What-If: Supporting Smartphone Self-Regulation through Counterfactual Future Narratives

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Abstract

Smartphone self-control tools often emphasize momentary limits, offering little help for reflecting on how phone use aligns with longer-term goals and future selves. We present What-If, a mobile system that generates paired counterfactual future narratives from users' daily app usage and usage goals. Based on goal success or failure, it contrasts futures shaped by continued overuse versus successful regulation. Using a large language model, the narratives integrate personal context and recent behavior to support explicit comparison of alternative futures. From a two-week in-the-wild user study with eight participants, we found that counterfactual narratives were associated with reduced smartphone use, increased consideration of future consequences, and stronger responses to overuse-oriented futures. These findings suggest design implications for self-regulation systems grounded in counterfactuals.

CCS Concepts

• **Human-centered computing → Human computer interaction (HCI)**; **Ubiquitous and mobile computing**.

Keywords

Smartphone Use, Counterfactual Thinking, Future-Oriented Narratives, Self-Regulation

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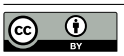

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1 Introduction

Smartphone overuse is often entangled with everyday routines, particularly through extended engagement with social media, entertainment, and mobile games [1, 16]. Such patterns have raised concerns around attention, productivity, and well-being. In response, the HCI community has explored approaches to make smartphone use more visible, such as self-tracking dashboards and feedback [8, 20]. Other work has proposed more active interventions, including social dynamics and incentives [15, 21], as well as restrictive designs such as app blocking or context-aware limits [13, 14].

These systems primarily regulate smartphone use in the moment by increasing visibility, interrupting habitual behavior, or enforcing predefined rules. While such approaches can support short-term adjustments, they often frame smartphone use as an issue of immediate control or compliance. As a result, they provide limited support for helping users reflect on what smartphone overuse means in relation to their longer-term goals and future selves [24, 26, 27]. In practice, many digital self-control tools focus on limiting screen time or blocking distractions, prioritizing behavioral compliance over opportunities to consider why regulating smartphone use matters to users personally [17, 26]. Consequently, it can be difficult for users to connect momentary decisions with their potential future consequences.

In everyday life, people often make sense of their actions through contrast, imagining how things might unfold under different choices. This kind of comparison helps them reflect on the paths they are currently following and the futures those paths may lead to. Prior work has discussed how such counterfactual thinking (i.e., "what-if" scenarios) can help individuals reinterpret current behavior and adjust future choices by situating present decisions in relation to possible outcomes and goals [5, 7]. However, smartphone self-control tools rarely build on this mode of reasoning. Even when they support goal setting or self-tracking, they typically present a single behavioral trajectory (e.g., continued overuse) rather than inviting users to consider how different choices might lead to contrasting futures.

To address this limitation, we designed *What-If*, a system that supports smartphone self-regulation by presenting contrasting future narratives grounded in users' everyday smartphone use. The

system leverages individuals' smartphone usage logs together with a given daily usage goal, and evaluates whether the goal was met. This evaluation directly serves as the basis for generating paired, future-oriented narratives that contrast alternative behavioral paths. When the usage goal is met, the system contrasts a narrative of a future shaped by continued successful regulation with an alternative showing how the future might unfold if overuse persists. Conversely, when the goal is exceeded, it contrasts a narrative of a future shaped by continued overuse with an alternative shaped by successful regulation. These narratives are generated using a large language model (LLM) and incorporate user-provided personal context along with smartphone use evaluation outcomes. Rather than predicting outcomes, they are intended to support reflection by helping users connect recent behavior to possible future selves through explicit counterfactual comparison.

To examine the feasibility of What-If, we conducted an exploratory in-the-wild user study. We examined whether engaging with counterfactual narratives influenced smartphone use and explored the user experiences that emerged through interacting with the narratives. Participants reported that the narratives helped them imagine possible futures related to their smartphone use, supporting reflection and more restrained use over time. In particular, narratives depicting negative futures were often perceived as more salient. Together, these findings provide preliminary evidence that counterfactual, narrative-based reflection is a feasible design space for smartphone self-regulation.

