ when $a > 2\underline{v}$. Thus, the decision maker executes action A in the first period, which finishes after the second period, and plans action A for periods three and four.

When the third period arrives, the decision maker faces maximization $\max\{\underline{v} + \beta\underline{v}, \beta a\} = \beta a$, Thus, the decision maker executes action A in this period, which lasts for two periods. This completes the proof.

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As shown in Proposition 2, the decision maker still engages in time-inconsistent behaviors. When $2\underline{v} < a \leq \left(1 + \frac{1}{\beta}\right)\underline{v}$, the decision maker behaves inconsistently in each decision point. In other words, the student always plans to study but never keeps the plan and executes it in the subsequent periods. Instead, the student always watches videos in action if $a \leq \left(1 + \frac{1}{\beta}\right)\underline{v}$.

Corollary 2. Shortening time periods by half for instantly-rewarded activities increases the likelihood of time-inconsistent decisions under present bias.

Proof. Comparing Proposition 2.2 and Proposition 1.2, the feasible range is always larger in Proposition 2.2 than in Proposition 1.2.

$$\left(\frac{1+\beta}{\beta}\underline{v} - 2\underline{v}\right) - \left(\frac{v}{\beta} - v\right) = \frac{1-\beta}{\beta}(\underline{v} + v) > 0.$$

■

Furthermore, Proposition 2.3 shows that a person cannot resist the temptation of instantly rewarded activities unless the person's present bias is so low that $\frac{1}{\beta} < \frac{a}{v} - 1$, i.e., $a > \left(1 + \frac{1}{\beta}\right)\underline{v}$. Comparing it with the corresponding result in Proposition 1 reveals the impact of short time periods on addiction.

Corollary 3. Cutting the duration of instantly rewarded activities increases addiction if and only if a viewer's present bias is low, i.e., $\frac{1}{\beta} < \frac{v}{v-\underline{v}}$.

Proof. Comparing the bounds $\left(1 + \frac{1}{\beta}\right)\underline{v}$ in Proposition 2.3 and $\frac{v}{\beta}$ in Proposition 1.3 leads to: $\left(1 + \frac{1}{\beta}\right)\underline{v} > \frac{v}{\beta}$ if and only if $\frac{1}{\beta} < \frac{v}{v-\underline{v}}$.

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Corollary 3 shows that reducing video length by half increases addiction among viewers with low present bias. This finding provides a theoretical explanation for why short-form video formats increase overall addiction. Viewers with high present bias are already susceptible to addiction, so shortening video length does not qualitatively change their behavior. In contrast, viewers with low present bias are not initially addicted; however, when video length is reduced, their consumption incentives increase sufficiently to induce addiction. Consequently, shorter video formats expand the set of viewers who become addicted.

6. Conclusion

Nowadays, many students and young adults are addicted to short-form videos on platforms such as TikTok and Instagram. We develop an analytical model to examine the role of present bias in short-form video addiction and how video duration interacts with viewers' present bias. Our analysis shows that present bias contributes to addiction: viewers with greater present bias are more susceptible. Importantly, reducing video duration extends addiction to viewers with lower present bias, who would not otherwise become addicted.
Our study contributes to the present bias literature by connecting it with addiction. We also contribute to the short-form video addiction literature, the majority of which focuses on empirical studies through surveys and experiments. Our analytical model and results offer a theoretical explanation for the empirical observations on short-form video addiction.

Our research not only helps to understand addiction but also offers insights into preventing addiction. Such addiction can be understood as a symptom of present bias. To effectively prevent it, interventions should target the reduction of present bias itself. In other words, rather than merely treating the symptom, we should address the underlying root cause. This provides guidance for parents and educators on how to help students. Our results also provide theoretical support for the governance of short-form content platforms.

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Biography

Yilin Guo is a junior student at the Woodlands College Park High School in Texas. After observing short-video addiction among her peers and sometimes herself, Yilin wants to decode the addiction so that people can better prevent addiction once they understand the mechanism. Yilin is the co-founder and president of Kindness Alliance, a nonprofit focusing on mental health. Yilin is one of the four finalists in North America for 2025 S.-T. Yau High School Science Award in the category of Economic and Financial Modeling.