

Strategies for Digital Wellbeing

(Current) Strategies for Digital Wellbeing
Alberto Monge Roffarello

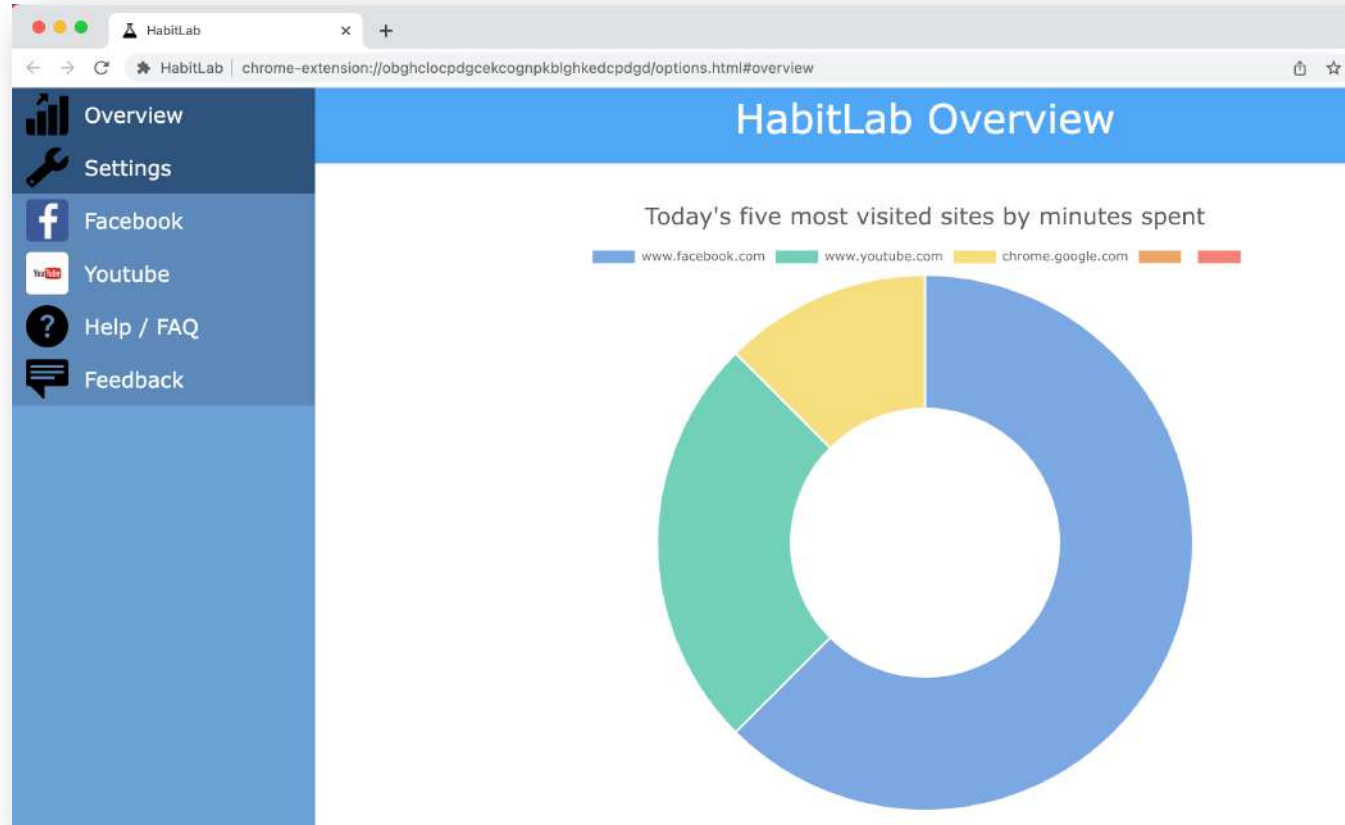
Outline

- Overview of contemporary DSCTs
- Evaluation of contemporary DSCTs
- Gaps in contemporary DSCTs
- Designing theoretically-grounded DSCTs

Digital Sel-Control Tools: Introduction

- The last few years have seen the flourishing of **Digital Self-Control Tools (DSCTs)** both in academia and as off-the-shelf products:
 - external tools, such as **apps** or **browser extensions**, that support users to self-regulate their use of devices, apps, and/or websites.
- They typically allow users to:
 - track their usage patterns, and
 - define self-imposed interventions, e.g., usage timers.

Research and commercial DSCTs

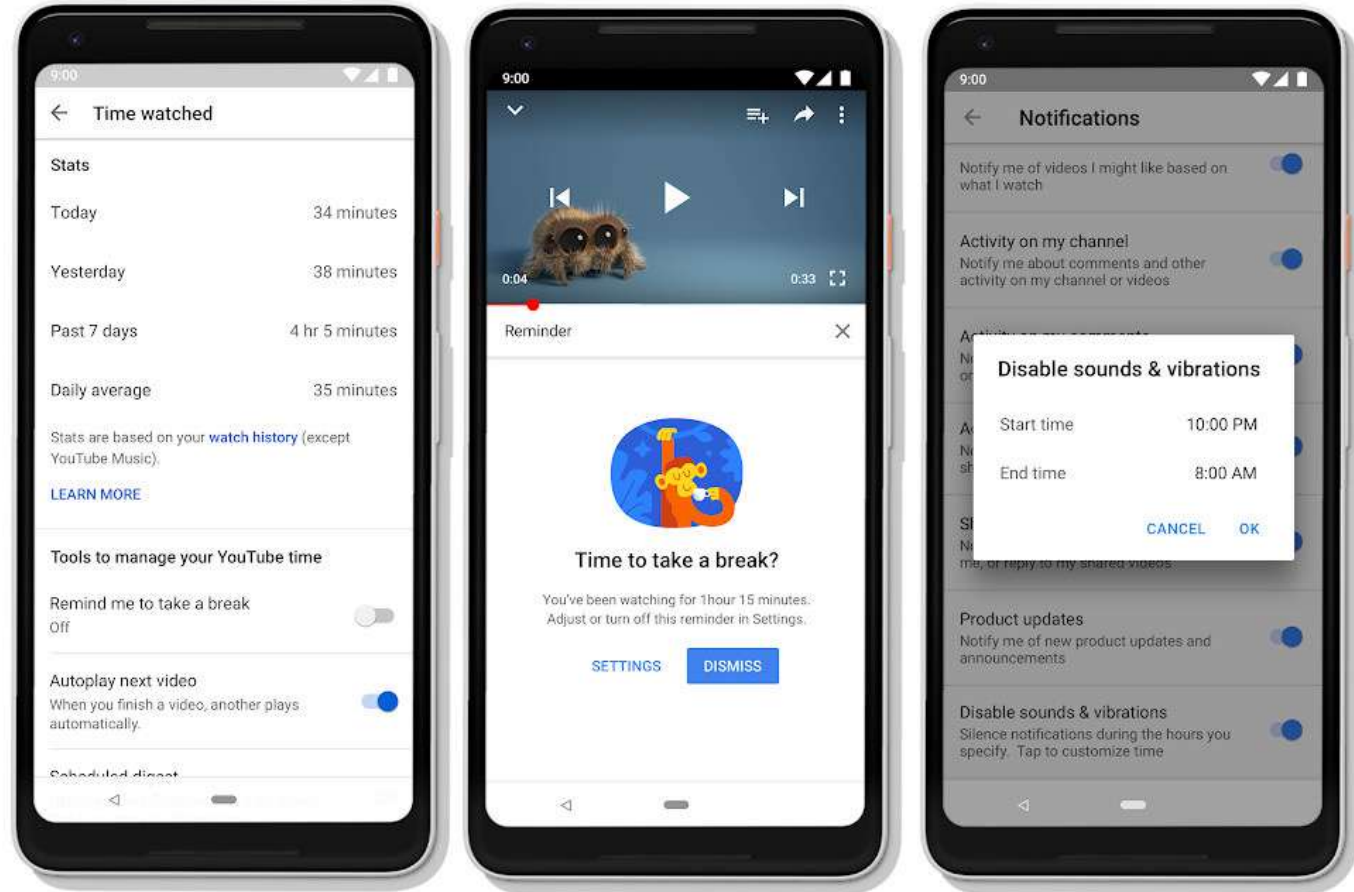
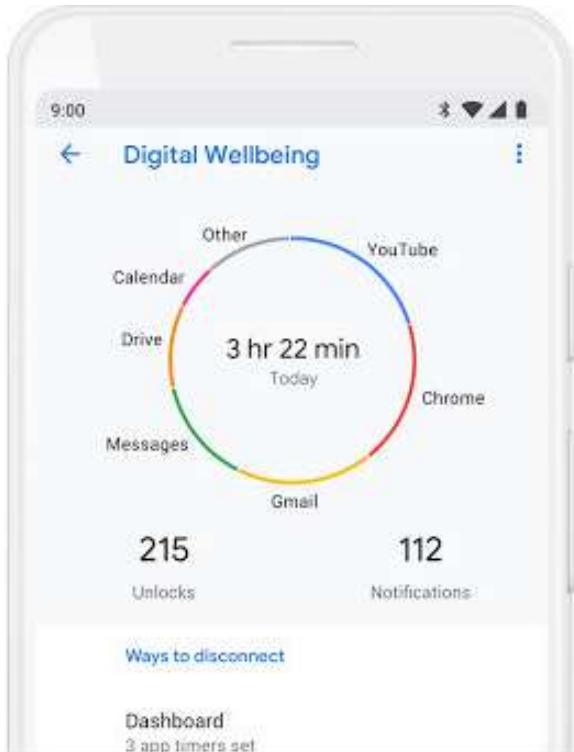


HabitLab
<https://habitlab.github.io/>



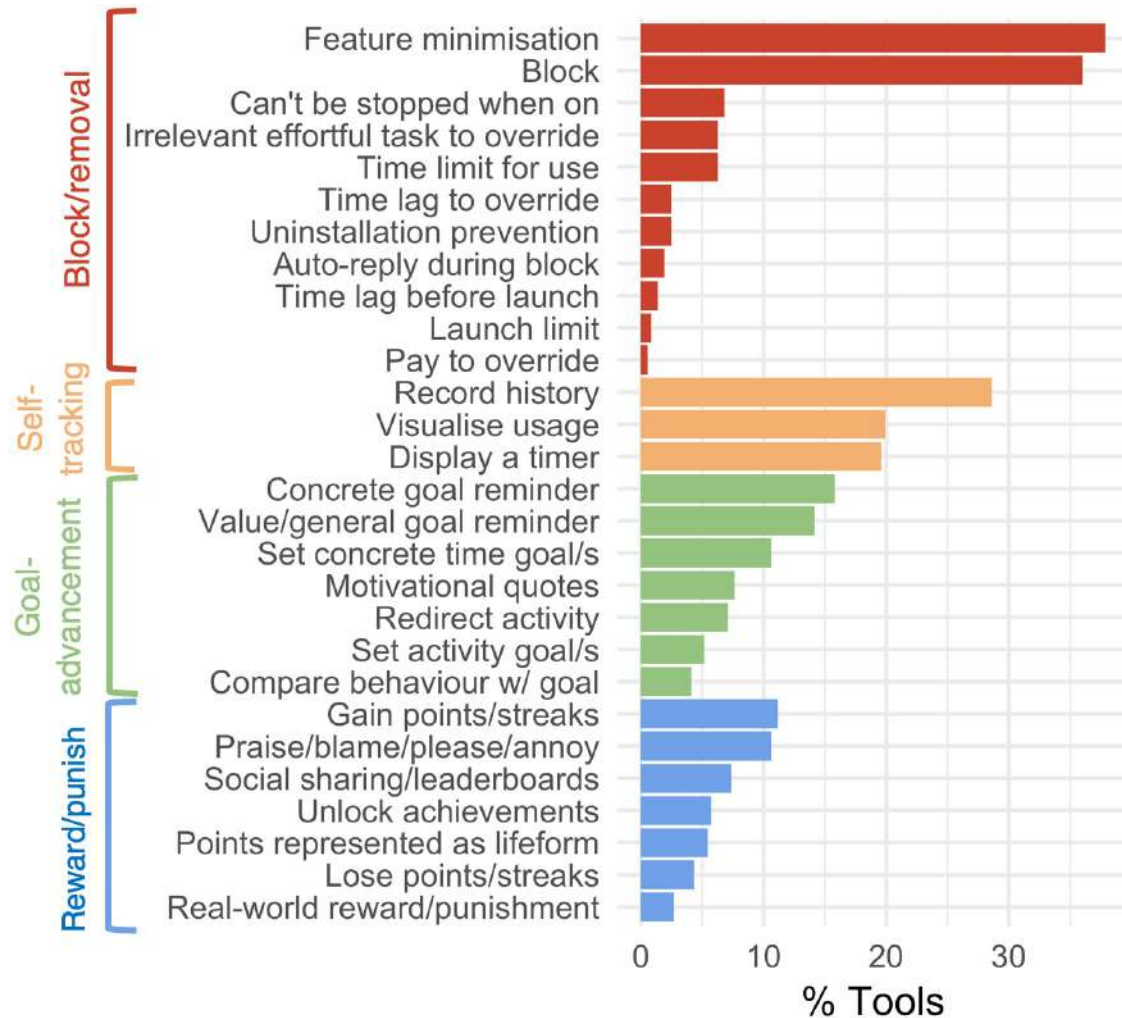
FOREST
<https://www.forestapp.cc/>

DSCTs



Google Digital Wellbeing <https://wellbeing.google/>

What do current DSCTs do?

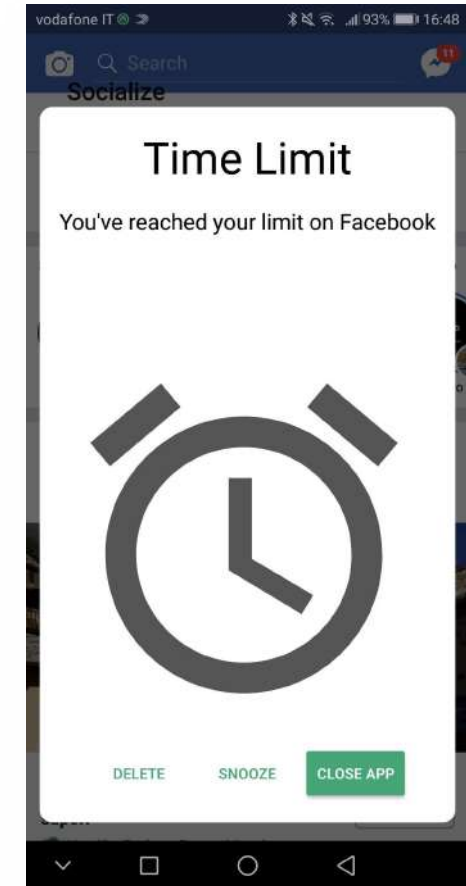


Self-Control in Cyberspace: Applying Dual Systems Theory to a Review of Digital Self-Control Tools