2 System Design

2.1 Design Rationale

Our design is primarily informed by prior work on **counterfactual thinking**, which characterizes "what-if" reasoning as a cognitive mechanism that supports behavior regulation following goal-related outcomes [5, 7]. Counterfactual thinking goes beyond retrospective reflection by helping individuals reinterpret prior actions through alternative possibilities and revise intentions for future behavior. Recent HCI research has also shown that counterfactual scenarios can support self-reflection by illustrating alternative outcomes [11]. Building on these studies, we apply counterfactual comparison to smartphone use regulation by linking "what-if" reflection to usage-based goal outcomes.

A further design decision concerns how counterfactual futures are represented to users. Prior work suggests that purely numerical summaries can make it difficult for users to understand how everyday actions lead to meaningful consequences over time [19]. In contrast, narrative representations frame alternative outcomes as sequences of events, making links between present and future easier to follow and supporting *qualitative* self-reflection [6]. Accordingly, we adopt future-oriented narratives as a representational form for conveying counterfactual alternatives.

Generating counterfactual narratives that resonate with individual users requires the ability to flexibly incorporate personal context. Prior work suggests that LLMs can support scalable personalization by synthesizing content grounded in users' behavioral data and lived experiences [10]. LLM-augmented systems have demonstrated the capacity to tailor coaching dialogues and therapeutic narratives to user-specific contexts, resulting in content perceived as more relevant and resonant [4, 9]. Based on these insights, we employ an LLM to generate personalized narrative scenarios that adapt to each user's context while maintaining a consistent narrative structure [3, 18].

2.2 What-If

2.2.1 System Overview. **What-If** is a mobile application that supports smartphone use regulation through daily reflection with counterfactual future narratives. The system centers on a single home screen used throughout everyday interaction, while key personal and behavioral context is collected during onboarding. During this process, users select the apps they wish to regulate and provide personal profile information, including demographic details, current roles and activities, and short- and long-term goals. This information is collected once at sign-up and serves as persistent contextual input for narrative generation. After onboarding, the home screen displays cumulative smartphone usage for the selected apps from 00:00 to the present, alongside a to-do list for recording daily plans. Users can generate reflective content by pressing the "**What if?!**" button, which produces narratives based on smartphone usage from the previous day. Previously generated narratives and usage records are accessible through a separate history view. Together, user profiles, app-level usage logs, and to-do entries constitute the primary inputs for supporting daily reflection.

Each day, the system evaluates smartphone use by comparing the previous day's app-level usage against predefined daily goals. If the usage goal is exceeded for any app, the day is classified as a goal failure; otherwise, it is classified as a goal success. This binary outcome determines the structure of the counterfactual narrative pair. When goals are met, the system contrasts a future shaped by continued successful regulation with an alternative future reflecting persistent overuse. When goals are exceeded, the contrast is reversed. In both cases, the narratives depict alternative future trajectories stemming from different patterns of smartphone use.

2.2.2 Counterfactual Narrative Generation. Counterfactual narratives are generated using the Anthropic Claude API (Sonnet 4.5) based on a structured prompt template. The prompt incorporates four categories of input: (1) user profile, including demographic details, recent activities, and long- and short-term goals; (2) app-level usage goals and whether each goal was met; (3) a summary of smartphone usage from the previous day; and (4) user-provided to-do items.

Based on the evaluation of the previous day's smartphone use, the model is instructed to generate two parallel narratives with fixed labels. *What you did* reflects a future trajectory that plausibly follows from the user's actual behavior, while *What if you didn't* presents a counterfactual future based on the alternative behavioral outcome. Both narratives share a common contextual background but diverge according to the usage evaluation, enabling users to compare how different patterns of smartphone use may lead to different future experiences.

