GoldenTime:
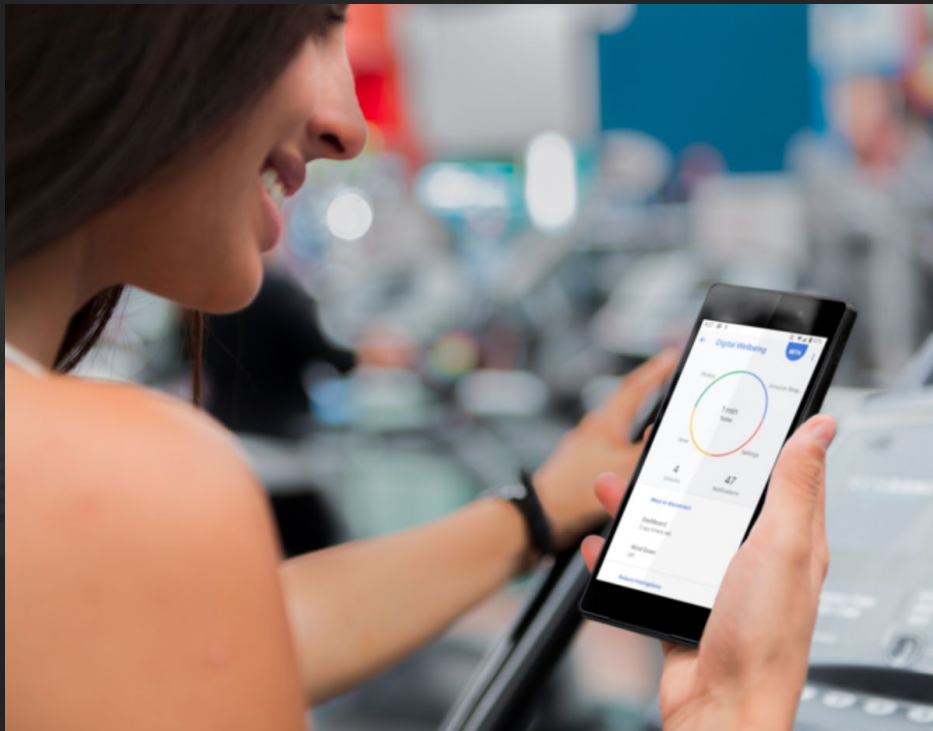
Exploring System-Driven Timeboxing and Micro-Financial Incentives for Self-Regulated Phone Use

Joonyoung Park*, Hyunsoo Lee*, Sangkeun Park*, Kyong-Mee Chung†, Uichin Lee*
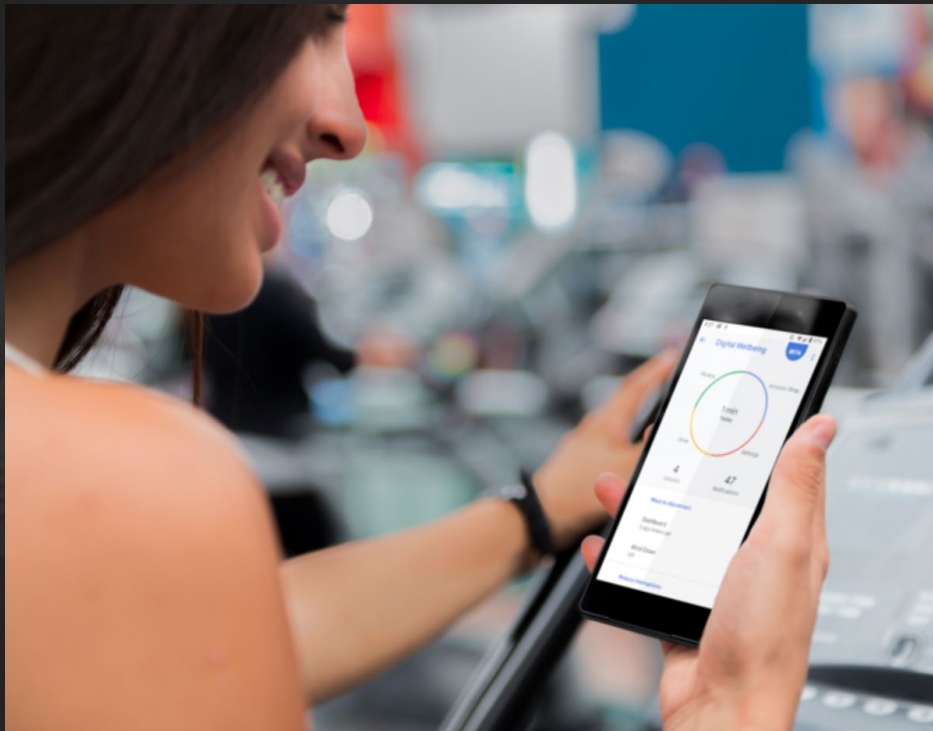
*KAIST, †Yonsei Univ.

A Study on Digital Wellbeing

What is Digital Wellbeing?

"**Digital Wellbeing is about crafting and maintaining a healthy relationship with technology.** It's about how technology serves us and moves us towards our goals, rather than distracting us, interrupting us or getting in the way."

\- Google -

Android vs. iOS: digital health features in comparison, https://versus.com/en/news/android-vs-ios-digital-health-features-comparison