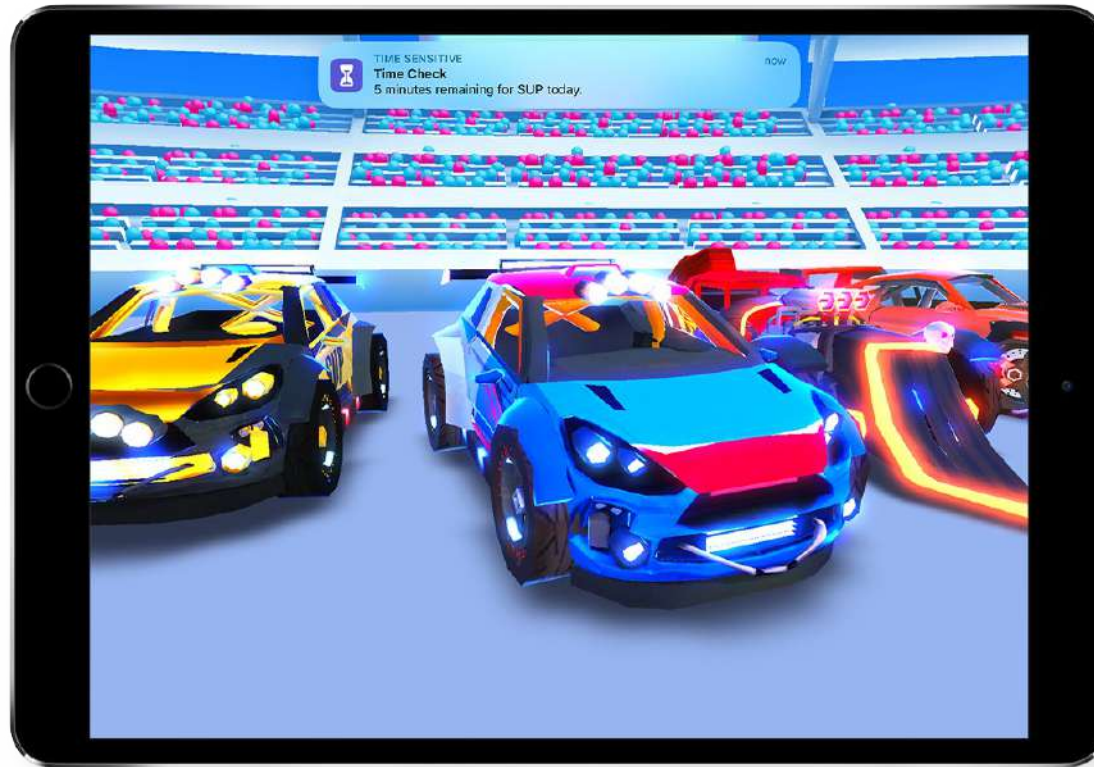
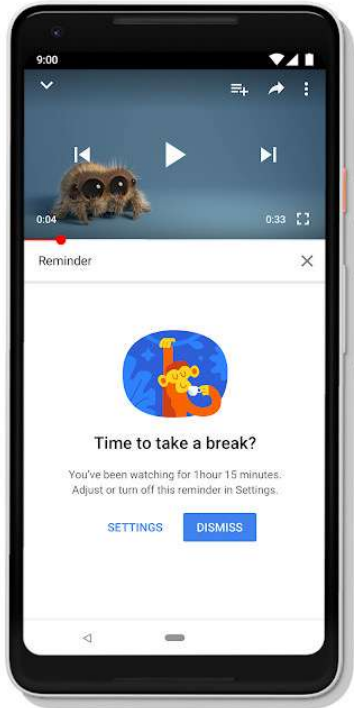
<https://arxiv.org/abs/1902.00157>

Block/Removal (74% of tools)

- The most common type of feature is to **block or remove** distractions.
- Through block/removal, DSCTs might:
 - enable people to **block themselves** from using specific apps or websites or their smartphones altogether (more common);
 - **remove** specific distracting **features** within the services they use (less common).
- Examples:
 - usage timers and blockers;
 - whitelists and blacklists;
 - friction desing: introducing something (e.g., a time lag, an additional task) to make techonology usage more difficult.

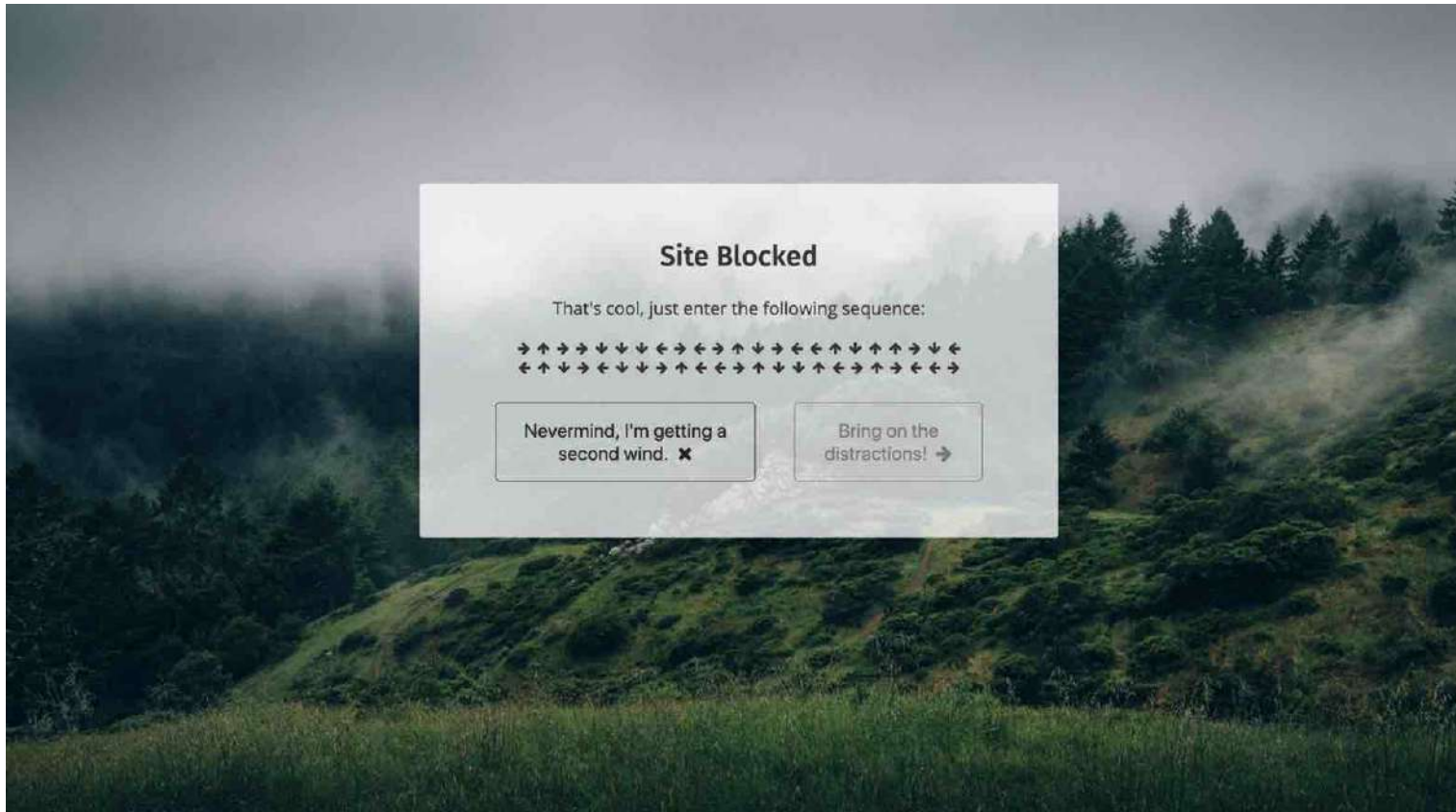


Block/Removal



Google Digital Wellbeing and Apple Screen Time allow users to set up usage timers for specific apps. When a usage timer expires, there is a warning, e.g., a notification

Block/Removal

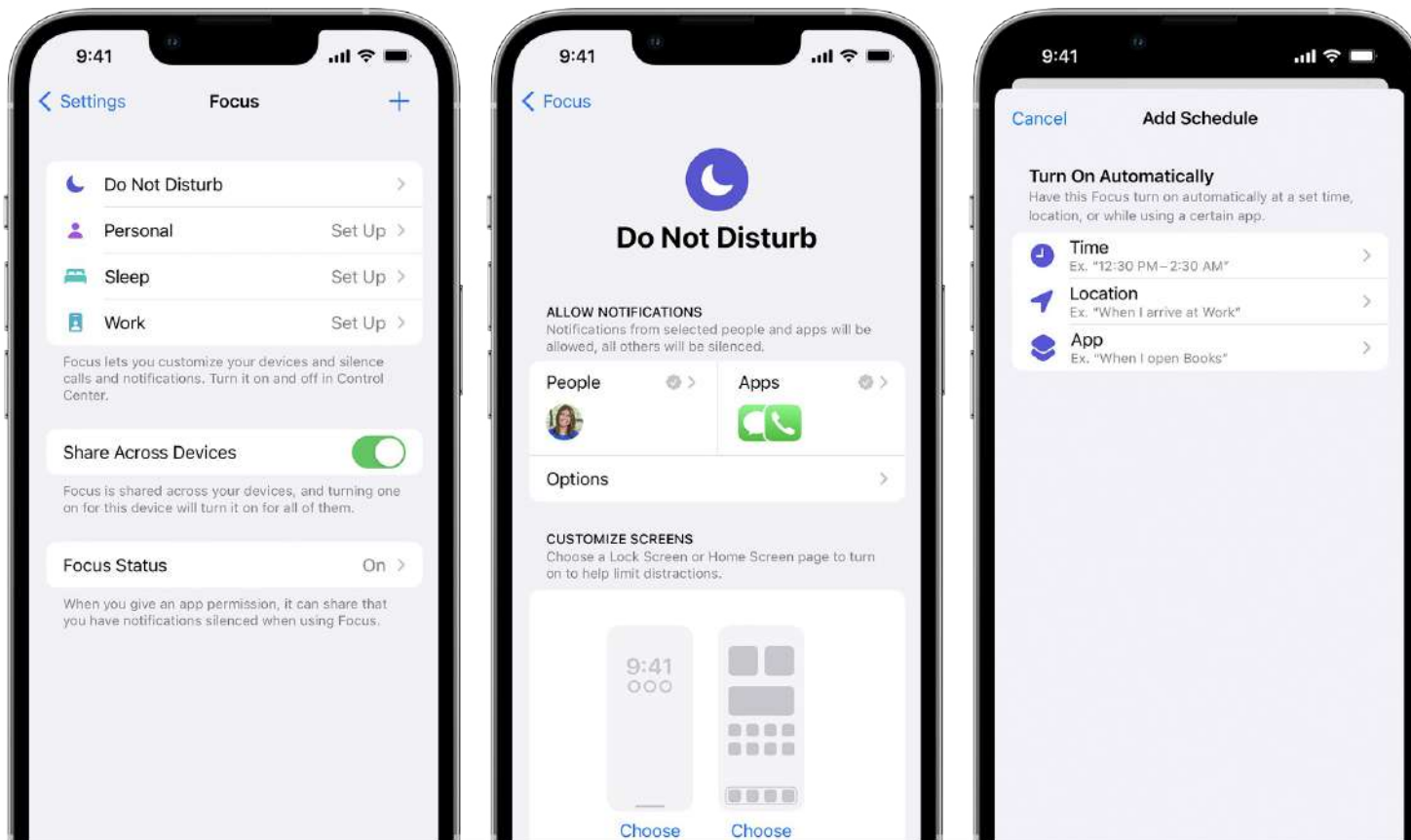


[Focusly](#) blocks access to websites on a blacklist, then helps people stick with their intention by requiring them to type in a series of 46 arrow keys in a specific order, before they can stop a blocking session.

Block/Removal

iOS and Android smartphones have a **“focus mode”** feature to disable notifications.

On Pixel smartphones you can set up a **“bedtime mode”** that silences the phone and remove the screen's color.



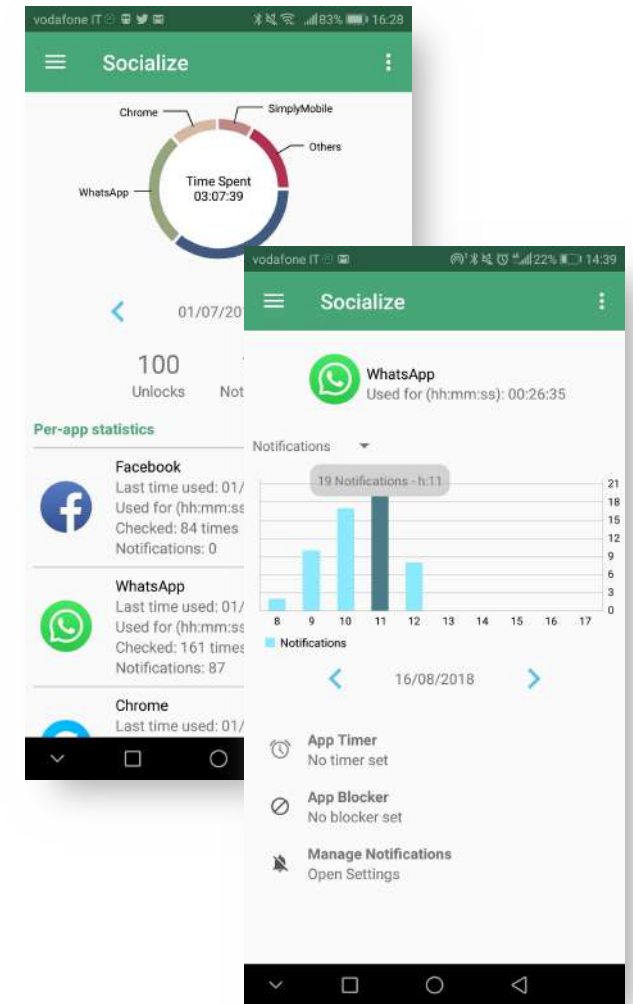
Block/Removal



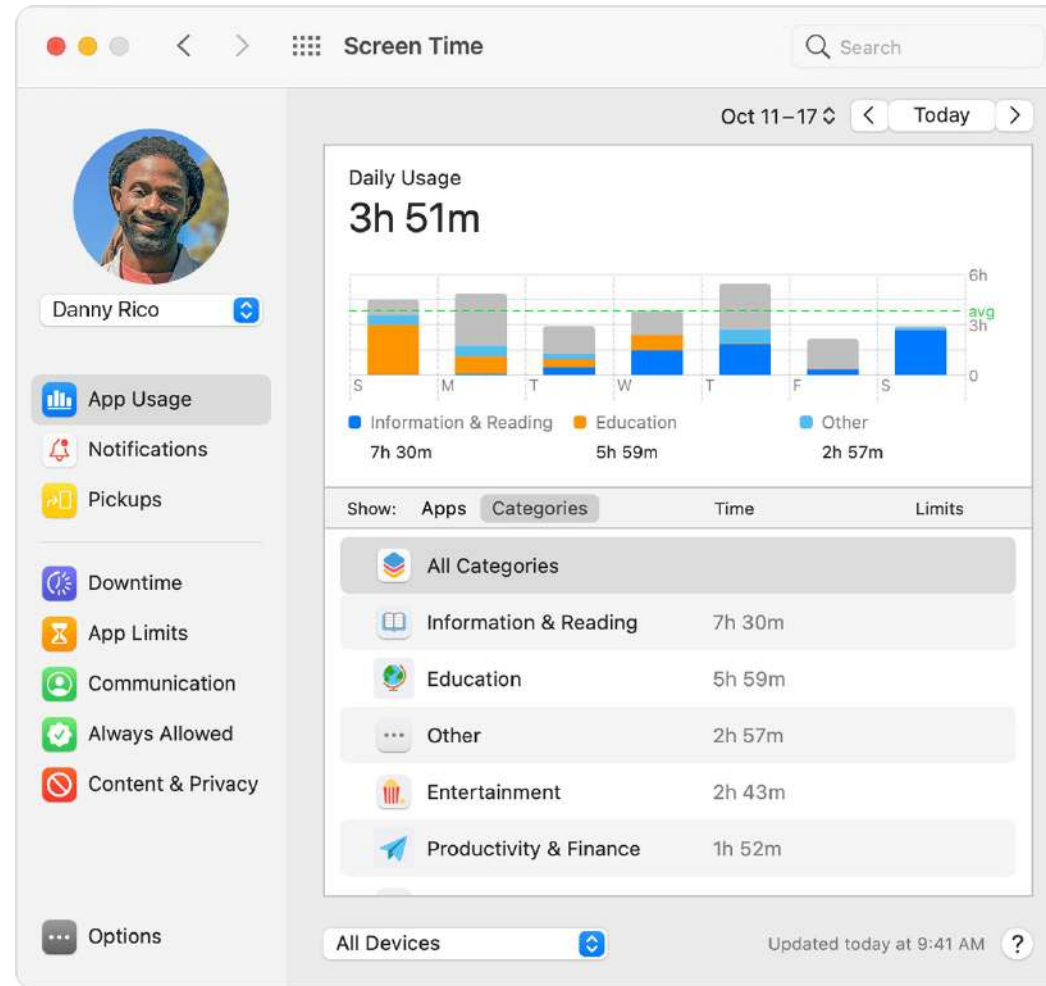
The [News Feed Eradicator](#) removes the newsfeed from Facebook and replaces it with a motivational quote. Similar extensions do things such as remove suggested videos on YouTube.