All narratives are written in the first-person perspective and link everyday smartphone use to downstream consequences over time, allowing users to experience the scenarios as their own. To enhance realism and causal clarity, failure narratives explicitly identify the apps contributing to overuse and modulate narrative intensity based

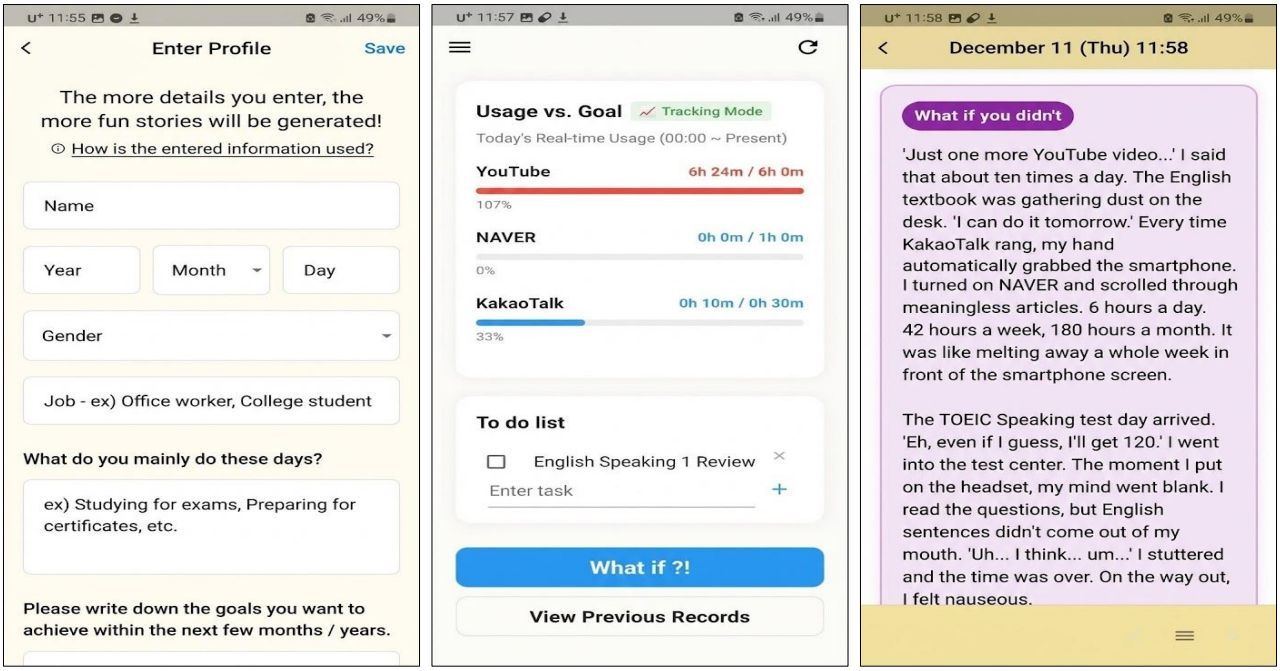

Figure 1: Key screens of What-If: (a) onboarding with user profile input; (b) the home screen showing daily smartphone usage and access to What-If narrative generation; and (c) a view of the generated What-If narratives.

on the degree of excess (e.g., minutes versus hours), often translating daily overuse into cumulative time loss over longer periods. In contrast, success narratives illustrate how reclaimed time could plausibly be invested in activities aligned with users' goals and daily plans. By contrasting how different usage patterns unfold into diverging futures, the paired narratives emphasize the connection between present smartphone use and longer-term outcomes, supporting counterfactual reflection through concrete and personally grounded comparison. The prompt used in What-If and an example of generated narratives are provided in Appendix A.1 and A.2.

3 User Study

3.1 Methods

We conducted a two-week exploratory, in-the-wild user study with eight participants (4 women, 4 men; mean age: 22.1) to examine the feasibility of What-If in supporting smartphone use regulation. Participants were recruited from university communities through online postings. Eligibility was restricted to individuals who are in the *contemplation* or *preparation* stages of the Transtheoretical Model (TTM) [23], indicating awareness of problematic smartphone use and readiness to change. Individuals who had depressive symptoms within the past year were excluded to minimize potential risk. All participants provided informed consent prior to participation.