Purpose of Study on Digital Wellbeing

Design Technology to Promote
Healthy Use of Digital Devices

↓

Self-Regulated Use of Digital Devices

Android vs. iOS: digital health features in comparison, https://versus.com/en/news/android-vs-ios-digital-health-features-comparison
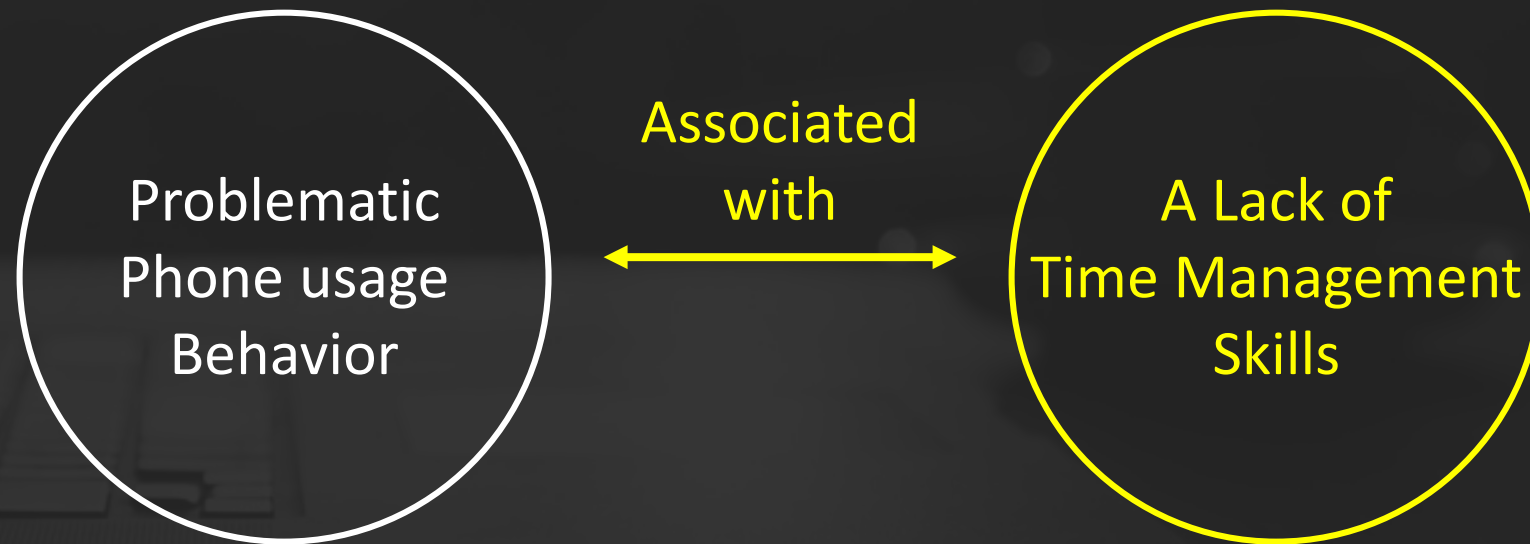
A Lack of Self-Regulated Phone Usage

Distracting daily life

https://www.wsj.com/articles/3-simple-ways-to-kick-your-smartphone-addiction-1511388903
https://www.dallascaraccidentlawyers.net/faqs/are-distracted-driving-accidents-in-texas-increasing-with-cell-phone-usage/
https://www.today.com/health/sleep-texting-affects-health-how-prevent-phone-addiction-t144206

Association w/ Time Management Skills

Problematic Phone usage Behavior

Associated with

A Lack of Time Management Skills

(Alexander JAM Van Deursen et al., 2015; Kim et al., 2017; Fausto Giunchiglia et al., 2018)

Van Deursen, A. J., Bolle, C. L., Hegner, S. M., & Kommers, P. A. (2015). Modeling habitual and addictive smartphone behavior:
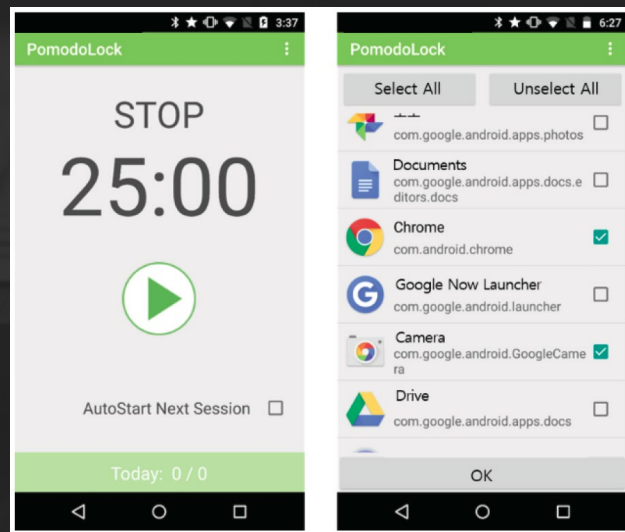The role of smartphone usage types, emotional intelligence, social stress, self-regulation, age, and gender. Computers in human behavior, 45, 411-420.
Kim, J., Cho, C., & Lee, U. (2017). Technology supported behavior restriction for mitigating self-interruptions in multi-device environments. IMWUT, 1(3), 1-21.
Giunchiglia, F., Zeni, M., Gobbi, E., Bignotti, E., & Bison, I. (2018). Mobile social media usage and academic performance. Computers in Human Behavior, 82, 177-185.
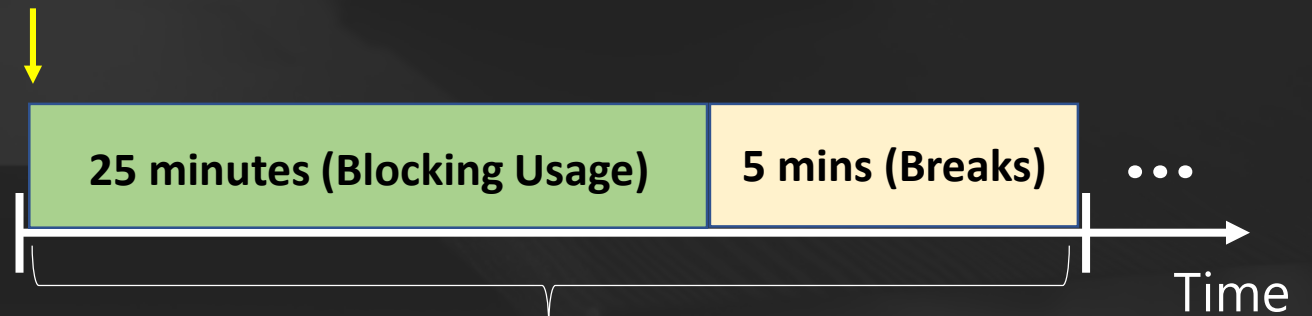
Digital Wellbeing Study based on Time Management Skills

- User-driven Timeboxing Design (Kim et al., 2017)