Self Tracking (38% of tools)

- Several DSCTs record and visualise how people use their device, or display timers so that people can keep track of how long they've stayed on task.
- They make use of **productivity dashboards** with usage **statistics** and **charts**.
- They enable users to:
 - **"self-evaluate"** themselves by monitoring their own behavior with technology;
 - decide what countermeasures to take:
 - "I noticed I was using Instagram too much, let's set a timer to limit my use."

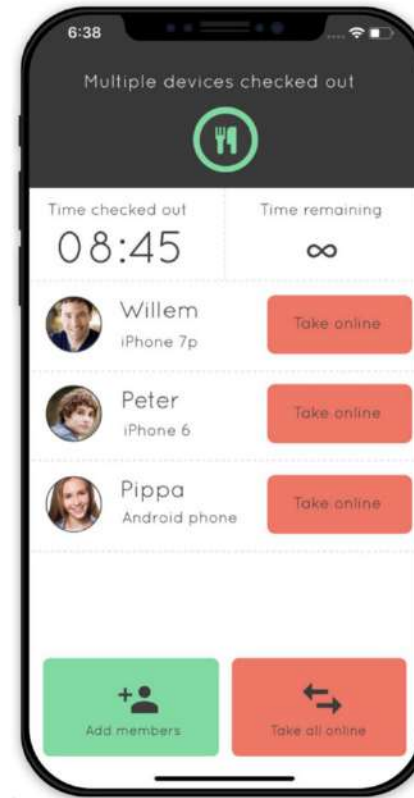
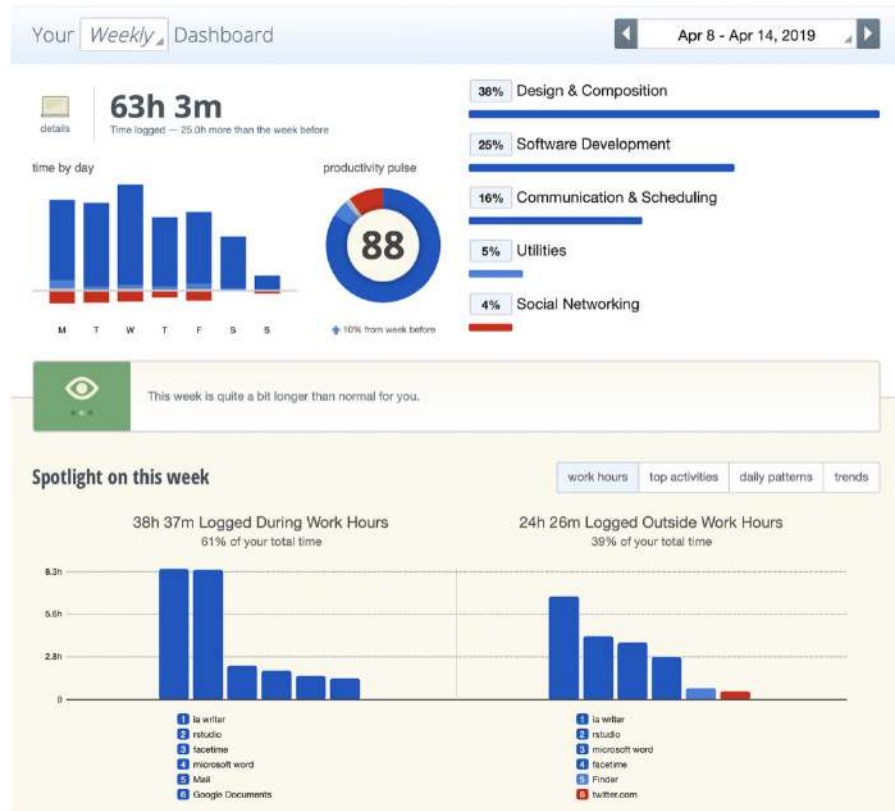


Self Tracking



Google Digital Wellbeing and Apple Screen Time have their own dashboards for self tracking.

Self Tracking

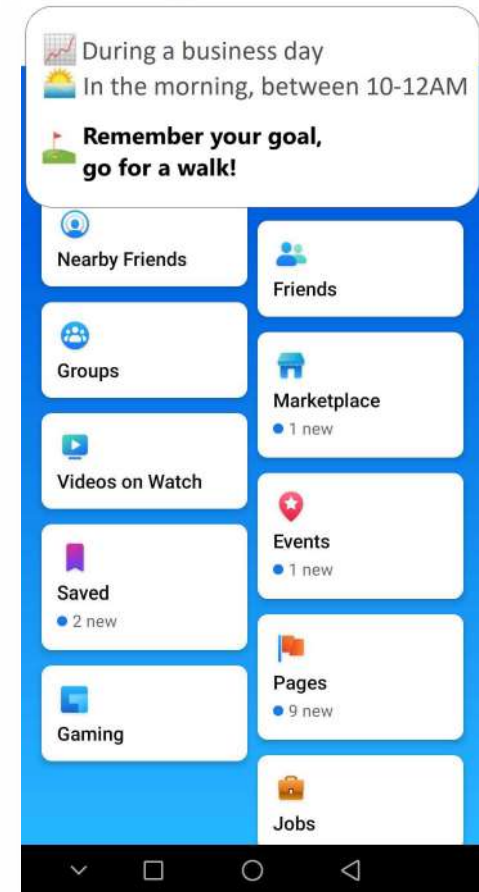


[RescueTime](#) (left) tracks and visualises time spent on laptops.

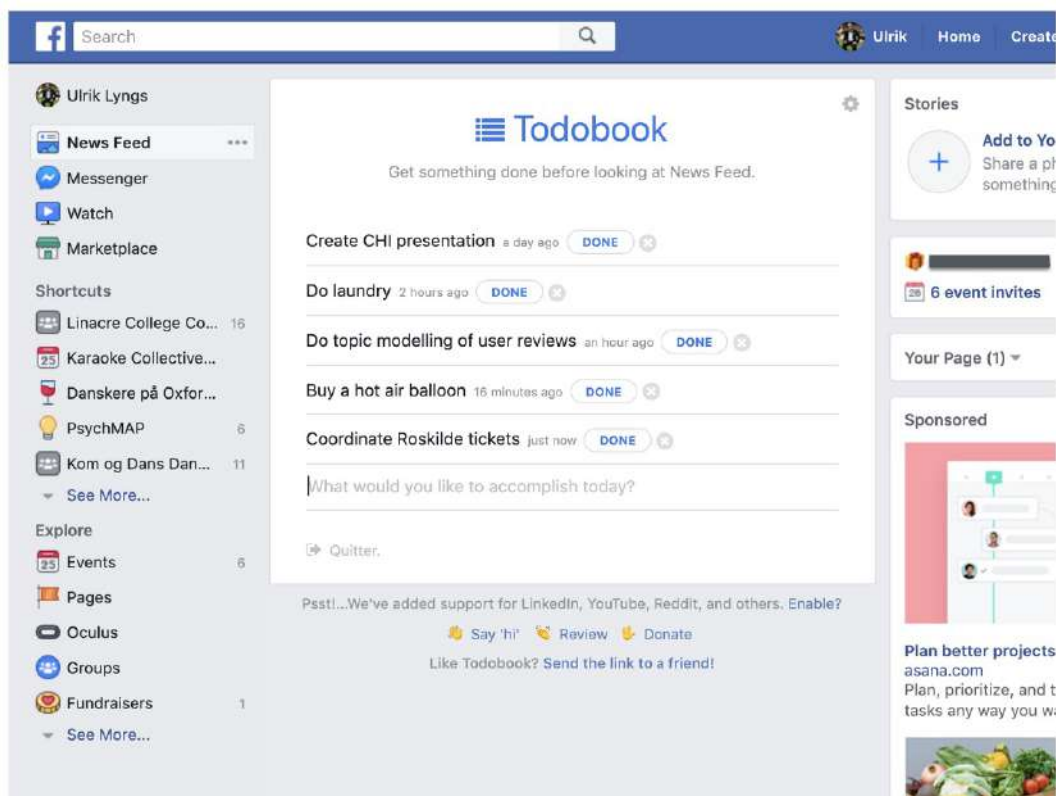
[Checkout of Your Phone](#) (right) tracks how long you've time you've managed not to use your smartphone.

Goal Advancement (35% of tools)

- Some DSCTs include features for **nudging** people towards working on the **right tasks** when they actually use their devices.
- They may allow users to set **usage goals** and control their progress:
 - "I want to use Twitter at most half an hour a day."
- They may use notifications and reminders with motivational sentences to **encourage** users to meet their goal.



Goal Advancement



Todobook (left) replaces Facebook's newsfeed with a to-do list

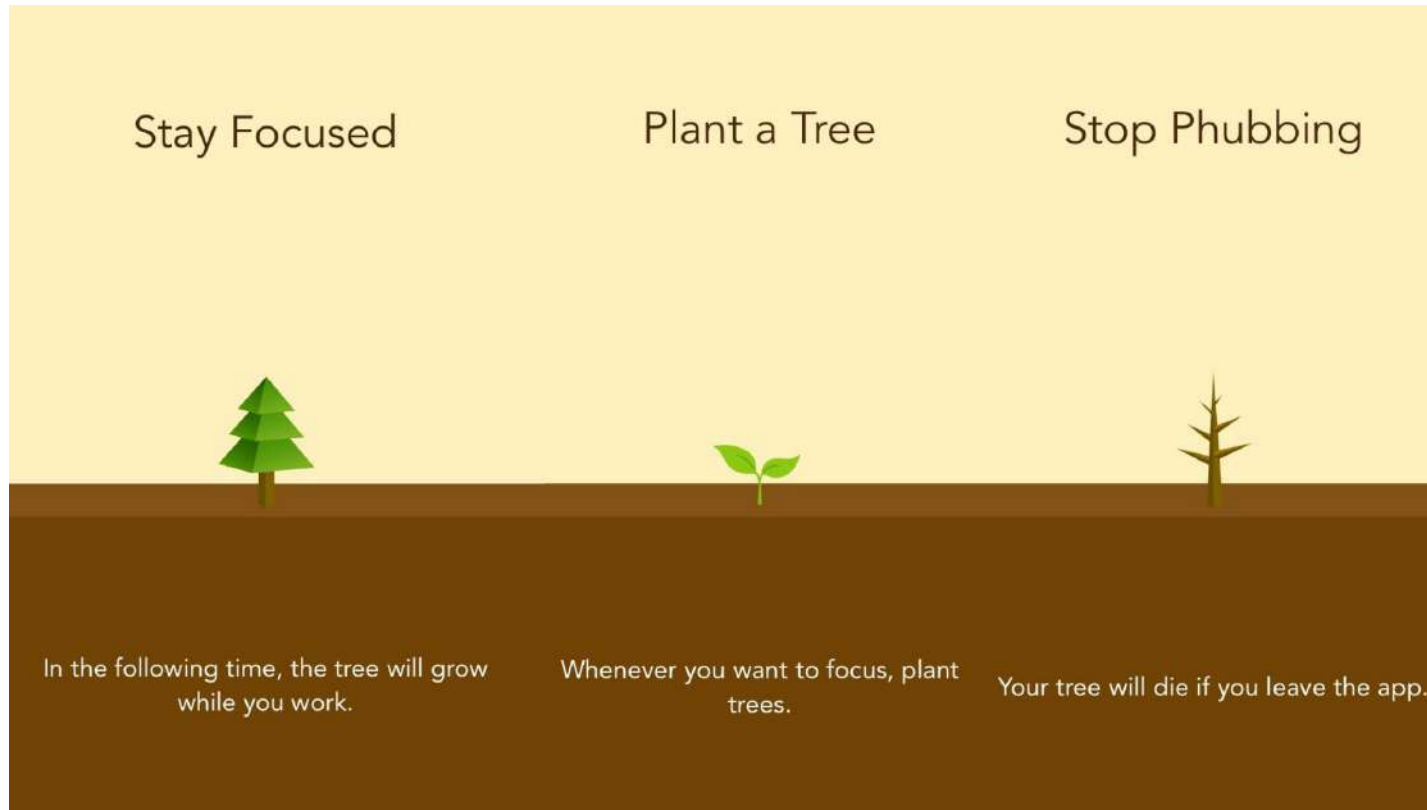
Time (right) is a to-do list which provides continual task reminders if the user leaves the app.

Reward/Punishment (22% of tools)

- Some DSCTs include features that **reward** or **punish** people for how they use their devices.
- They may use **gamification**:
 - the use of a device, app, or website is tied to a score;
 - points are earned if self-imposed usage limits are met;
 - there may be the possibility to share scores and "challenge" other users

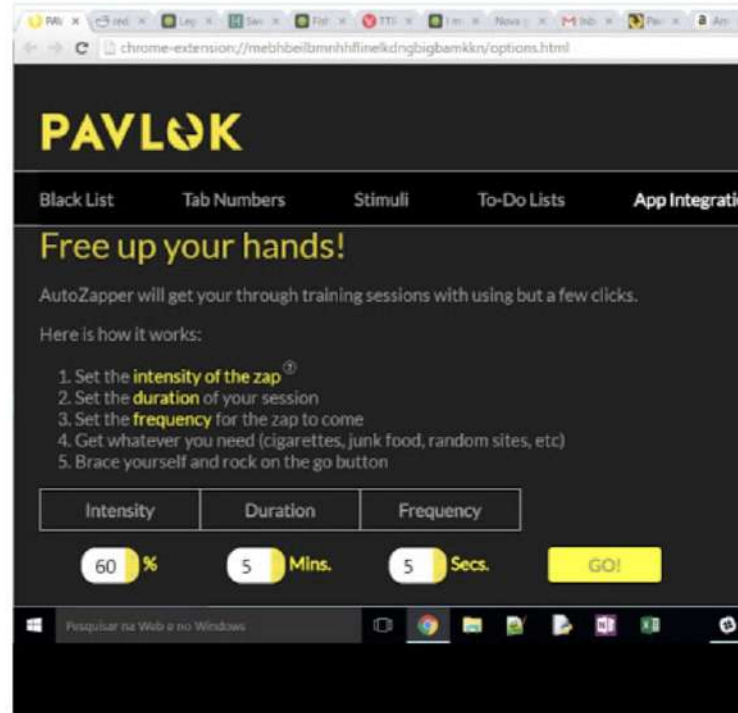
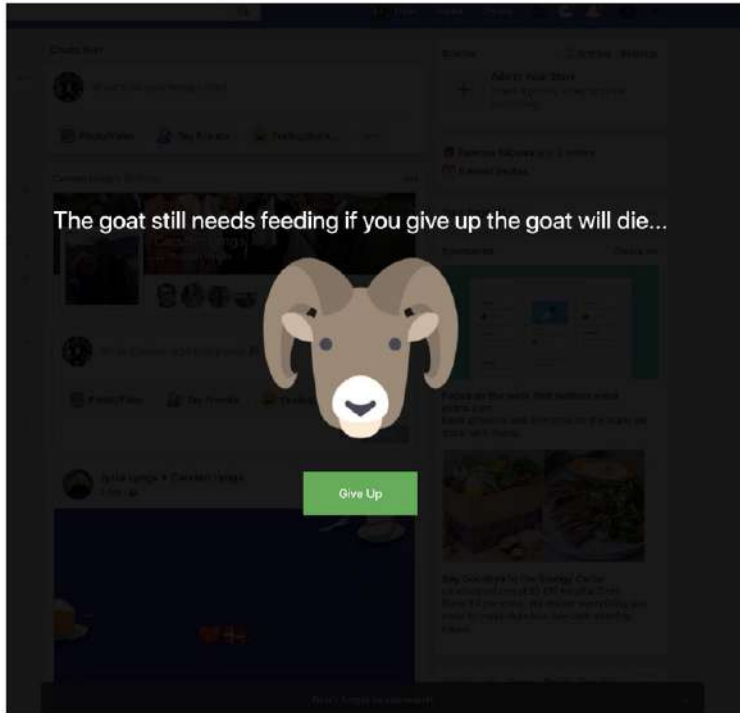


Reward/Punishment



Forest grows virtual trees that may be killed if one's device is used inappropriately.