During onboarding, participants selected the smartphone apps they wished to regulate. For each app, the system set a daily usage goal at 80% of its average daily usage during the week prior to the study. Throughout the two-week period, the system automatically collected app-level smartphone usage data and generated a pair of counterfactual narratives each day based on the participant's smartphone use from the previous day. These narratives presented alternative future scenarios reflecting goal success and goal failure. Participants were encouraged to read the narratives and reflect on their smartphone use, but no explicit instructions were provided regarding behavioral change.

In the study, surveys and interviews were used to assess participants' experiences with What-If. To capture potential changes in future-oriented tendencies, we used the Consideration of Future Consequences (CFC) [25] both before and after the study. In the post-study survey, we included the Transportation Scale–Short Form (TS-SF) [2] to measure narrative transportation evoked by the narratives. After the two-week deployment, we conducted semi-structured interviews to better understand user experiences. The interviews focused on how the narratives influenced regulation efforts, how participants experienced and compared success versus failure narratives, and suggestions for system improvement. With participants' consent, all interviews were audio-recorded and analyzed using thematic analysis.

3.2 Results

3.2.1 *Changes in Smartphone Use Over Time.*

To examine whether engaging with What-If was associated with changes in smartphone use, we analyzed app-level usage data collected over the two-week deployment period. Participants selected between one to four apps to regulate (M = 2.4 apps). The selected

apps were predominantly social media and entertainment platforms (e.g., YouTube, Instagram), along with web browsers and online community apps (e.g., Chrome, Naver, DCInside).

Across participants and regulated apps, smartphone use decreased relative to the pre-study baseline, defined as the daily average usage during the week prior to the study. On average, participants showed a 21.9% (SD = 23.4) reduction in daily app usage compared to baseline. While the magnitude of reduction varied across individuals, seven out of eight participants exhibited an overall decrease in usage relative to baseline. Among them, five participants achieved an average reduction that met or exceeded the target goal of a 20% decrease. When examined over time, reductions were more pronounced during the first week of the study (Week 1: M = -24.9%, SD = 26.8). During the second week, usage remained below baseline levels, although the average reduction was smaller (Week 2: M = -18.8%, SD = 28.0).

At the individual level, daily usage changes relative to baseline varied across participants. Some participants (P3, P5, P7) showed consistent reductions across most days, whereas others (P1, P2, P6, P8) exhibited mixed patterns with both increased and decreased usage relative to baseline. P4 was the only participant whose usage exceeded baseline levels during both weeks. Despite this variability, most participants had more days of reduced usage than increased usage. Taken together, these results suggest that engagement with What-If was associated with reduced smartphone use for most participants, while highlighting individual differences in how usage patterns evolved over time.

3.2.2 User Experiences of Counterfactual Narrative Reflection.

Making Future Consequences Concrete Through Narrative Reflection. Engagement with the What-If narratives was associated with participants considering how present smartphone use could shape future outcomes. CFC scores showed an upward trend, increasing from a pre-study mean of 38.6 (SD = 7.0) to a post-study mean of 41.6 (SD = 5.8). Although changes varied across individuals, this pattern suggests that interacting with the system was accompanied by greater attention to the longer-term implications of everyday smartphone use.

Interview responses illustrated how narrative reflection helped participants connect their current behavior to personally meaningful futures. Participants described that reading the narratives prompted them to think about how regulating smartphone use could bring them closer to their long-term goals. "*Seeing how even five minutes could help my long-term goal of speaking English fluently really affected me*" (P1). They also highlighted the value of viewing contrasting futures side by side, which encouraged direct comparison and deeper reflection. "*When I saw both a positive and a negative future, comparing them made me realize I needed to put in more effort*" (P3). In addition, P7 noted that narratives grounded in their own information felt personally tailored, making future scenarios more plausible.

For some participants, reflecting on these narratives translated into concrete intentions or subsequent actions. P5 described, "*After reading the story, I thought that if I failed yesterday, today I should try harder to get a better story.*" Other participants reported making changes beyond simple time reduction, such as deleting a game app (P2), substituting distracting apps with alternatives (P1), or minimizing device use during focused activities (P3).