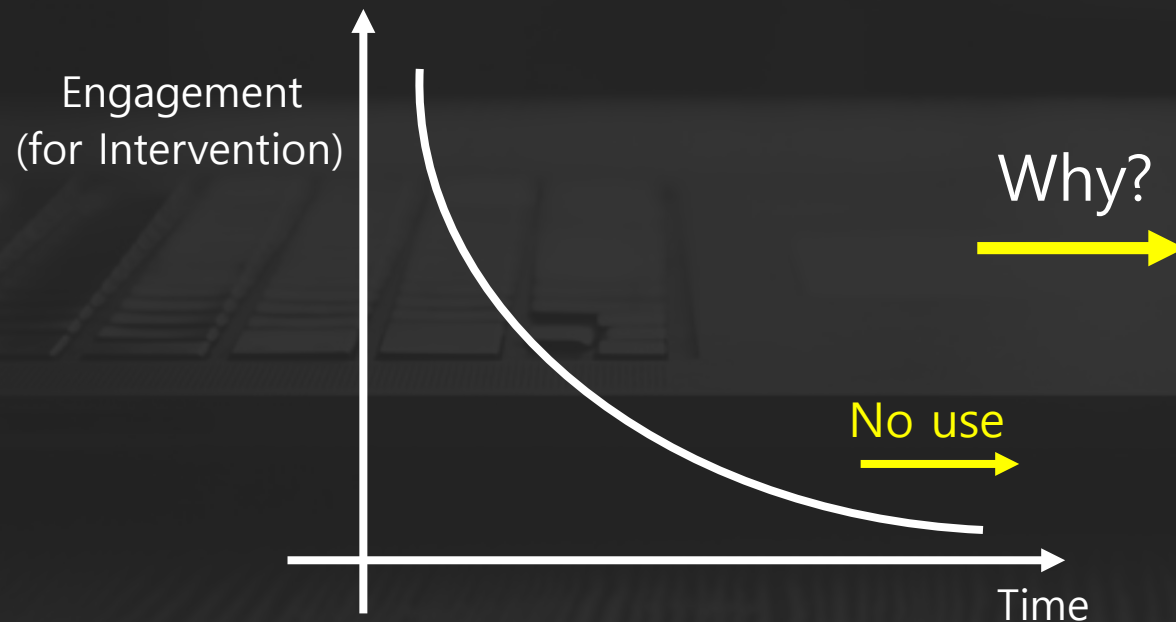

PomodoLock UI

User manually starts timeboxing

| 25 minutes (Blocking Usage) | 5 mins (Breaks) |

Time

1 Pomodoro (= Timebox)

Kim, J., Cho, C., & Lee, U. (2017). Technology supported behavior restriction for mitigating self-interruptions in multi-device environments. IMWUT, 1(3), 1-21.

Limitations of User-driven Timeboxing

- Warning a lack of user engagement over time

Engagement
(for Intervention)

Why?

No use

Time

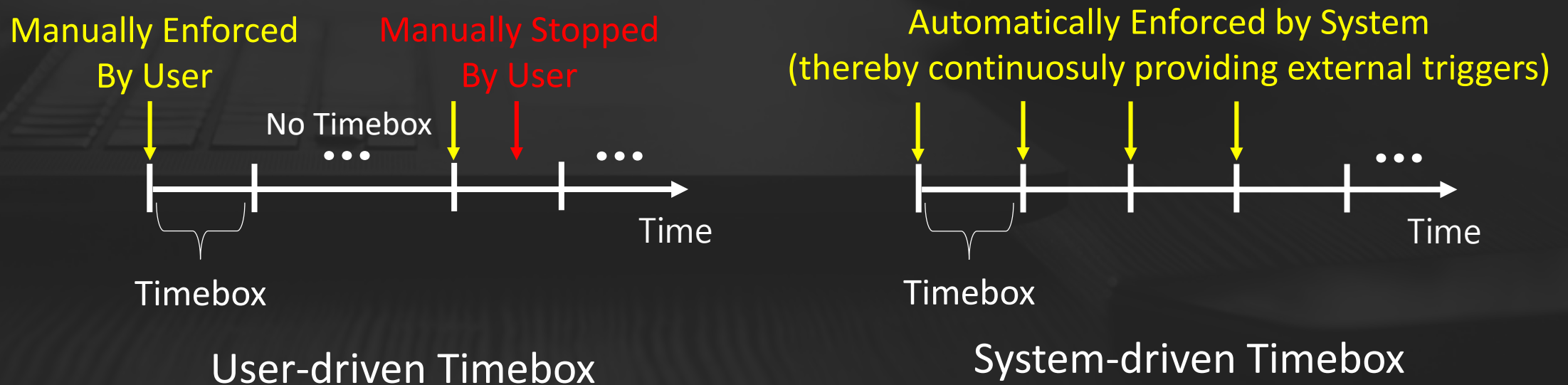"Triggers are an important factor to consider, as a number of participants reported that they simply forgot to use PomodoLock despite the fact that they considered it to be helpful."

"Fully rely on internal triggers of self-necessity"

- Kim et al., 2017-

Kim, J., Cho, C., & Lee, U. (2017). Technology supported behavior restriction for mitigating self-interruptions in multi-device environments. IMWUT, 1(3), 1-21.

Our Approach: System-driven Timeboxing

- **Automatically** enforced by system → **Continuously** providing trigger
- **Easily** track user's phone usage behaviors

Manually Enforced By User

Manually Stopped By User

No Timebox

· · ·

· · ·

Time

Timebox

User-driven Timebox

Automatically Enforced by System
(thereby continuosuly providing external triggers)

· · ·

Time

Timebox

System-driven Timebox

Our Approach: Financial Incentives

- leveraging behavioral reinforcement strategies

⟷ (green) : Successful Timebox (Regulation Success)

⟷ (red dashed) : Not Successful Timebox (Regulation Failure)

Getting Incentives

Getting Incentives

...

Time

# System-driven Timeboxing + Financial Incentives

Fogg Behavior Model
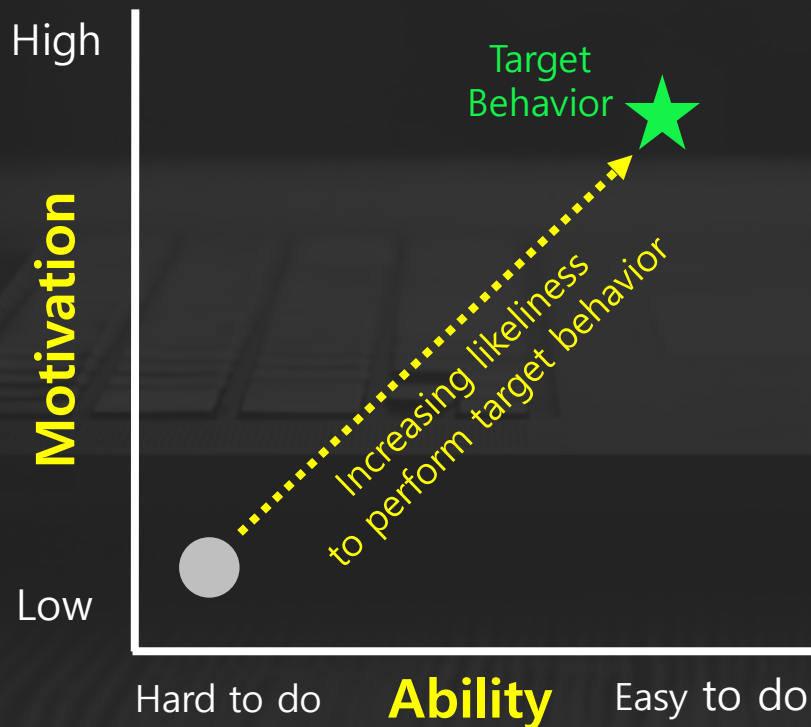
GoldenTime

- ✓ System-driven Timeboxing
  - Easily & Continuously Track Phone Usage
  - Improving Ability (Simplicity)