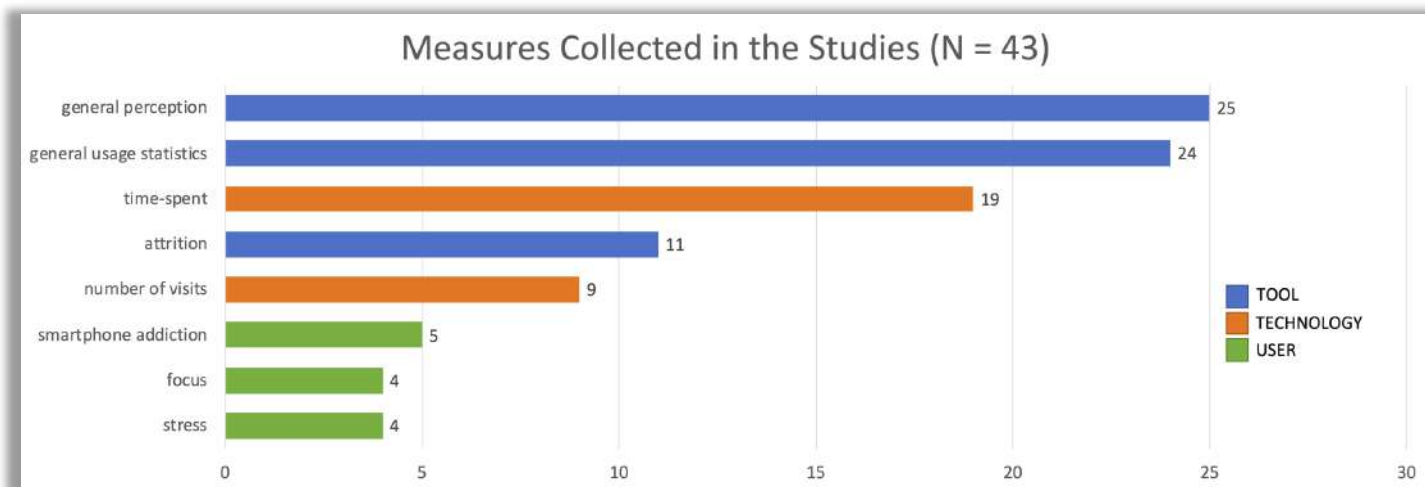
Reward/Punishment



[Timewaste Timer](#) takes money out of your bank account if you spend too much time on Facebook.

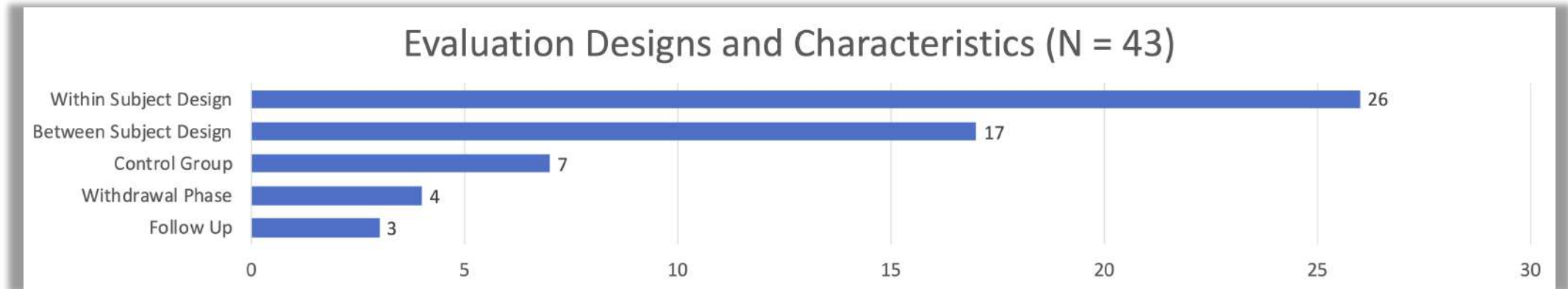
[PAVLOK](#) lets you automatically administer yourself electrical shocks via a bracelet if you try to access blacklisted websites.

Evaluation of Contemporary DSCTs: Collected Metrics



Scale	Summary	Paper/Authors
Smartphone Addiction Scale (SAS) [120]	A self-diagnostic scale composed of 33 questions and 6 points from daily-life disturbance to tolerance to evaluate the smartphone addiction using self-reporting.	Kim et al. [105]; Pinder et al. [177]; Monge Roffarello et al. [159]; Ko et al. [114]; Ahn et al. [127];
Nasa-Task Load Index (NASA-TLX) [76]	A multidimensional assessment tool to evaluate perceived workload of a task or a system in terms of mental, physical, and temporal demand, performance, effort, and frustration.	Kim et al. [105]; Kim et al. [106]; Mark et al. [149]; Mark et al. [150]; Liu et al. [133];
Cognitive Absorption Scale [9]	A scale to measure five states associated with deep engagement with technology, i.e., temporal dissociation, focused immersion, heightened enjoyment, control, and curiosity.	Kim et al. [105]; Mark et al. [149]; Mark et al. [150];
General Self-Efficacy Scale (GSE) [92]	A 10-item psychometric scale to assess optimistic self-beliefs and perceived self-efficacy to cope with daily activities and isolated stressful events.	Monge Roffarello et al. [159]; Ko et al. [114];

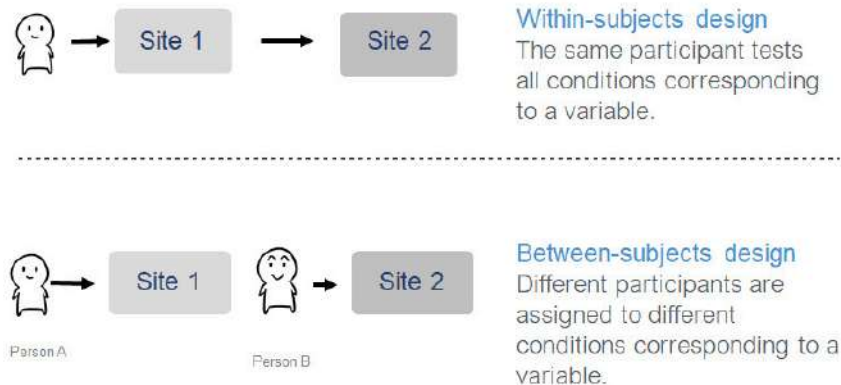
Evaluation of Contemporary DSCTs: Study Design



A summary of the designs and the main characteristics of the 43 studies under analysis.

Within Subject vs. Between Subject

- **Between-subjects** (or **between-groups**) study design: different people test each condition so that each person is only exposed to a single tool/interface/...
- **Within-subjects** (or **repeated-measures**) study design: the same person tests all the conditions (i.e., all the tools/interfaces/...).



nngroup.com NN/g

<https://www.nngroup.com/articles/between-within-subjects/>

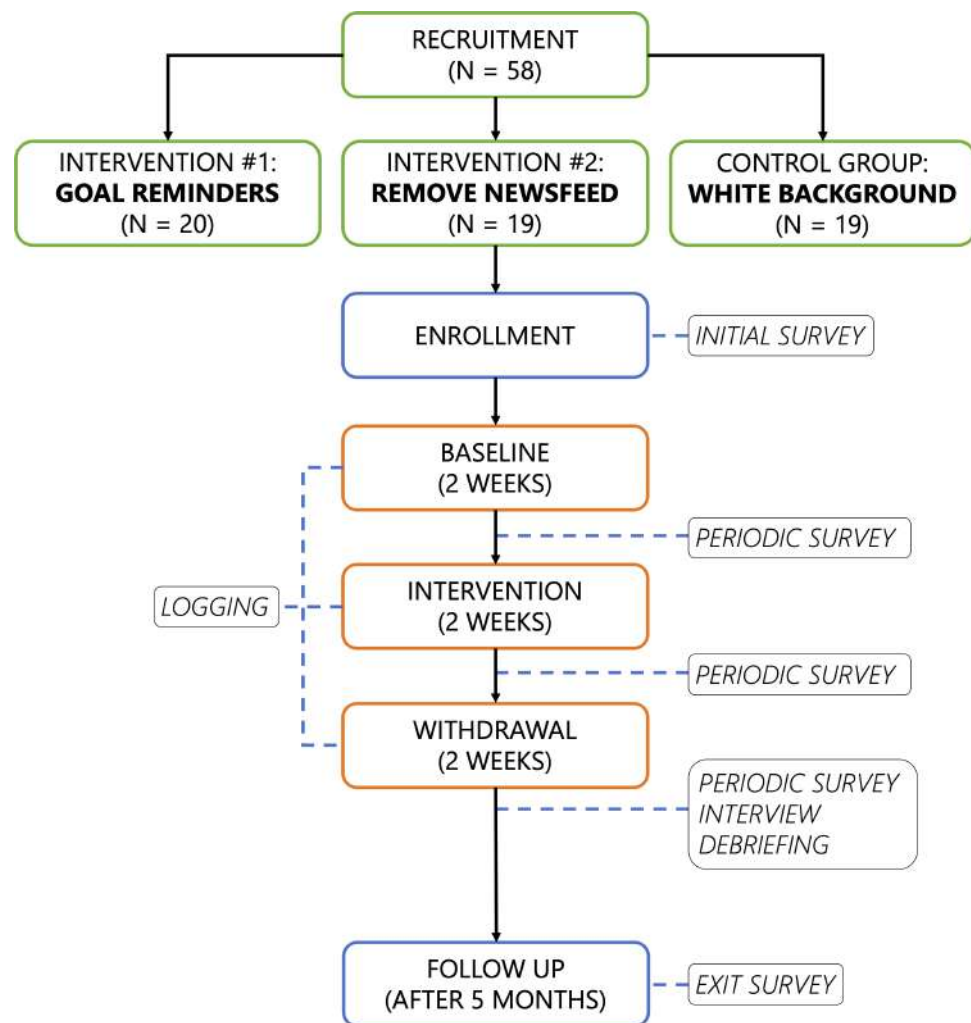
Evaluation of Contemporary DSCTs: Study Design

- The average number of participants involved in DSCTs experiments is 36
- The most common type of evaluation adopted by researchers is a 21-day controlled field study that follows a **within-subject** design:
 - the DSCT is deployed on participants' devices;
 - one initial week of **baseline**, i.e., 7 days during which the tool is “transparent” to the participants;
 - two weeks of **intervention**, i.e., 14 days during which participants can use all the functionality of the DSCT.

Evaluation of Contemporary DSCTs: Problems

- Experiments are typically short (e.g., 21 days) and cannot assess the long-term effects of using a DSCT.
- Experiments rarely include a control group, with a prevalence of within-subject experiments.
- Experiments rarely include a withdrawal phase, i.e., a phase during which the DSCT is (progressively) removed:
 - we cannot know if the usage of a DSCT can promote the formation of new behaviors.
- Strong selection bias towards young university students, and, more generally, towards technology-savvy users that use devices like PCs and laptops every day, e.g., for studying or working.

Evaluation of Contemporary DSCTs: an Example



Example of a good study design:

- it compares two randomly-selected groups of participants subjected to different Facebook interventions, i.e., *goal reminders* and *remove newsfeed*;
- a group of users receives a “placebo” intervention, i.e., turning the Facebook background from light grey to white;
- it uses surveys and interviews after each phase of the study, including a 5-month follow-up that partially addresses the need for long-term evaluations.

Known Gaps in Contemporary DSCTs

1. **self-monitoring nature:** through contemporary DSCTs, people need to figure out for themselves the causes of their problems and possible solutions;
2. **short-term effectiveness:** contemporary DSCTs are not effective in the long term, as they do not promote the formation of new habits;
3. **focus on (single-device) screen-time:** is reducing screen time the right way to support people's digital wellbeing?
4. **theoretical gap:** DSCTs and the digital wellbeing research area are not sufficiently grounded in HCI and behavioral theories.

Self-Monitoring and Short-Term Effectiveness

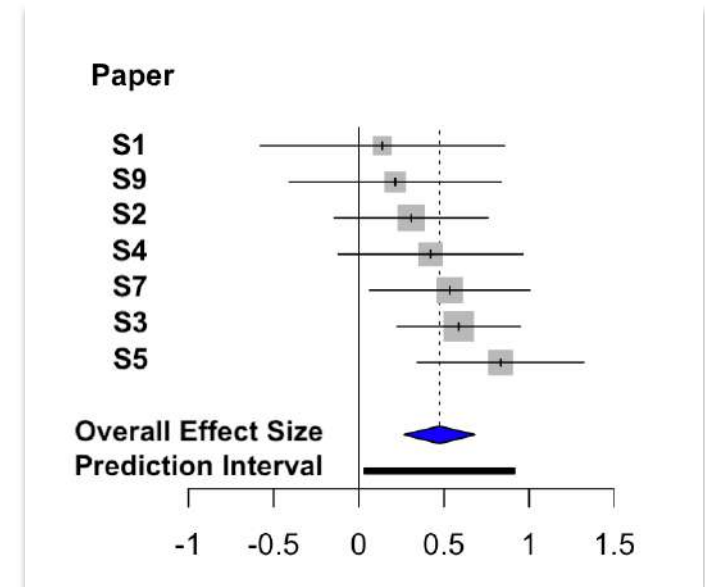
- The majority of contemporary DSCTs are based on self-tracking statistics block/removal strategies, i.e., they have **self-monitoring nature**:
- Users need to figure out for themselves:
 - what are the causes of their problems, e.g., by selecting which apps they would like to use less;
 - what is the most appropriate strategy to intervene on their unwanted behaviors, e.g., by selecting an appropriate time threshold for a usage timer.