Failure Narratives as a Stronger Trigger for Reflection. Participants often reported that narratives depicting futures shaped by smartphone overuse were more impactful than those depicting successful regulation. This tendency was also reflected in the TS-SF. Failure narratives received higher TS-SF scores (M = 25.8, SD = 3.3) than success narratives (M = 23.8, SD = 3.9), implying that participants experienced greater immersion when engaging with negative scenarios.

The interviews revealed why failure narratives were experienced as more salient. Participants often described them as more realistic and plausible future outcomes. As P3 noted, "*I didn't think the benefits would really be that big just because I reduced my phone use, but failing an exam felt like something that could actually happen.*" Failure narratives also elicited a strong sense of warning, evoking regret and caution and leaving a more lasting impression than success ones, as described by multiple participants (P1, P4, P6). However, responses were not uniform, with some participants reporting that success narratives motivated continued effort (P5, P7).

Suggestions for Improving Narrative Support. Participants suggested directions for improving the system, most notably the need for greater narrative diversity over time. Several participants noted that repeated exposure made the stories feel familiar, reducing engagement. As P1 remarked, "*After about a week, the stories felt quite similar, so I started getting used to them.*" Others suggested expanding the temporal scope of the narratives, such as incorporating multi-day usage patterns (P8) or extending stories beyond a single future endpoint (P3). They also expressed interest in more flexible narrative expression. They suggested varying presentation styles, such as using a more imaginative tone or visual elements, to increase engagement and memorability (P7). Others emphasized the need to calibrate narrative intensity, noting that persuasiveness depended on alignment with individual short- or long-term goals. Participants also reported that some narratives felt less realistic, highlighting the importance of improving plausibility.

4 Discussion and Conclusion

This work explored counterfactual future narratives as an approach for supporting smartphone self-regulation. Rather than enforcing control through restrictions or rules, What-If aimed to prompt reflection by helping users reinterpret their current smartphone use in relation to possible future selves. Our findings suggest that engaging with counterfactual narratives was accompanied by shifts in how users thought about and managed their smartphone use, indicating the potential of counterfactual-based reflection as an approach to smartphone self-regulation.

A key finding was that narratives depicting futures shaped by goal failure often elicited stronger reflective engagement than success narratives. One possible interpretation relates to prior work in behavioral economics, which suggests that people tend to weigh potential losses more than gains [12]. Failure narratives may therefore have been more salient because they framed smartphone overuse in terms of what participants stood to lose, such as time, opportunities, or progress toward personal goals, rather than what they might gain through successful regulation. This interpretation aligns with

behavioral intervention research showing that loss-framed messages can be particularly motivating [22]. In What-If, narratives depicting continued overuse may have functioned as a form of loss framing, rendering future costs more vivid and personally relevant. At the same time, the effectiveness of loss- versus gain-oriented futures may depend on individual differences and goal contexts, suggesting that future counterfactual narrative systems may benefit from accounting for how individuals are differentially motivated by alternative future scenarios.

Furthermore, participants' feedback highlighted a desire for greater narrative diversity over time. In the current design, key inputs used for narrative generation (e.g., short- and long-term goals) remained fixed, which may have constrained the range of the generated narratives. Future designs could allow users to update such personal information over time to support more varied and evolving narratives. In addition, enabling users to provide feedback on generated narratives may help identify which types of future scenarios are perceived as more helpful for regulating smartphone use, allowing systems to better tune narrative framing to individual needs. More broadly, counterfactual narratives could be extended beyond smartphone use, such as productivity or physical activity.

This study has limitations. The small sample size, short deployment period, and homogeneous participant group limit the generalizability of the findings. In addition, the lack of a control condition and the possibility of novelty effects suggest that observed behavioral changes should be interpreted cautiously. Despite these limitations, our findings suggest that counterfactual, narrative-based reflection represents a promising method for supporting smartphone self-regulation. Future work could examine longer-term use, adaptive narrative strategies, and comparisons with non-narrative feedback to better understand when and for whom such approaches are most effective.

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