- ✓ Micro-Financial Incentives
  - Reinforcing Usage Regulation Motivation

Fogg, B. J. (2009, April). A behavior model for persuasive design. In *Proceedings of the 4th international Conference on Persuasive Technology* (pp. 1-7).

Exploring System Design

System-driven Timeboxing

- Automatically starting every hour on the hour

Starting

Timebox (1hour)

Time

. . .
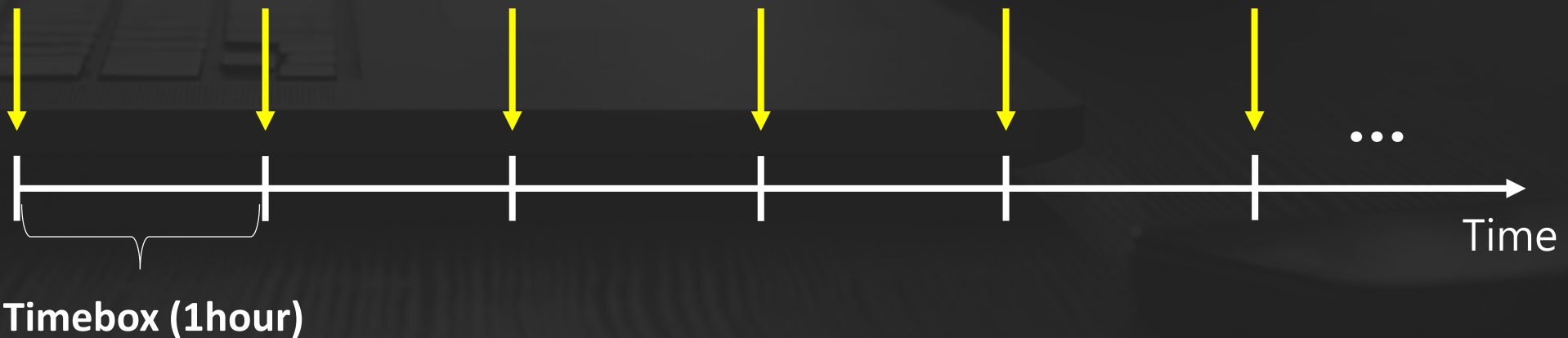
System-driven Timeboxing

- Measuring phone usage time every timebox
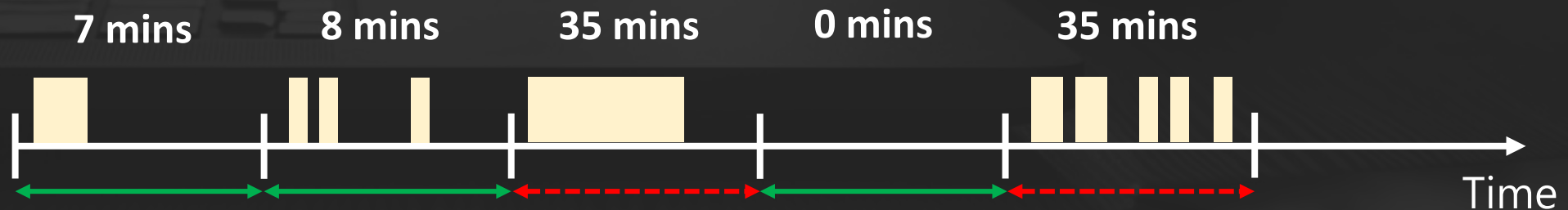
☐ : Phone Usage Behavior

7 mins   8 mins   35 mins   0 mins   35 mins
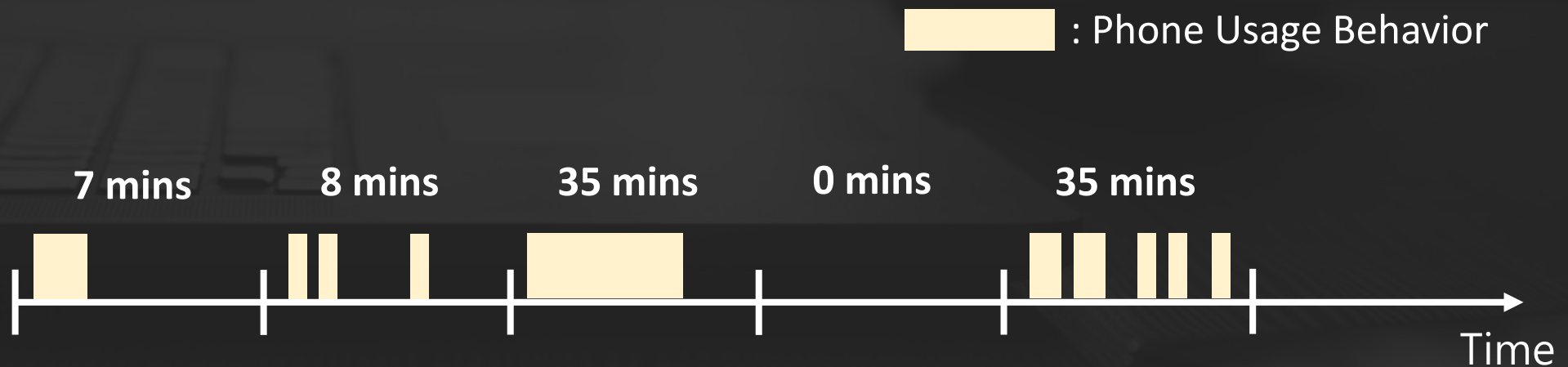
Time