Self-Monitoring and Short-Term Effectiveness

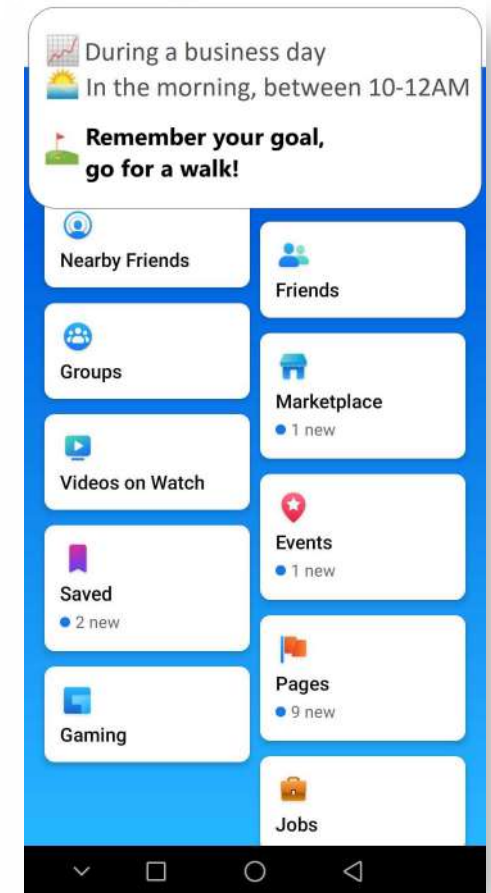
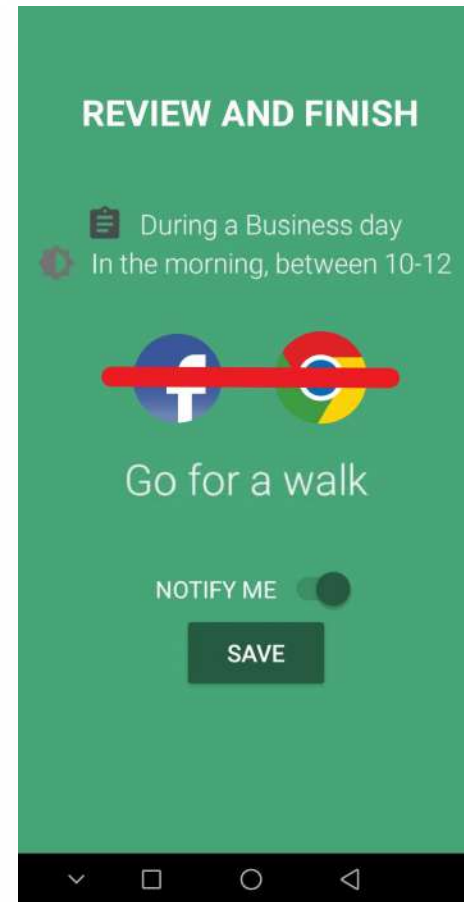
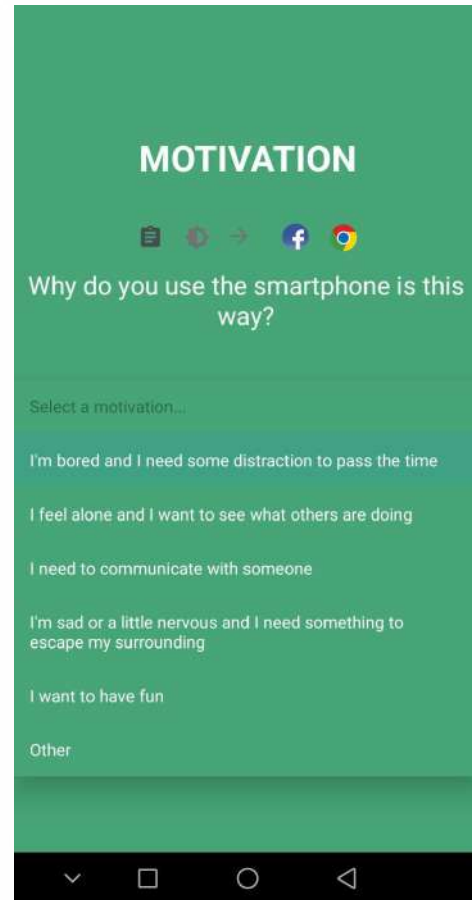
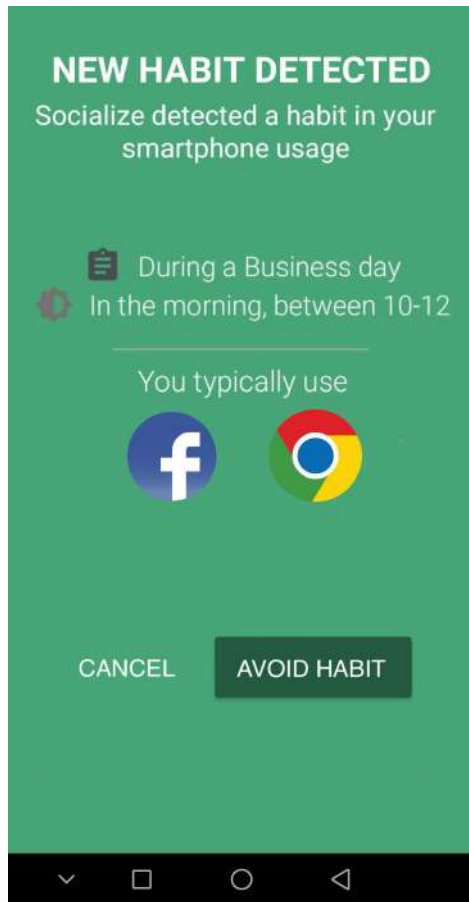
- Unfortunately, problems can be difficult to identify (and to admit), and DSCTs may not match users' expectations:
 - high attrition rate!
- As a result, DSCTs are not effective in the long term:
 - **basic contradiction:** technology to disincentivize the usage of other technologies;
 - **block** of negative behaviors rather than promoting alternative behaviors;
 - work in the **short term:** when users stop using (or use less) a DSCT, their behavior tends to return to previous levels;
 - lack of **proactivity:** users must remember to use the tool and "control" their behavior.

Self-Monitoring and Short-Term Effectiveness

Paper	Hedges' g	Participants [#]	95% CI
Okeke et al. (S5) [114]	0.8325	35	[0.3430;1.3221;]
Whittaker et al. (S3) [223]	0.5863	61	[0.2236;0.9489]
Kim et al. (S7) [105]	0.5340	36	[0.0634; 1.0046]
Ko et al. (S4) [112]	0.4211	27	[-0.1187; 0.9609]
Monge Roffarello et al. (S2) [159]	0.3071	38	[-0.1454;0.7595]
Lyngs et al. (S9) [145]	0.2140	20	[-0.4078; 0.8357]
Tseng et al. (S1) [177]	0.1375	15	[-0.5791;0.8542]
Overall Effect Size	0.4734	255	[0.2657; 0.6811]
Prediction Interval			[0.0332; 0.9136]



Socialize: a Proactive DSCT



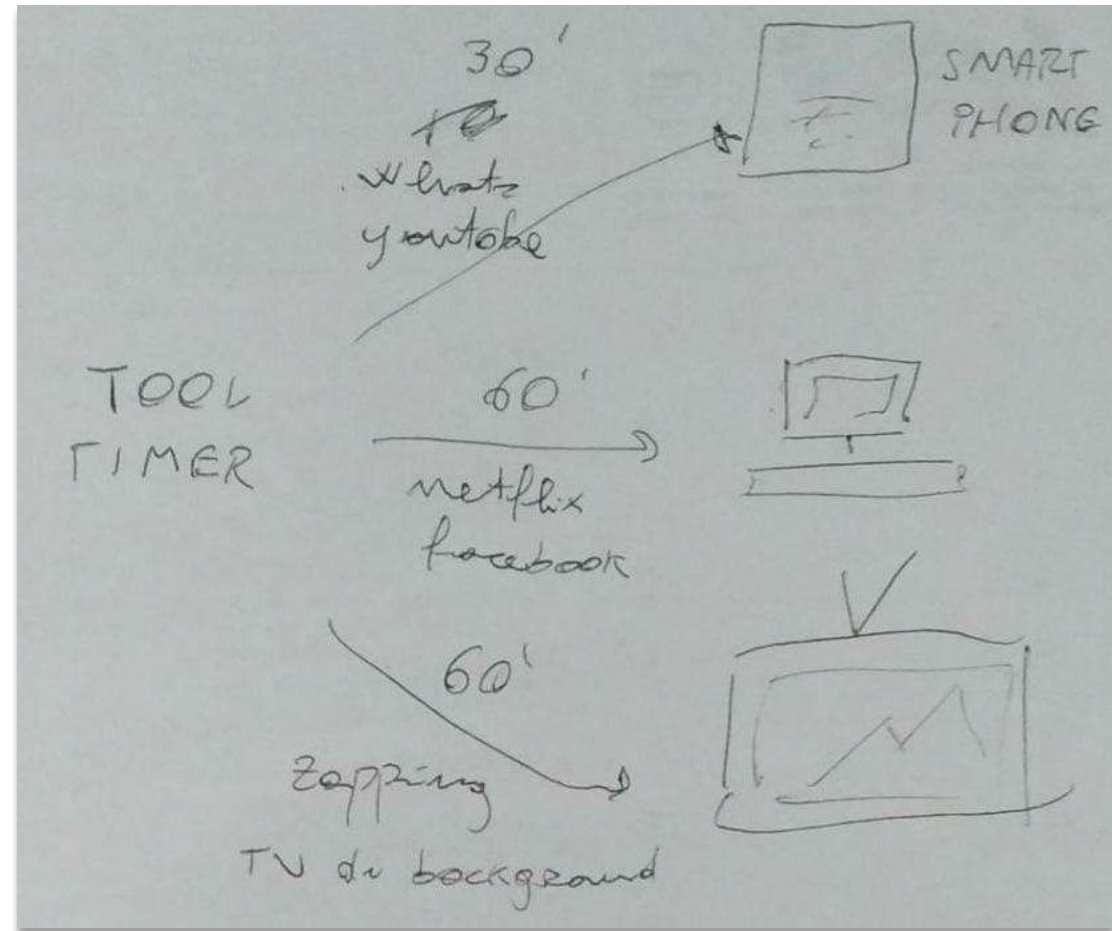
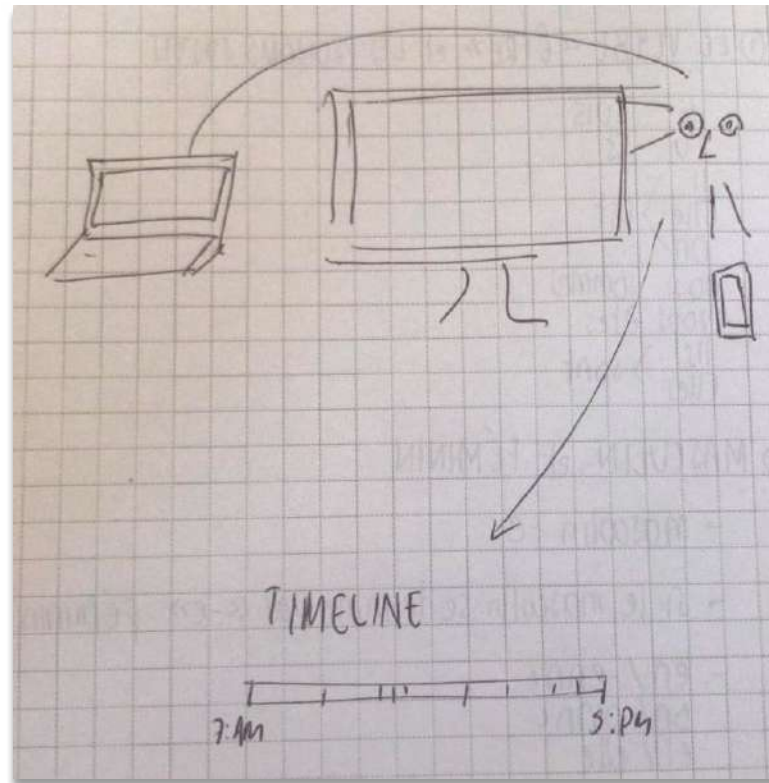
Single Device DSCTs

- The majority of contemporary DSCTs only take into account the **device on which they are installed**:
 - a mobile app allows monitoring/acting on the apps installed on the smartphone;
 - A browser extension allows monitoring/acting on websites visited with that specific browser.
- Users' digital habits are **more complex**:
 - we own many devices, each with its own characteristics;
 - we often use more than one device at the same time;
 - what if I set a block for the Facebook website, but I can still access it via my smartphone?

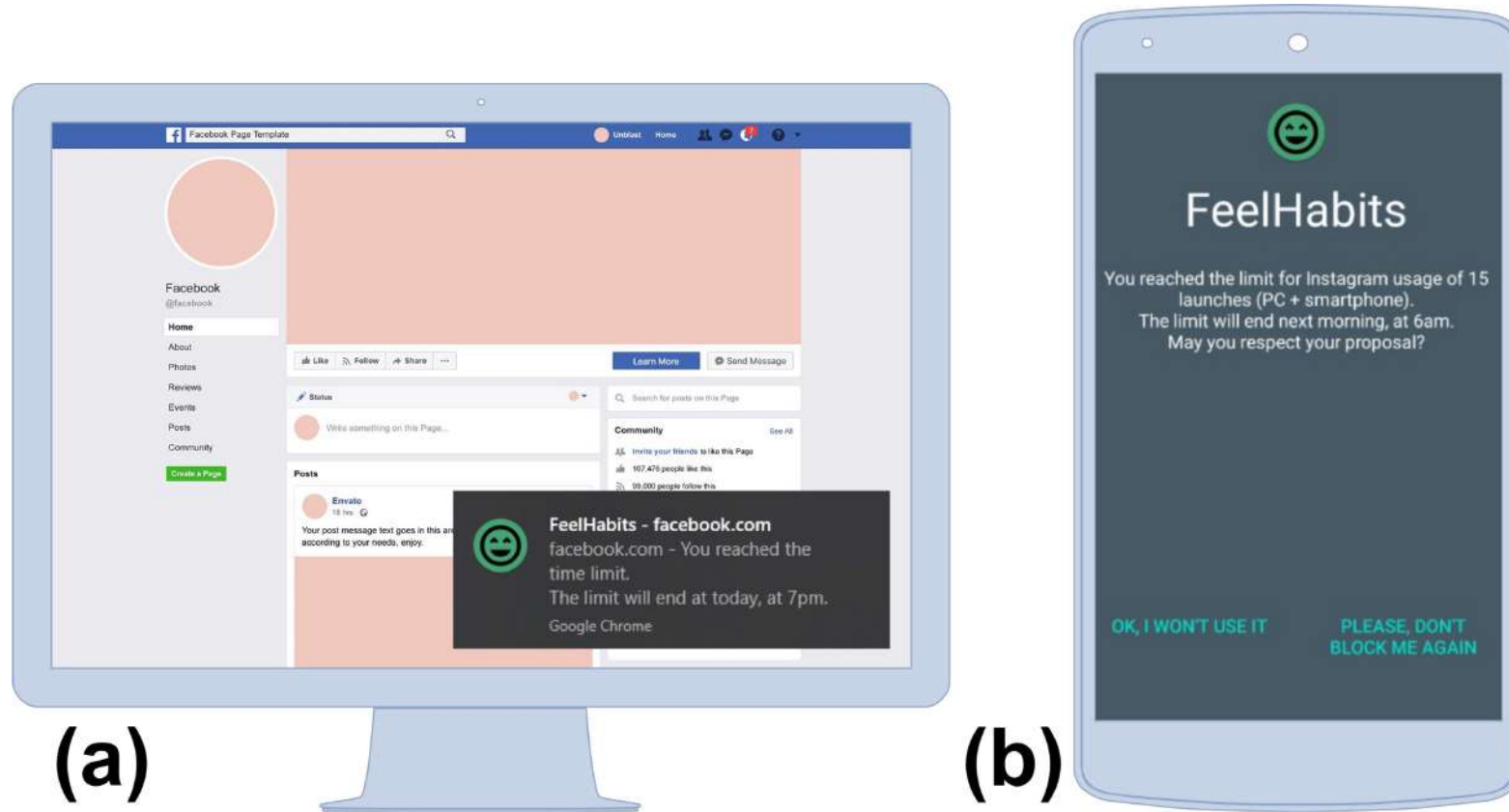
From Single Device to Multi Device DSCTs

- *“With an Internet connection and a screen, any device can be a source of distraction.” (P7)*
- *“I regularly use my laptop to listen to music while I’m working on the desktop computer. Sometimes, this is distracting, especially when the music is on YouTube and there is a video in the background.” (P11)*
- *“When I am particularly stressed, it’s likely that I interrupt my work on the PC with the smartphone to relieve the tension.” (P20)*
- *Sometimes, when I’m on Facebook on my computer, I take my smartphone, I go on Instagram, and then I unconsciously open Facebook, too. So I have it opened on my smartphone and my PC at the same time. When this happens, I feel really addicted to social networks. (P12)*

