Romadoro: Leveraging Nudge Techniques to Encourage Break-Taking

KATARINA JURCZYK, University of Florida, USA

CHRISTOPHER YOU, University of Florida, USA

MAHSAN NOURANI, University of Florida, USA

MANAS GUPTA, University of Florida, USA

LISA ANTHONY, University of Florida, USA

BENJAMIN LOK, University of Florida, USA

Excessive screen-time has negative impacts on mental and physical well-being, and taking breaks is important to keeping creativity, interest, and productivity high. We developed *Romadoro*, a Chrome extension that uses the Pomodoro Technique and technology-mediated nudges to promote better break-taking practices. Nudges involve designing choices to predictably alter the behavior of users. To test the effectiveness of using technology mediated nudges together with the Pomodoro Technique on break-taking, we conducted a mixed design user study with 36 participants. The findings from our study indicate that nudge techniques have a significant impact on motivating users to take breaks. Our work demonstrates potential avenues for designing time-management apps that could be more beneficial to the users than the classic Pomodoro approach.

1 INTRODUCTION

Mental and physical health have been shown to have an inverse association with hours of screen time [8, 11]; taking breaks is important to keeping creativity, interest, and productivity high [2]. One of the commonly known approaches to time management is Cirillo's [2] Pomodoro Technique. This technique involves 25 minutes of continuous work/focus on any task, followed by a short (5-minute) break. Every four pomodoros (after four 25-minute focus sessions) the individual takes a long (15-30 minutes) break instead of the short break. Ruensuk [6] used the Pomodoro Technique to reduce internal and external interruptions and showed that it can increase productivity.

In spite of the benefits, it can be challenging to achieve the time-management efficiency of the Pomodoro Technique since users might ignore or neglect the intended breaks. This reduces the potential for productivity increase and health benefits of taking time off from the screen.

We developed *Romadoro*, a Chrome extension based on the Pomodoro Technique to promote break-taking practices. We incorporated nudges into our interface design to persuade users to take breaks when suggested. Thaler and Sunstein [9] introduced and defined the concept of nudges as, "any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives." They discuss different biases and how developers can incorporate human biases to nudge the decision-maker's choice in certain directions.

2 STUDY SETUP

We developed a web-based application (Google Chrome extension), called *Romadoro*, that incorporated the Pomodoro Technique [2]. To promote taking breaks, we integrated four different types of nudges, inspired by the classification by Caraban et al. [1] (namely: facilitate (Fig. 1a), confront (Fig. 1b), social influence (Fig. 1c), and reinforce (Fig. 1d)) into our extension (Table 1). Our goal was to study the influence of these nudging techniques on people taking breaks. Before implementing the interface, we conducted semi-structured informal interviews with people who self-reported working

Table 1. Nudge categories implemented in our study

Nudge	Bias: Definition	Specific Nudge	Prior Work
Facilitate	*Status quo bias*: reduces mental or physical effort from the users; the individual's tendency to choose the path of least resistance [7, 9].	*Hiding* and *Positioning*: ensure undesired options are harder to reach [1].	Lee et al. [4] show that positioning unhealthy snacks toward the final pages of a search results in people buying healthier snacks.
Confront	*Regret aversion bias*: leverages people's tendency to make careful decisions after being made aware of the consequences [1].	*Reminding of the consequences*: causes people to consider the possible consequences of an action.	Minkus et al.'s [5] plugin detects whether there are children in photos that users are about to post to social media and asks the user to reconsider posting the image or change the privacy settings of the photo.
Leverage Social Influence	*Commitment bias* and *spotlight effect*: leverages the human tendency to conform to what people believe is expected of them because they overestimate the extent to which their actions are noticed by others [1].	*Leveraging public commitment* and *Raising the visibility of users' actions*: makes actions or decisions more visible to others, prompting the individuals to meet the commitments they believe are expected of them.	BinCam [10] is a social persuasion system in which a camera above the kitchen trash takes pictures of waste produced by the household and posts the pictures on social media for other people to see. This social nudge technique improves people's aware- and mindful-ness when creating waste.
Reinforce	*Affect heuristic*: increases the presence in an individual's thinking and reinforces specific behaviors [1].	*Instigating empathy*: impact an object of the user's affections in order to nudge their decision making.	Dillahunt et al. [3] studied how different visualizations (e.g., a polar bear in danger when children make environmentally-unfriendly choices) can motivate children's eco-friendly behaviors.
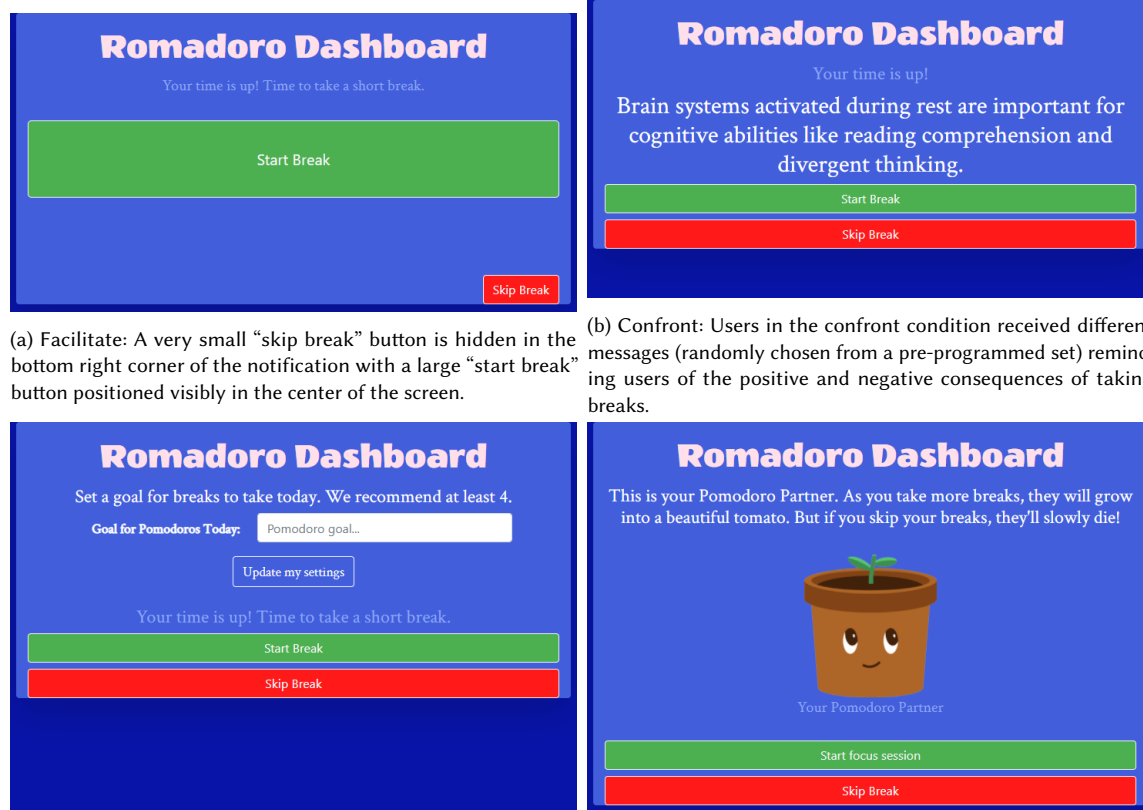
(a) Facilitate: A very small "skip break" button is hidden in the bottom right corner of the notification with a large "start break" button positioned visibly in the center of the screen.