System-driven Timeboxing
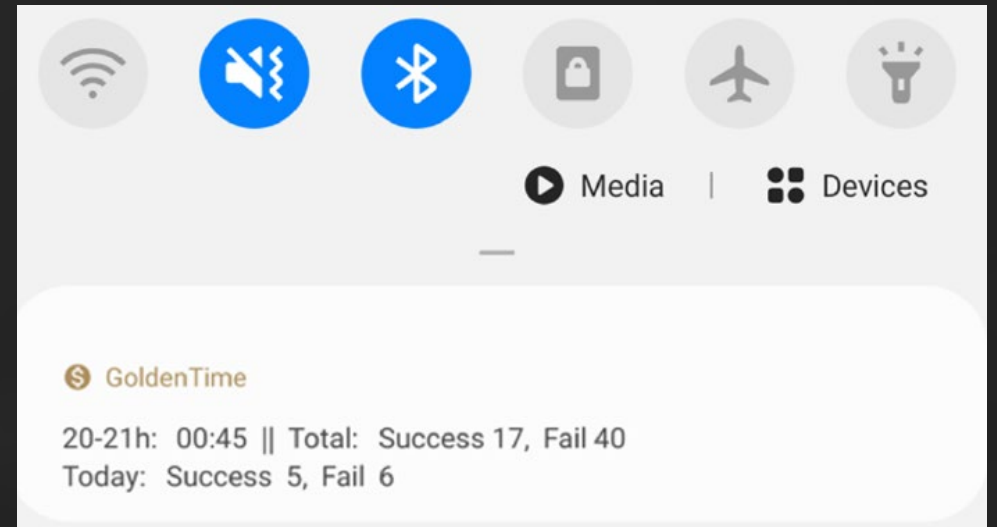
- Determining behavior results
- E.g., Regulation success or failure

↔ : Successful Timebox (Accumulated usage time ≤ 10 mins)

↔ : Not Successful Timebox (Accumulated usage time > 10 mins)

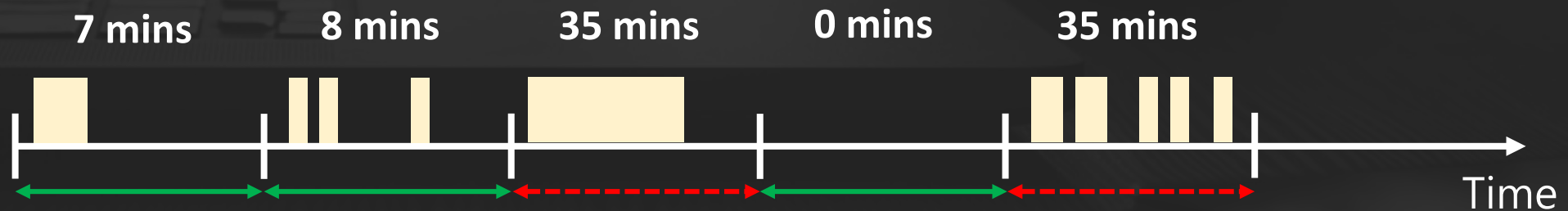**7 mins**   **8 mins**   **35 mins**   **0 mins**   **35 mins**

Time

System-driven Timeboxing

- Informing users of behavior results
- Using notification bar

GoldenTime

20-21h: 00:45 || Total: Success 17, Fail 40
Today: Success 5, Fail 6

⟷ : Successful Timebox (Accumulated usage time ≤ 10 mins)

⟷ : Not Successful Timebox (Accumulated usage time > 10 mins)
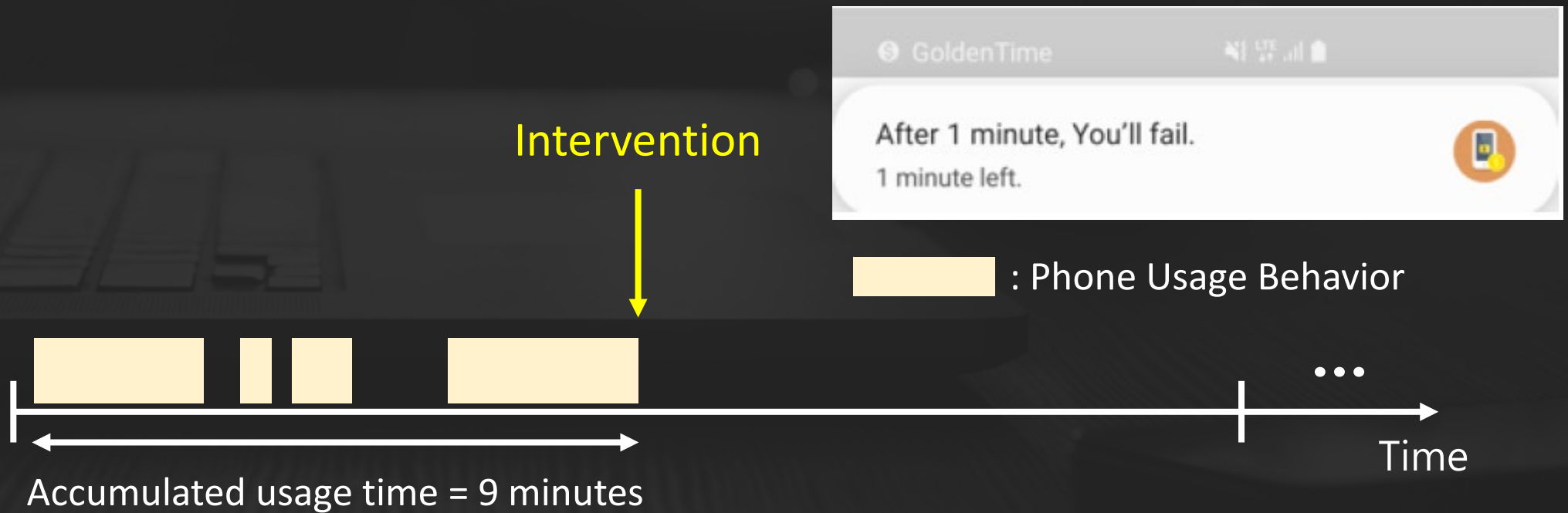
7 mins   8 mins   35 mins   0 mins   35 mins