From Single Device to Multi Device DSCTs



From Single Device to Multi Device DSCTs



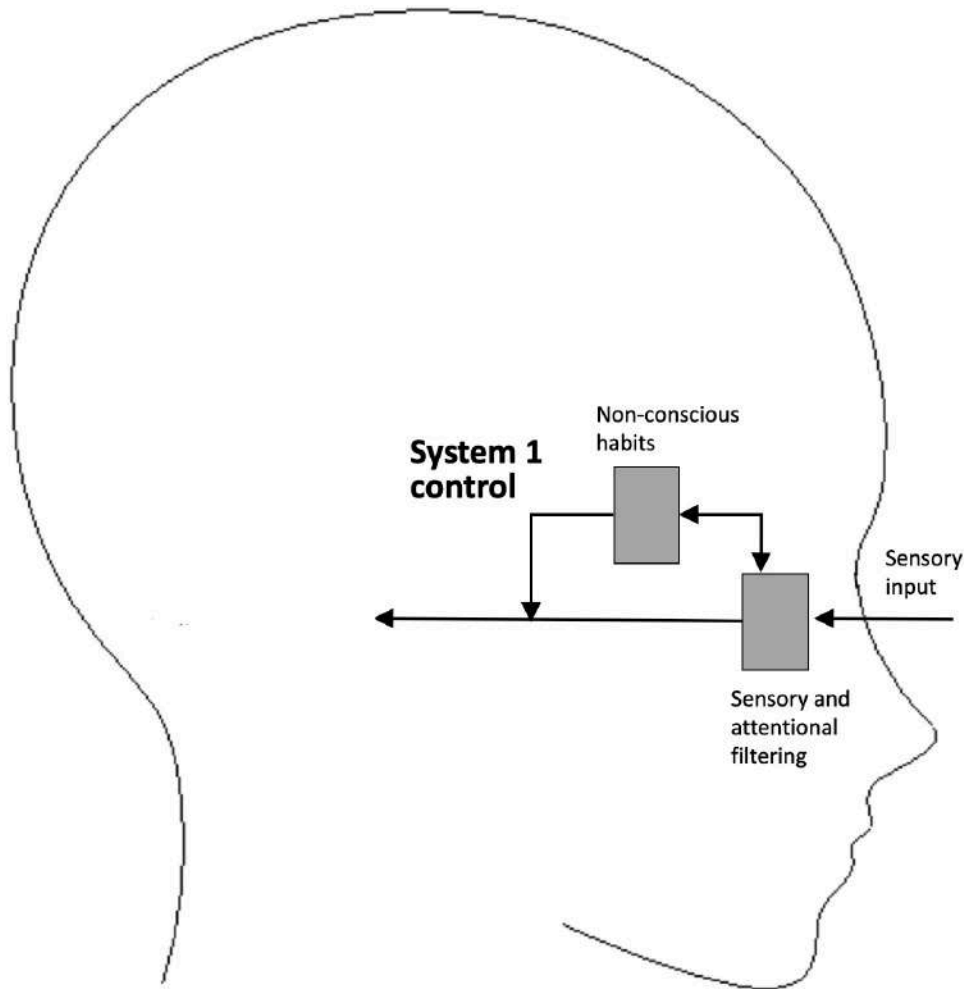
The Problems of Screen Time

- Using time spent as the sole measure for people's digital wellbeing may not be the right choice:
 - measures like screen time are too **coarse**, and they do not reflect the **variety of goals** and different kinds of tech usage of the users;
 - providing users with an indication of their screen time, e.g., for self-regulation purposes, may in turn produce **negative reactions**, thus inducing users to stop using the DSCT.
- It's also important to capture the underlying motivations and goals behind a usage session!
 - Lukoff et al., What Makes Smartphone Use Meaningful or Meaningless?, IMWUT 2018, <https://doi.org/10.1145/3191754>

The Theoretical Gap

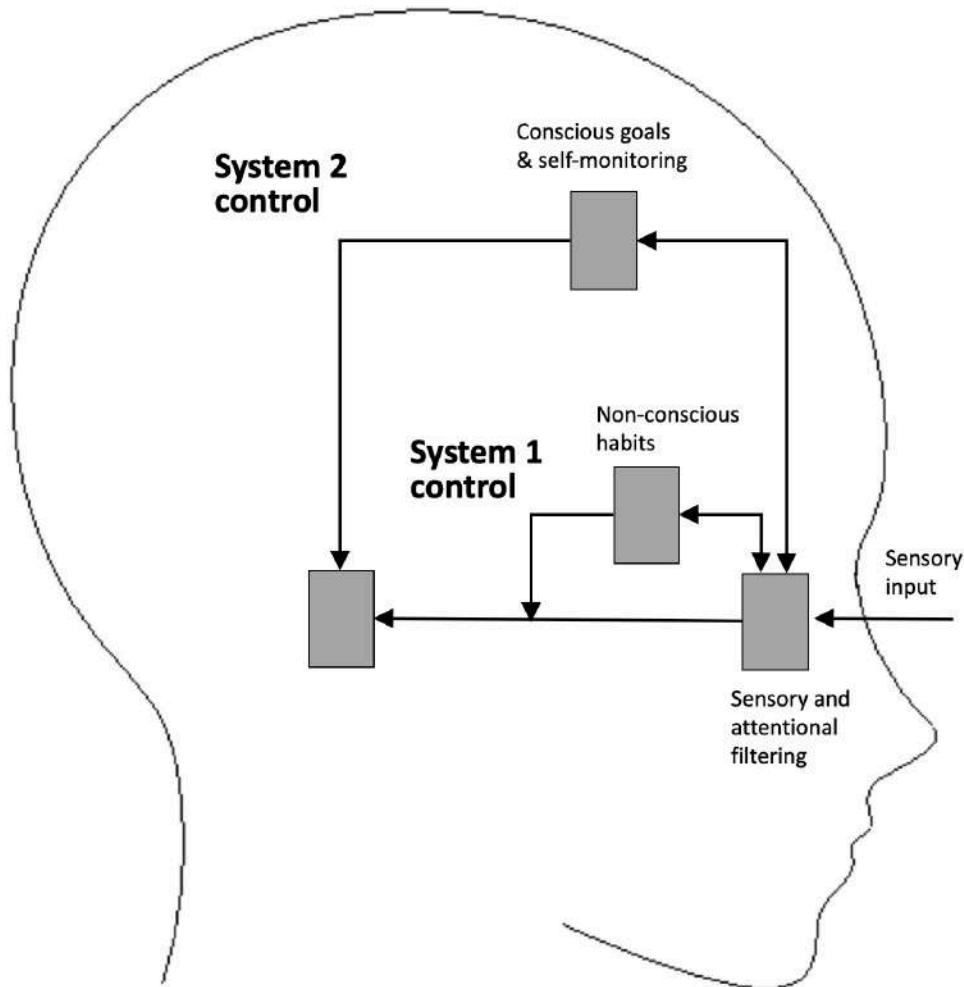
- Grounding the design of behavior change technologies on well established behavioral theories is fundamental to generate long-lasting results.
- Our literature review shows that a large quantity of DSCTs papers do not mention **any behavioral theory nor construct**.
- Other papers use a “pick & mix” approach, by mixing together different strategies that take inspiration from a known theory:
 - this makes it difficult to understand the effects of particular behavioral theories or techniques.

DSCTs and the Dual System Theory



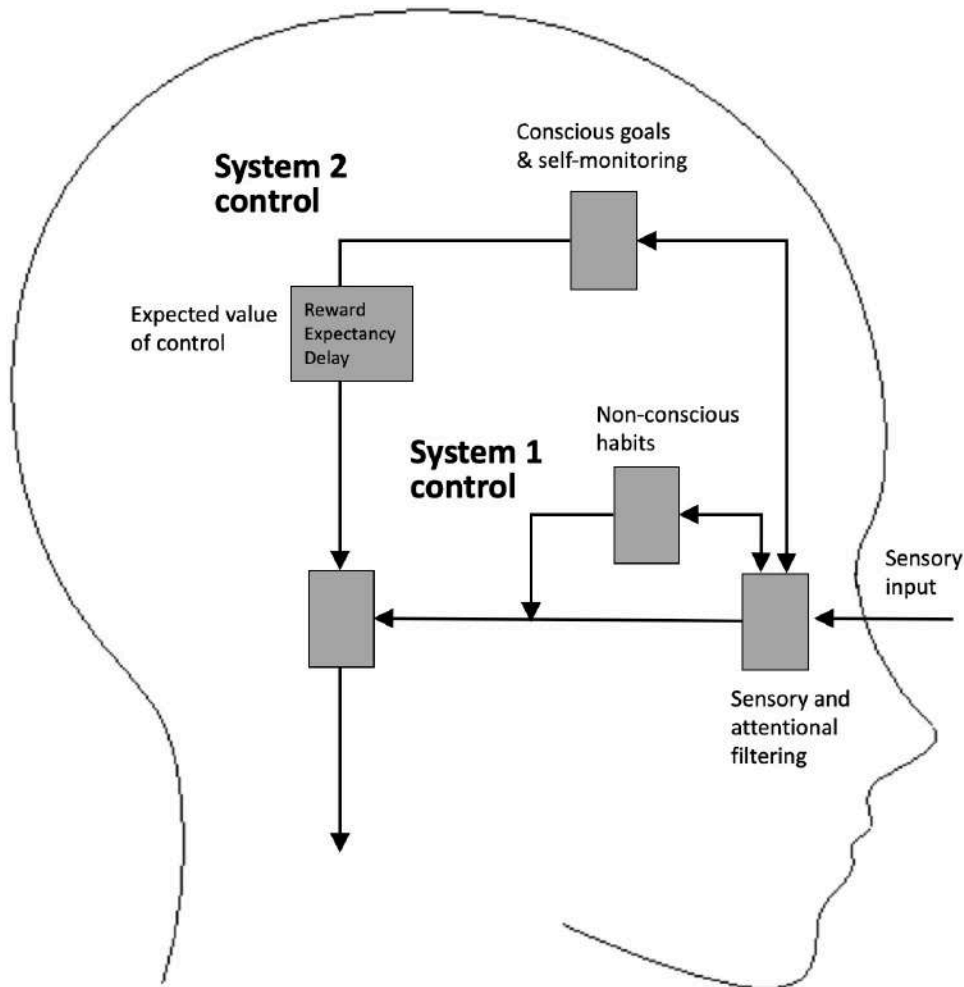
System 1 control is when our behaviour results from habits or instinctive responses that get triggered by external stimuli and internal states, with no need for conscious attention.

DSCTs and the Dual System Theory



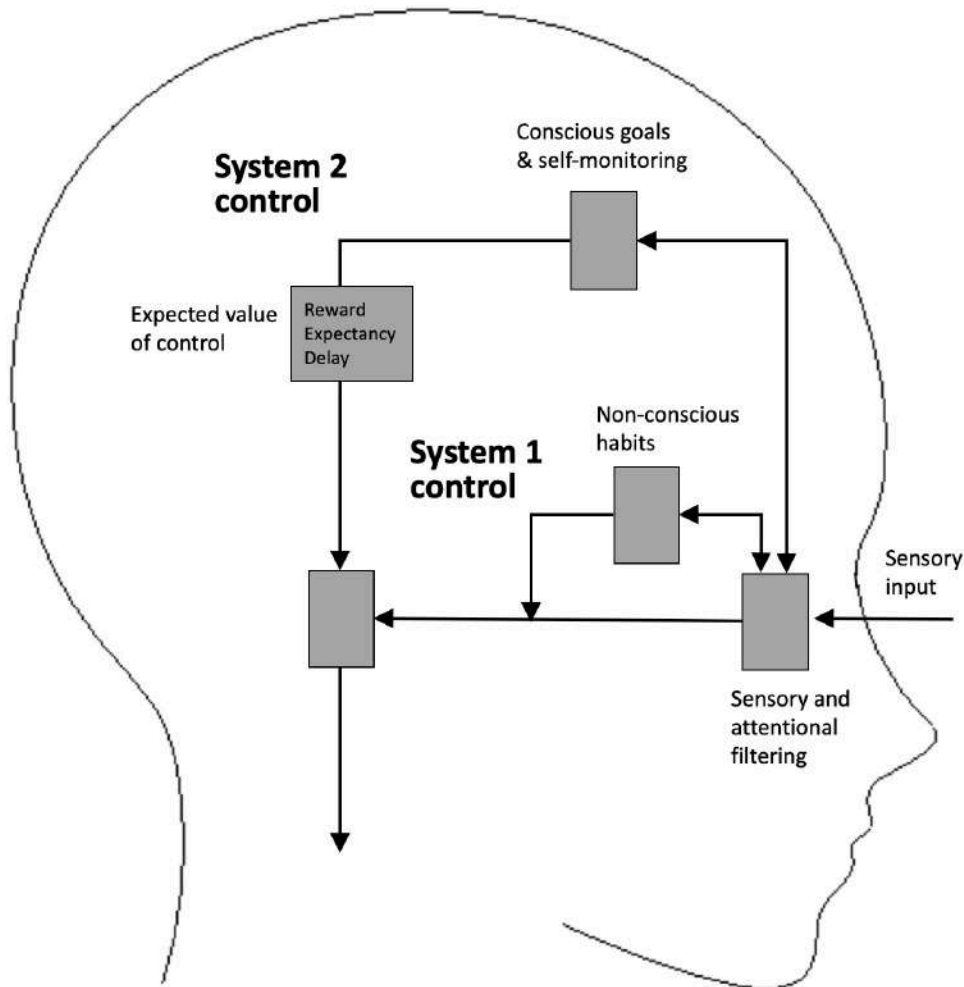
System 2 control is when our behaviour is triggered by goals, intentions, and rules held in conscious working memory.

DSCTs and the Dual System Theory



Sometimes we fail at self-control, even when we're aware of it in the moment. Neuroscientists think this comes down to the **expected value of control**, which is a cost-benefit analysis of what you might gain from exerting self-control.

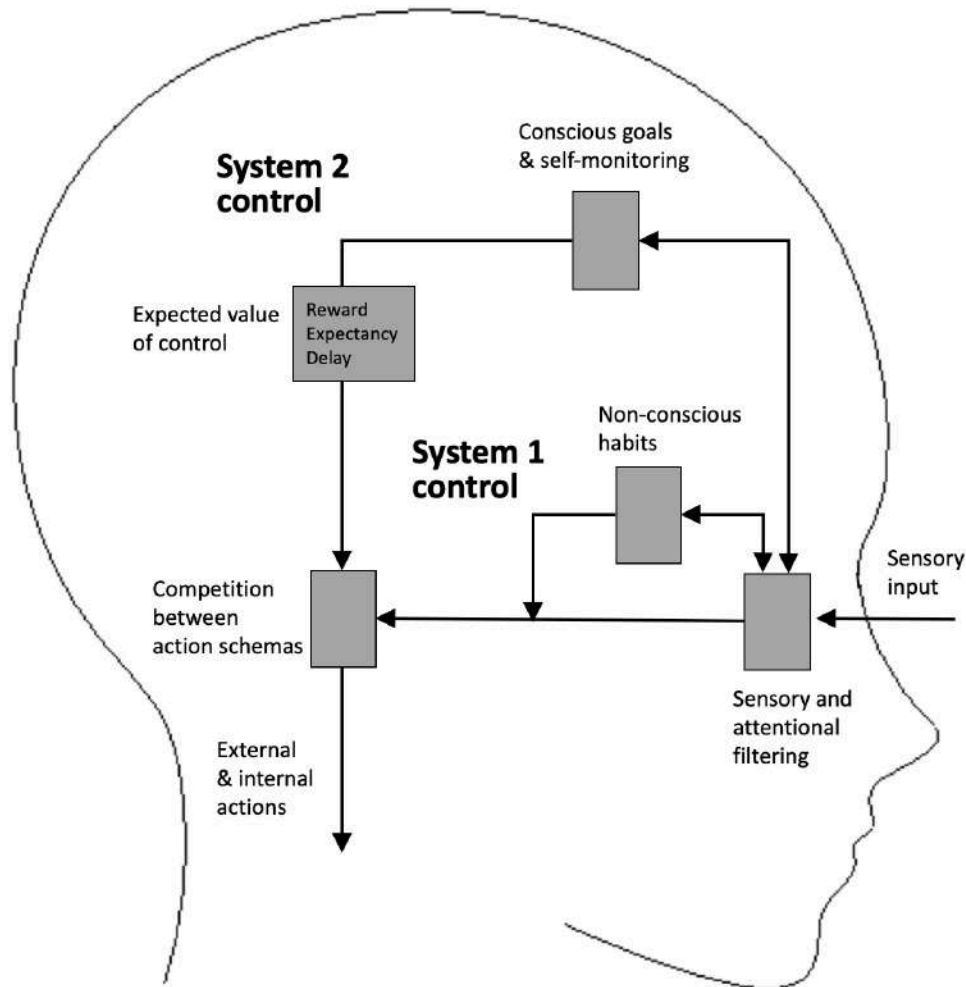
DSCTs and the Dual System Theory



The three different components of the expected value of control:

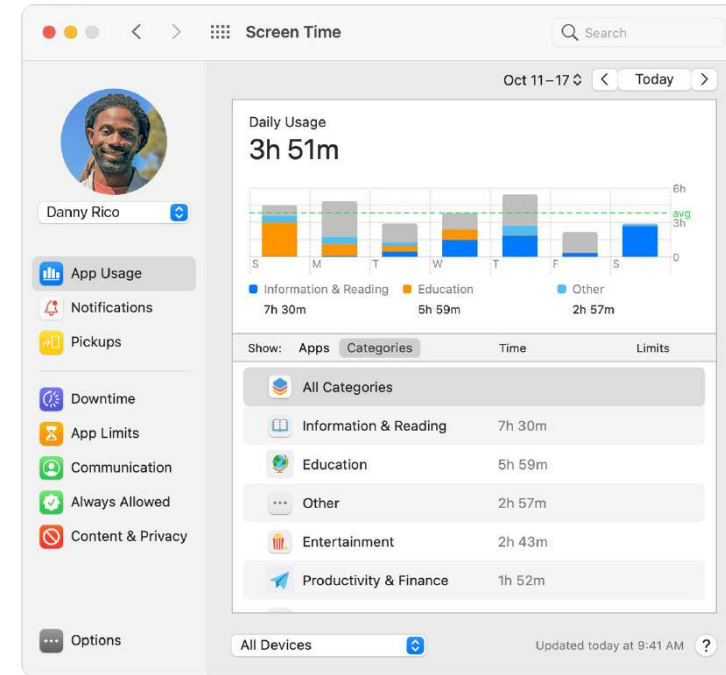
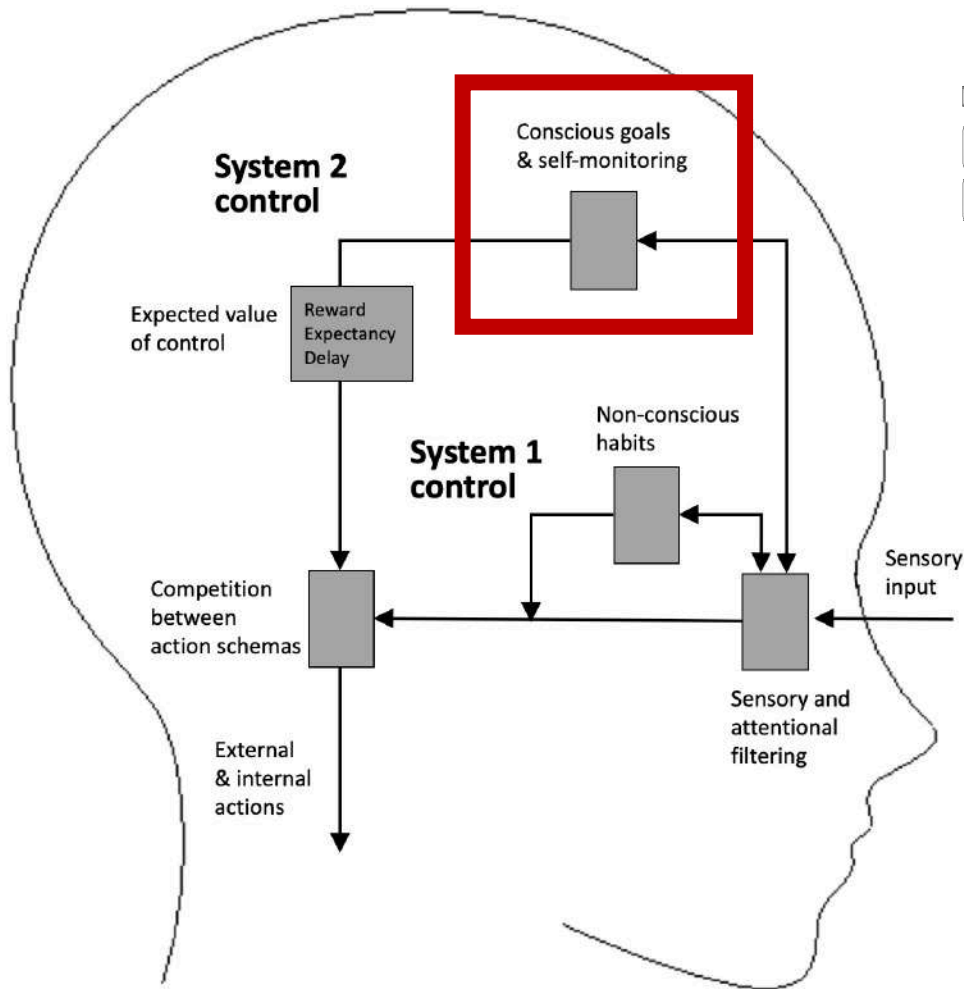
- the amount of **reward** you could obtain (or loss you may avoid);
- how likely you think it is that you will be successful in exerting self-control (**expectancy**)
- the **delay** before you get the potential reward.

DSCTs and the Dual System Theory

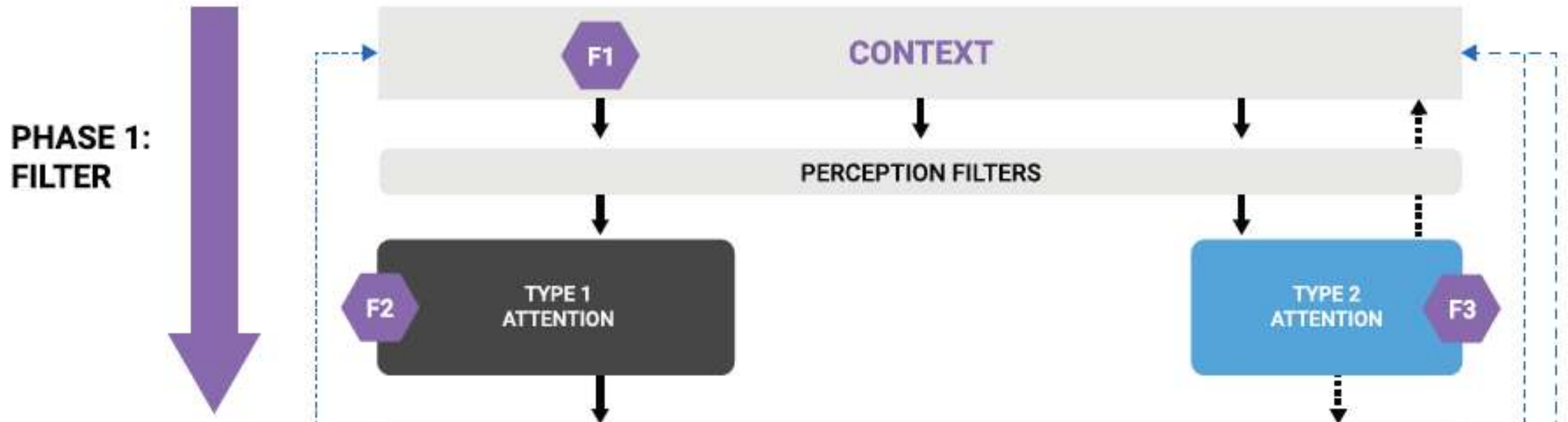


System 1 and System 2 **competes** to activate a given behavior.