Time

System-driven Timeboxing + Micro-Financial Incentives

- Reinforce motivation for phone usage regulation
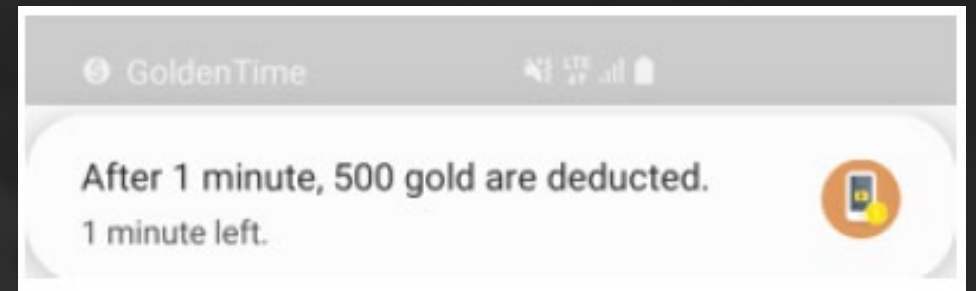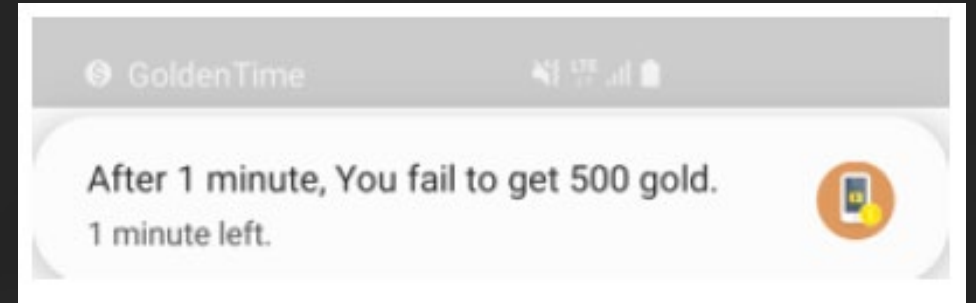- 2 incentive payment framing: Gain and Loss

500 Gold = 5 cents in USD

Gain Frame

| + 500 Gold | No Gain | + 500 Gold | ... |

Loss Frame

| No Loss | - 500 Gold | No Loss | ... |

Providing Intervention

- Delivered via notification message

Intervention

GoldenTime

After 1 minute, You'll fail.
1 minute left.

⬜ : Phone Usage Behavior

Accumulated usage time = 9 minutes

Time

Providing Intervention

- Delivered via notification message

GoldenTime
After 1 minute, You fail to get 500 gold.
1 minute left.

GoldenTime
After 1 minute, 500 gold are deducted.
1 minute left.

Intervention
w/ incentive framing

: Phone Usage Behavior

Time

Accumulated usage time = 9 minutes
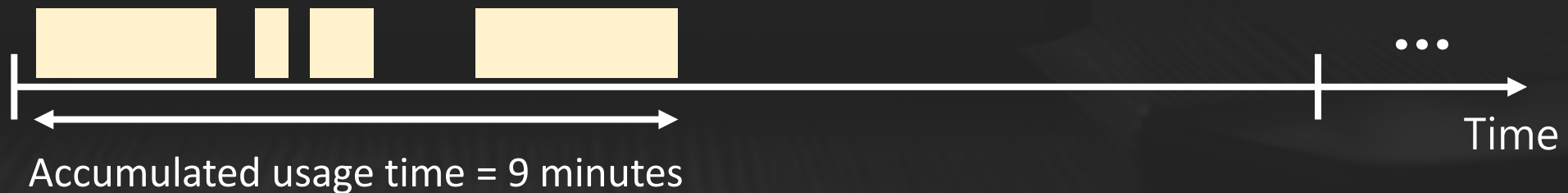
Our Hypothesis

- Effects on sustaining phone regulation: Loss > Gain

-500 Gold > **+500 Gold**

Value

Losses   Gains

Reference point

Kahneman, D., & Tversky, A. (2013). Prospect theory: An analysis of decision under risk. In Handbook of the fundamentals of financial decision making: Part I (pp. 99-127).
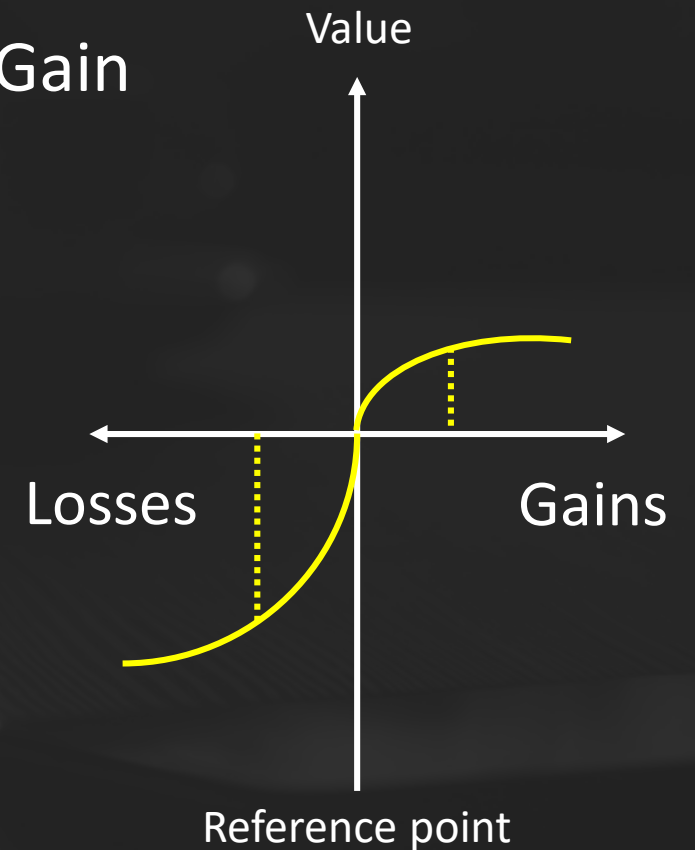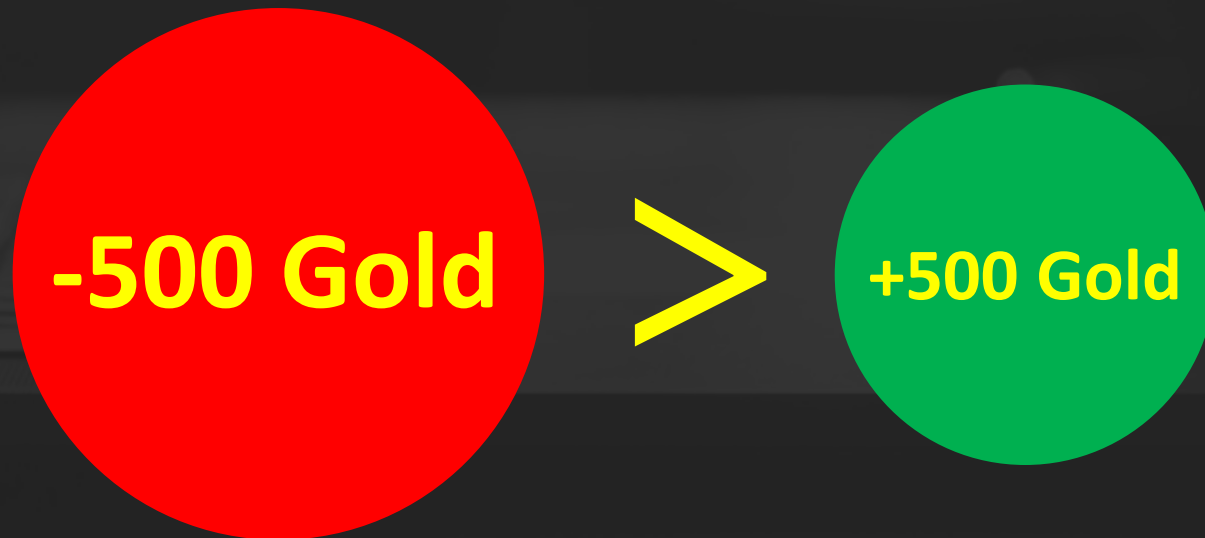
System Evaluations

Comparing Daily Average of Smartphone Usage Time

- Baseline

376 mins | 390 mins | 388 mins

Control | **Gain** | **Loss**

Comparing Daily Average of Smartphone Usage Time

- Intervention Period

376 mins

343 mins

390 mins

317 mins

388 mins

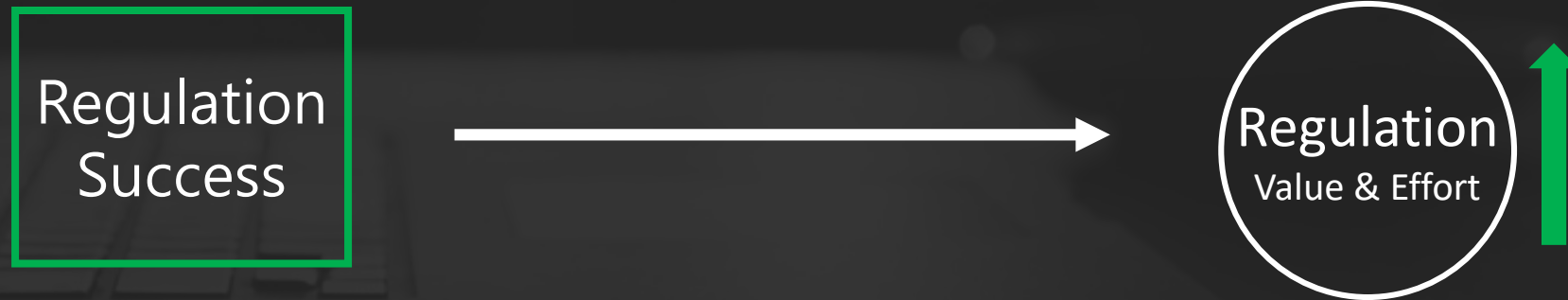253 mins

Control　　　　　　**Gain**　　　　　　**Loss**
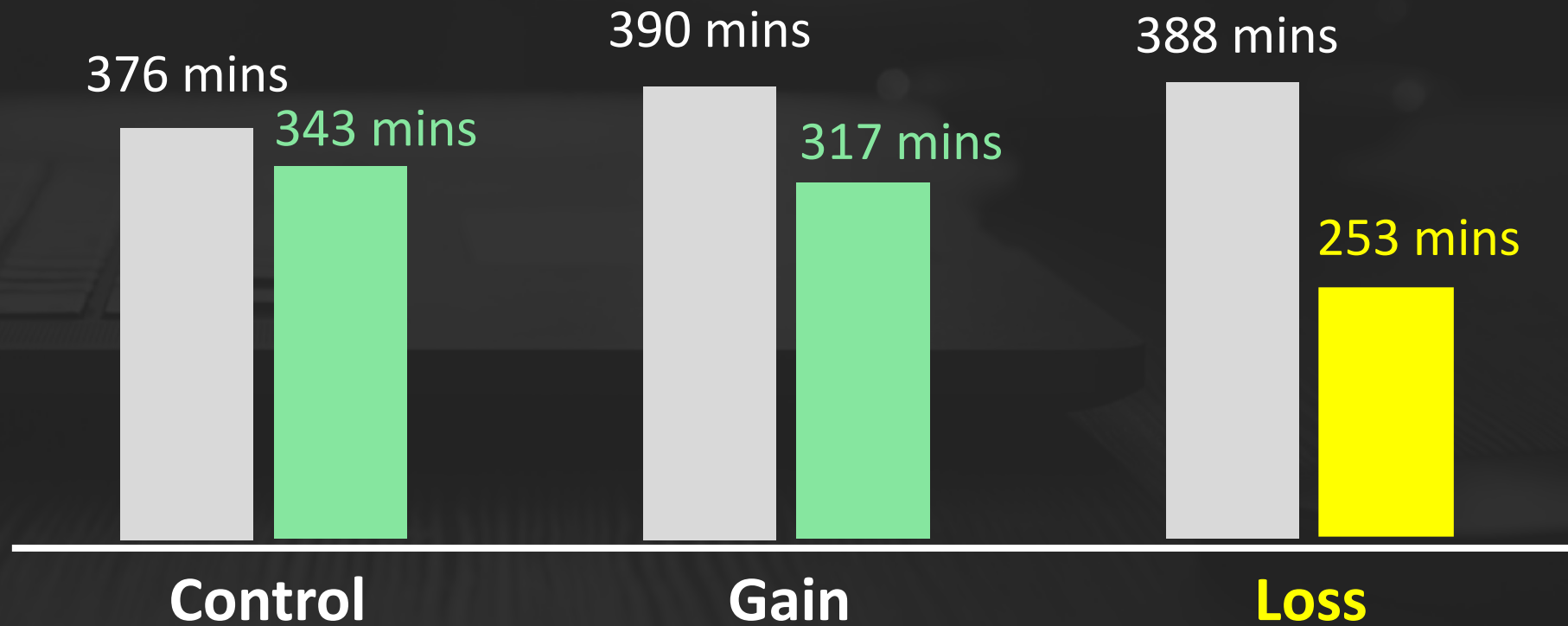
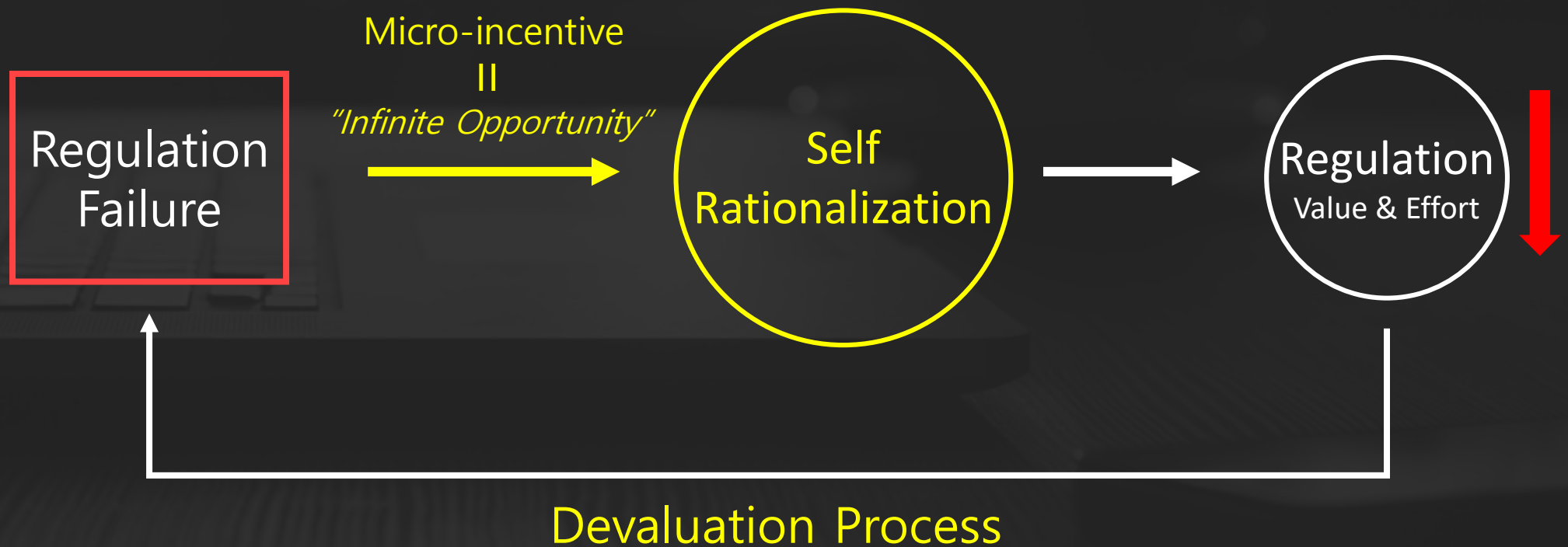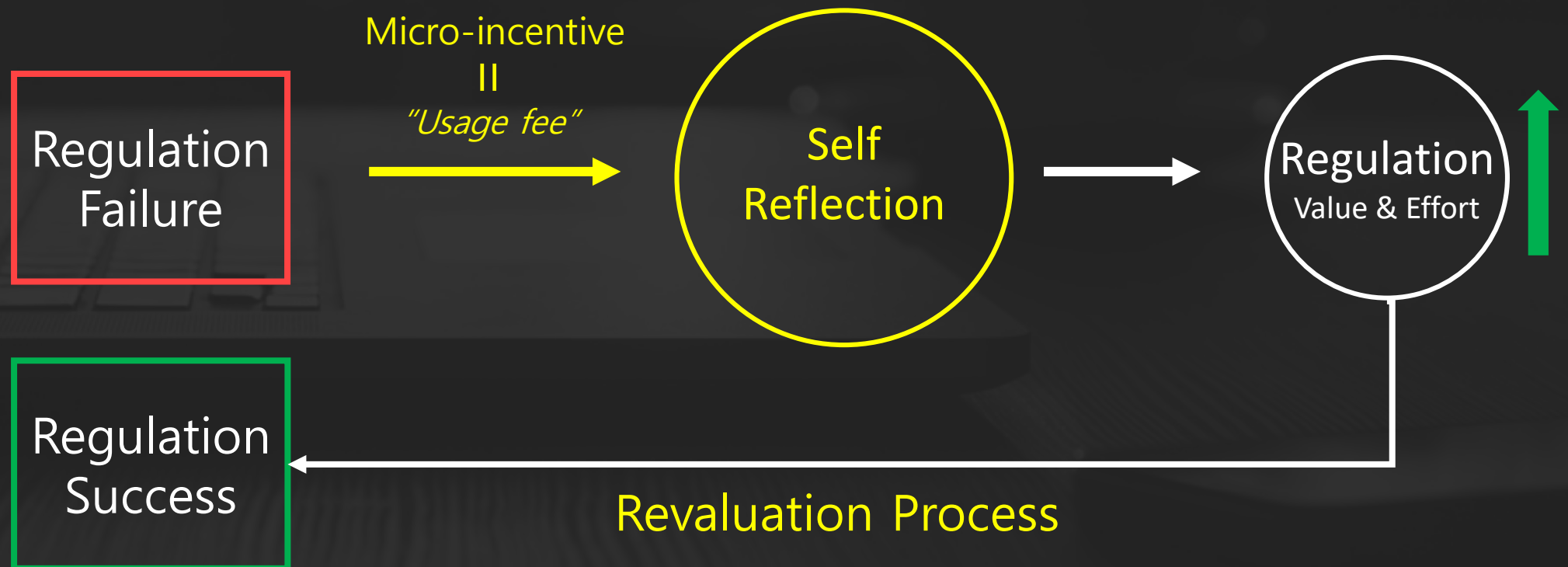# Effects of Incentive Framing
on System-Driven Timeboxing

Effects of Incentive Framing on System-Driven Timeboxing

- Gain Frame

Effects of Incentive Framing on System-Driven Timeboxing

- Loss Frame

Micro-incentive
II
"Usage fee"

Regulation
Failure

Self
Reflection

Regulation
Value & Effort

Regulation
Success

Revaluation Process

Thank you!

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Design Implications

- Towards flexible and context-aware proactive intervention

- Exploring micro-incentive design for timeboxing

- Data-driven actionable insights for better usage planning