DSCTs and the Dual System Theory



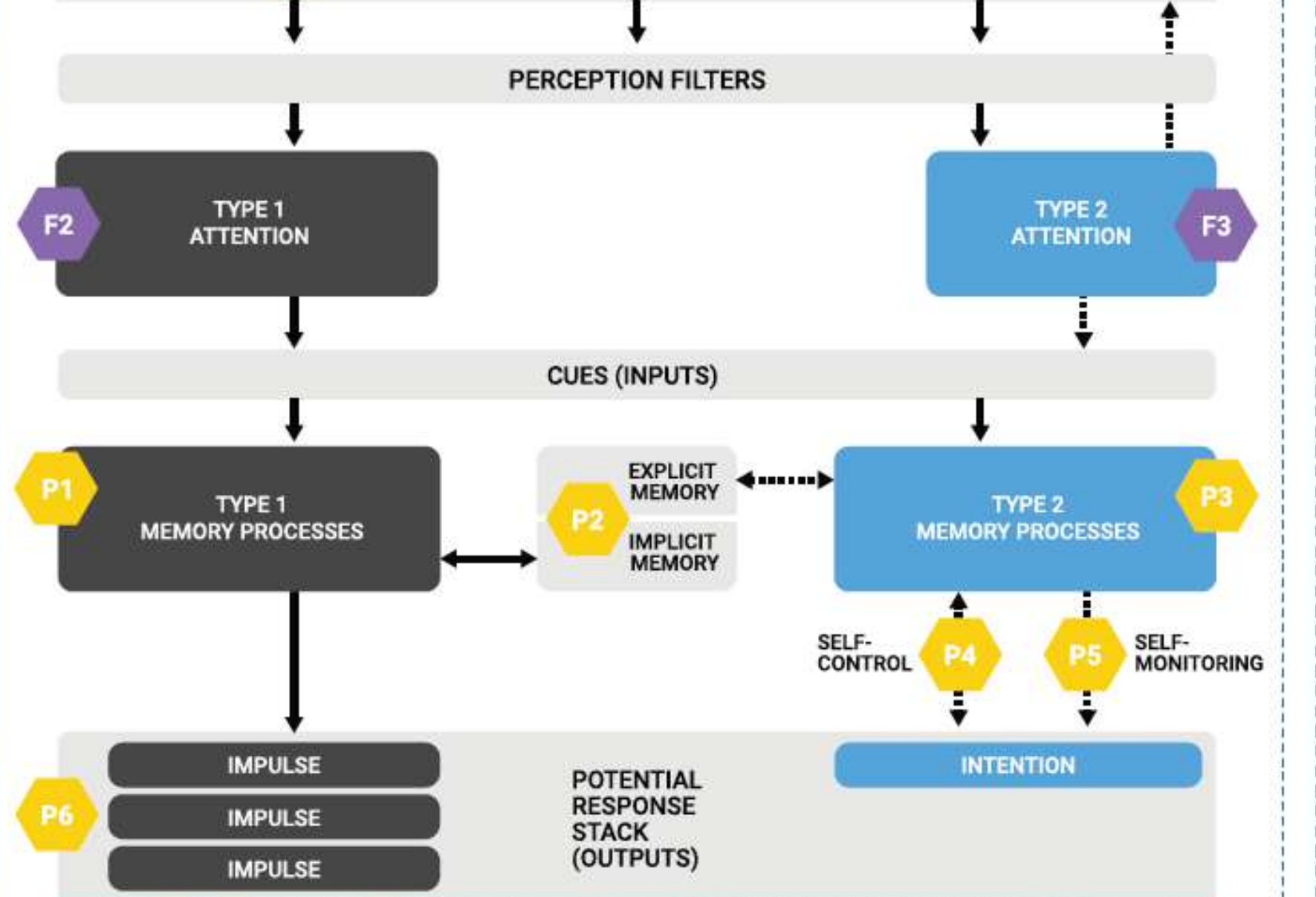
The Habit Alteration Model



**PHASE 1:
FILTER**

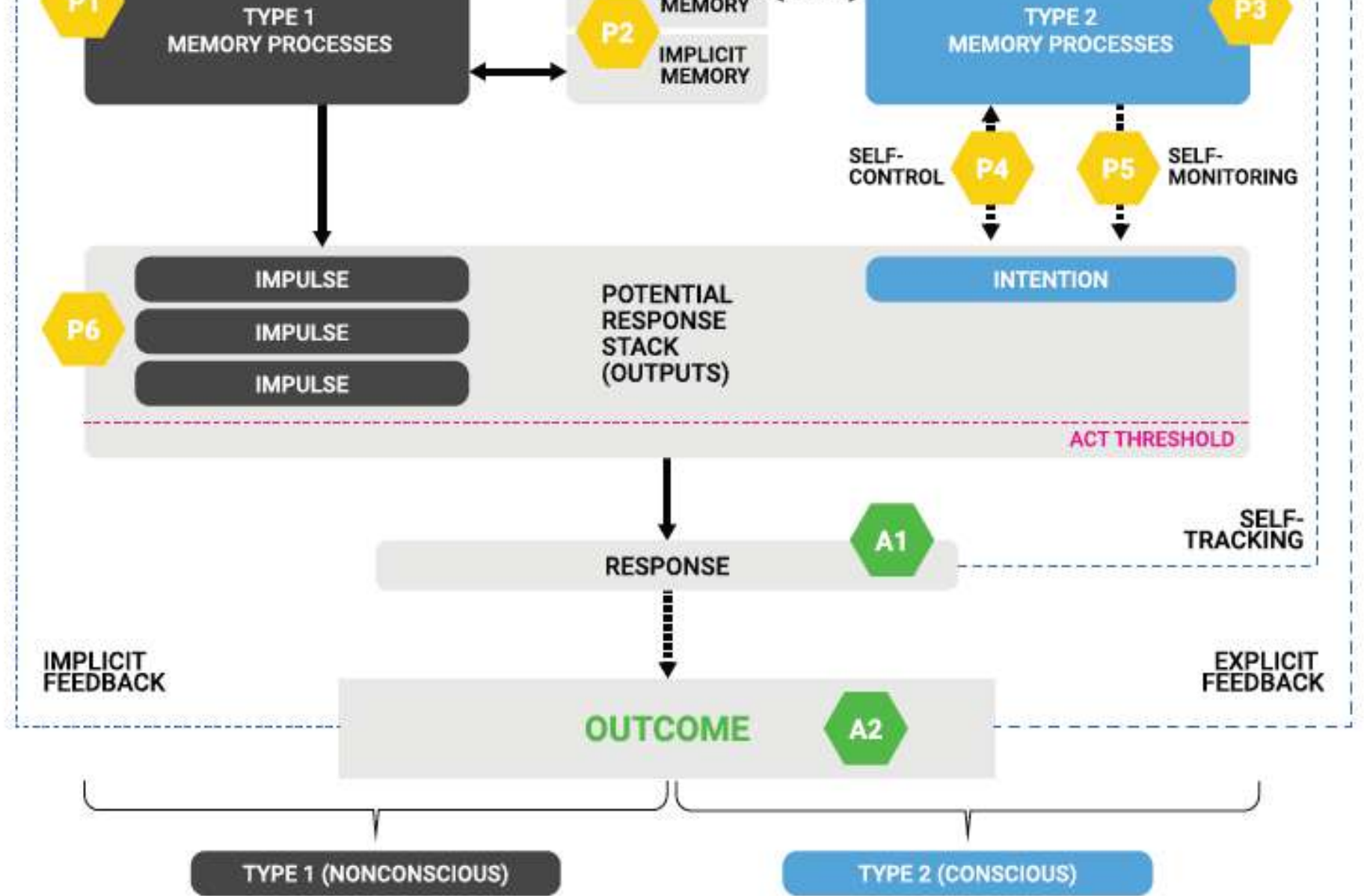


**PHASE 2:
PREPARE**

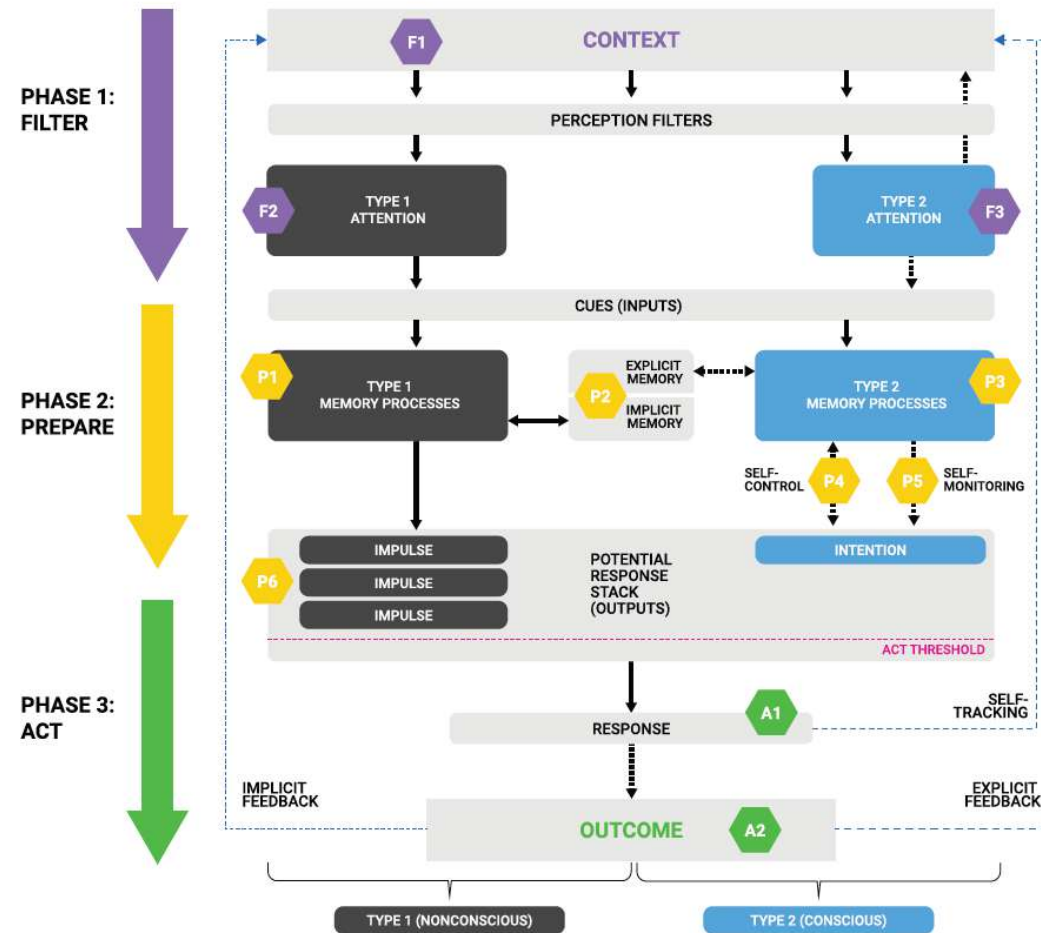


**PHASE 2:
PREPARE**

**PHASE 3:
ACT**



The Habit Alteration Model



Interventions in the Filter Phase

- **Alter context:** add or remove cues in order to affect which impulses and intentions arise in the Potential Response stack;
 - *“with our unhealthy snacking example, a DBCI could suggest to the user to not buy the snacks in the first place, or suggest replacing them with a healthy snack whilst watching television.”*
- **Alter cue saliency:** reduce the salience of contextual cues for unwanted responses, whilst also increasing the salience of cues for wanted responses, e.g., using Cognitive Bias Modification (CBM) techniques for attention biases;
 - *“with our unhealthy snacking example, a DBCI could try to reduce attention bias for the snack by giving the user a serious game to pair images of their problematic snack with something they find revolting.”*

Interventions in the Prepare Phase

- **Non-conscious goals:** unobtrusive presentation of cues to activate relevant mental representations, by using technology that users carry as part of their personal context, e.g., smartphones;
 - *“with our unwanted snacking example, a DBCI could support the user by displaying the prime of a photo of themselves consuming an alternative, wanted snack.”*

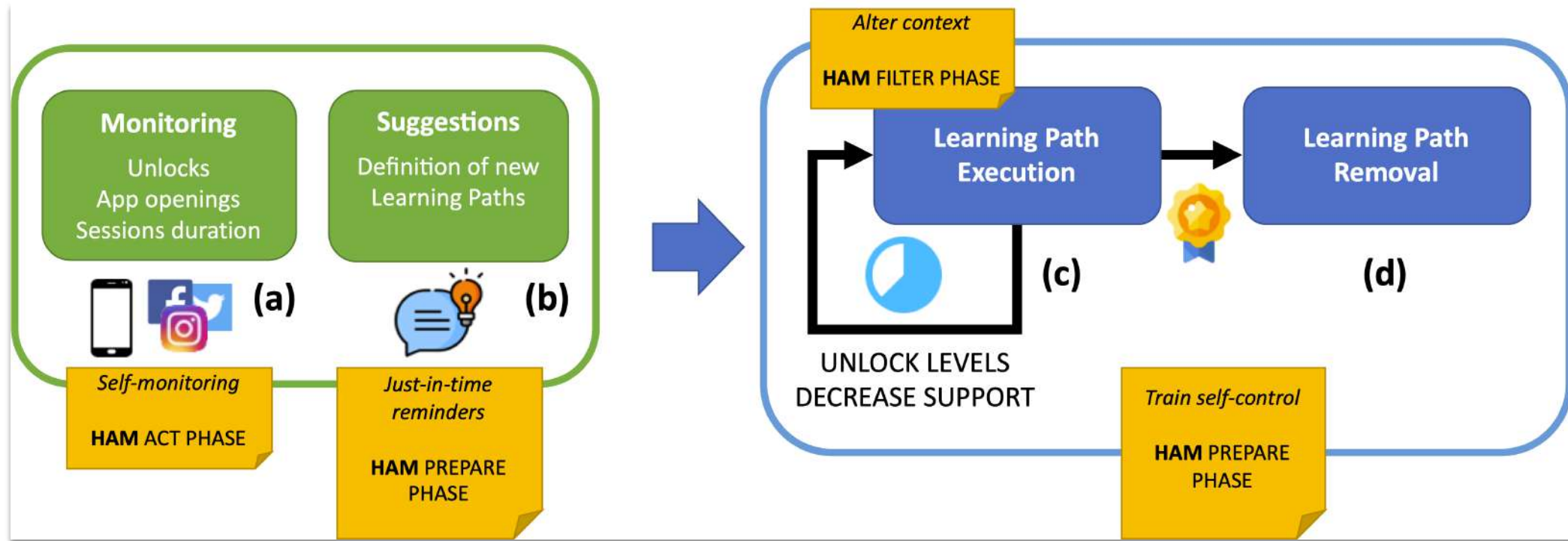
Interventions in the Filter Phase

- **Just-in-time reminders:** leverage pervasive context-aware technology to provide just-in-time reminders to behave in a particular way;
 - *“with the unhealthy snacking example above, a user’s phone could alert them to the unwanted eating behaviour and suggest an alternative.”*
- **Train self-control:** computer-based training to enhance self-control and make it a System 1 impulse;
 - *“with our unhealthy snacking example, a DBCI could be designed to support the user to train themselves to resist the snacks by using go/no go serious games.”*

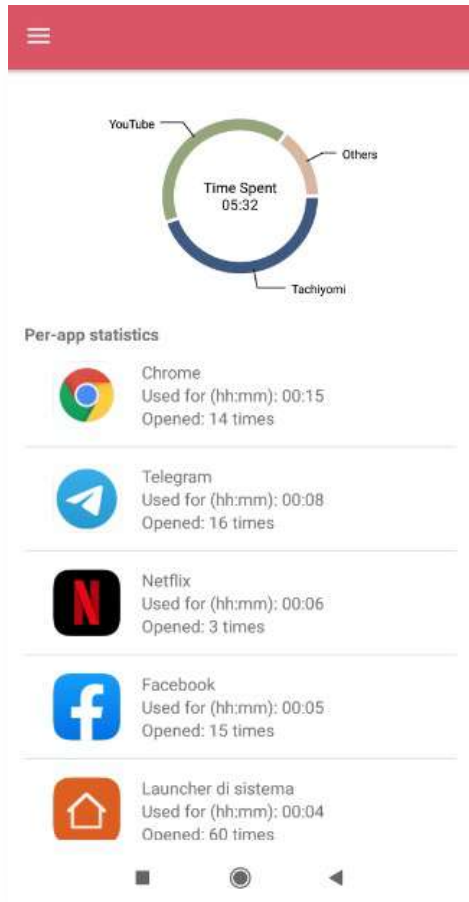
Interventions in the Act Phase

- **Self monitoring:** using information from self-tracking to form alternative intentions to act; it can be helpful to reveal the consequences of automatic Type 1 processes to Type 2 behavioural override mechanisms;
 - *“with our snacking example, the user could record the amount of unhealthy snacks that they eat in front of the television using a simple self-monitoring app to inform different behavioural decisions.”*
- **Revalue outcome:** providing rewards for ‘correct’ behaviour or punishments for ‘incorrect’ behaviour, following the operant conditioning theory;
 - *“with our unhealthy snacking example, the user could reward themselves for consuming healthy snacks as an alternative, e.g., by transferring a small amount of money into a virtual jar for each healthy snack consumed, and/or punish themselves for consuming unhealthy snacks by giving a small amount of money away.”*

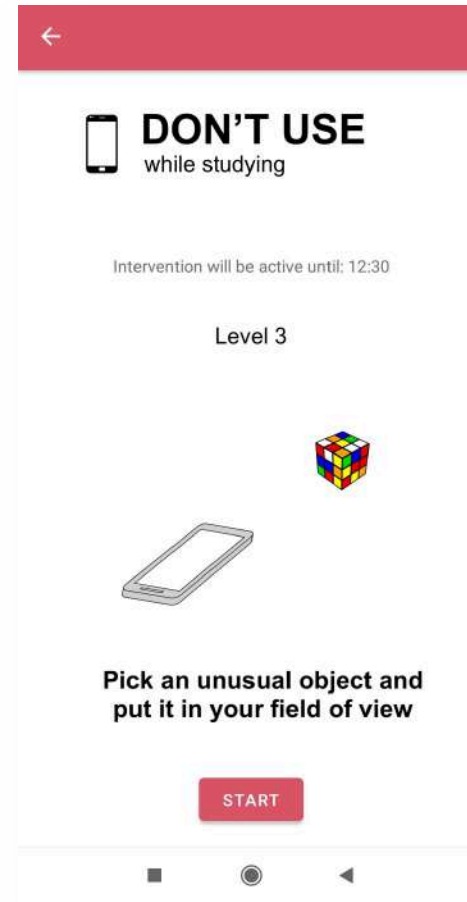
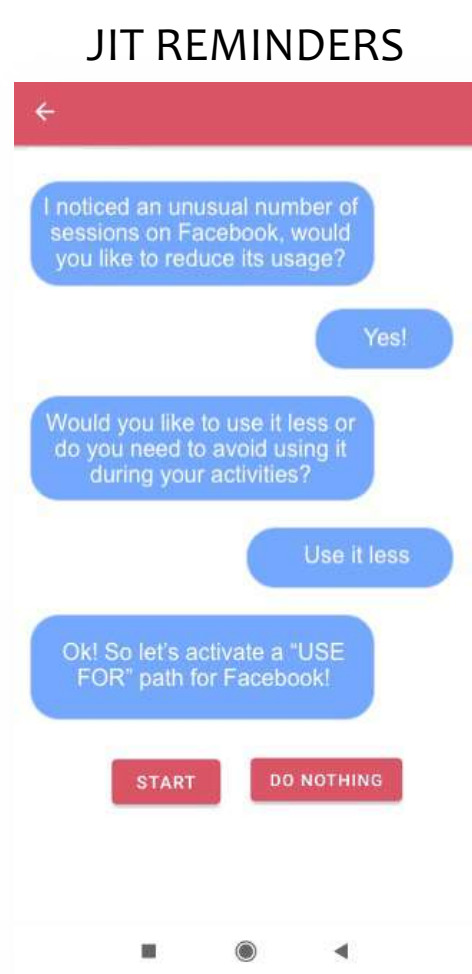
StepByStep: a Theoretically Grounded DSCT



StepByStep: a Theoretically Grounded DSCT



SELF-MONITORING


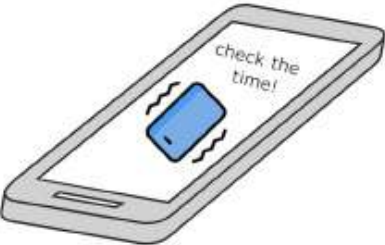


ALTER CONTEXT

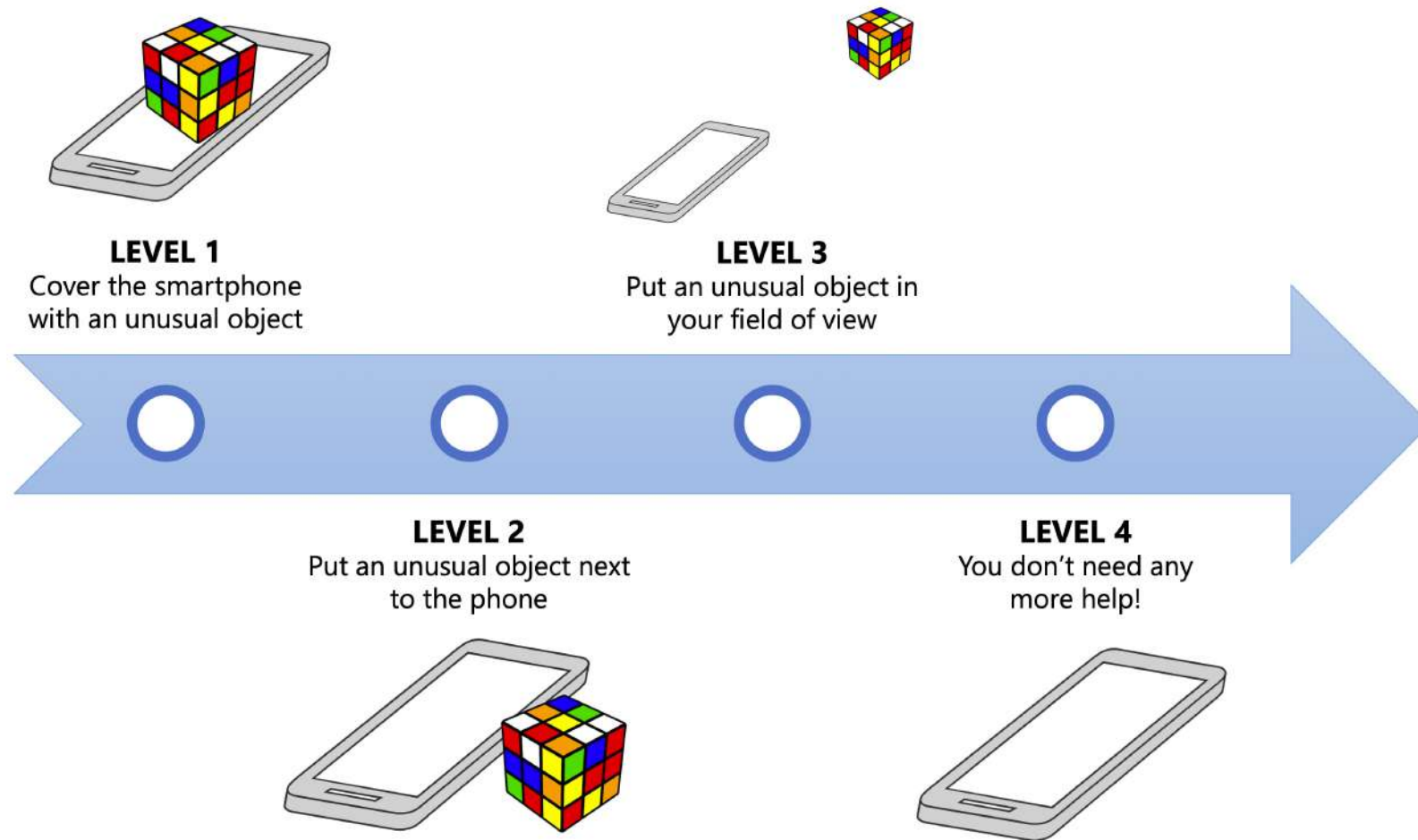


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Table 1: The interventions associated with *Don't Use* and *Use For* paths, respectively.

Path	Intervention
<i>Don't Use</i>	Ask users to put an unusual object near the smartphone, i.e., a visual cue to make them remember their goal. 
<i>Use For</i>	Use slight vibrations, i.e., a haptic cue, as long as users use the smartphone or specific apps, to spur them to check the time and respect their usage intention. 

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Acknowledgements

- Examples on contemporary DSCTs taken from <https://ulriklyngs.com/post/2019/04/30/367-tools-of-resistance-in-the-battle-for-online-attention/>
- Explanation of the Dual System Theory taken from https://www.youtube.com/watch?v=sJf_F7faczU

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