(b) Confront: Users in the confront condition received different messages (randomly chosen from a pre-programmed set) reminding users of the positive and negative consequences of taking breaks.

(c) Leverage: Users in this condition were able to set a goal number of breaks. They were informed how close they were to reaching that goal during every suggested break.

(d) Reinforce: An image of a "Pomodoro Partner" plant was shown to users. The plant grew when users took breaks and shriveled when users skipped breaks.

Fig. 1. The nudges used in the study were (a) facilitate, (b) confront, (c) leverage, and (d) reinforce.

on computers on a daily basis. We developed sketches of each of Caraban's [1] six nudge categories. By explaining the nudges and displaying the sketches to the interviewees, we were able to narrow down what nudging techniques users might find potentially beneficial before implementation.

We designed two versions of the extension: one which provided users with one of the four nudges each day and the other which provided users with no nudge at all. Romadoro was designed to enable users to customize the length of focus time, short breaks, and long breaks (while defaulting these values to 25-5-30 minutes as recommended by the Pomodoro technique). After each focus session, a notification popped-up, providing the corresponding nudge (or no nudge) to the user. They were then given the option to skip or take their break. We determine the effectiveness of our nudges by the ratio of times a user skips or takes their break to how many times a break was suggested.

3 USER STUDY

3.1 Population

We conducted our study with a total of 36 participants (19 male, 17 female), all of whom were above 18 years of age (52.8% were ages 18-24, 36.1% were ages 25-35). The majority of our participants (94.4%) were students. About half (19) of the participants interacted with the nudges condition (9 male, 10 female) and the remainder interacted with the no-nudges condition (10 male, 7 female). Some participant data had to be excluded on particular days of the study due to user inactivity. Participants were chosen from a population that work at their computers more than 4 hour per day on average. Most of our participants (55.6%) spent over 8 hours/day at their PC, while 38.9% of our participants spent between 4 and 8 hours/day at their PC. The majority of our participants (75.0%) had never used methods to help them track their breaks or motivate them to take breaks prior to participating in our study.

3.2 Procedure

Prior to using the application, participants were briefed on the use of the interface. Participants used the interface for four consecutive days. On each day of their participation, participants were asked to open the interface when they sat down at their computer for the day. They were asked to try completing a minimum of two full Pomodoro cycles (i.e., at least 3-4 hours) each day. Toward the end of the work day (5pm) users were asked to fill out a short online survey. Users could optionally continue to use the Romadoro interface. On the last day of interface use, the participants also filled out a post-study questionnaire. We normalized the breaks taken based on activity with the application for all participants to account for varying usage.

3.3 Study Conditions

We conducted a mixed-design study to more efficiently answer both of our research questions. We used a between-subjects study by splitting participants into two groups, one which interacted with nudges and one which did not, and a within-subjects study by sending a different nudge to the group with nudges each day of their participation in our study. The group with nudges received all nudges by the end of their participation and the order in which they received the nudges was randomly assigned.

(1) **Without nudges** (users only received a notification that their time was up)
(2) **With nudges** (users saw **all** the nudges over the course of the study)
  (a) **Facilitate** nudge technique
  (b) **Confront** nudge technique
  (c) **Social Influence** nudge technique
  (d) **Reinforce** nudge technique

4 RESULTS

4.1 Are nudge techniques effective in motivating users to take breaks?

To determine the answer to our first research question, we used a Kruskal-Wallis Rank sum test for between-subjects comparison. This test shows (Fig. 2a) that there is a significant difference between the two conditions ($\chi^2(1,34)$ = 5.14, p < 0.05), with participants in the nudge condition (M=67.5%, SD=30.1) being more likely to take breaks when prompted (breaks taken/(breaks taken + breaks skipped)) than their counterparts in the no-nudge condition (M=40.7%, SD=25.2).
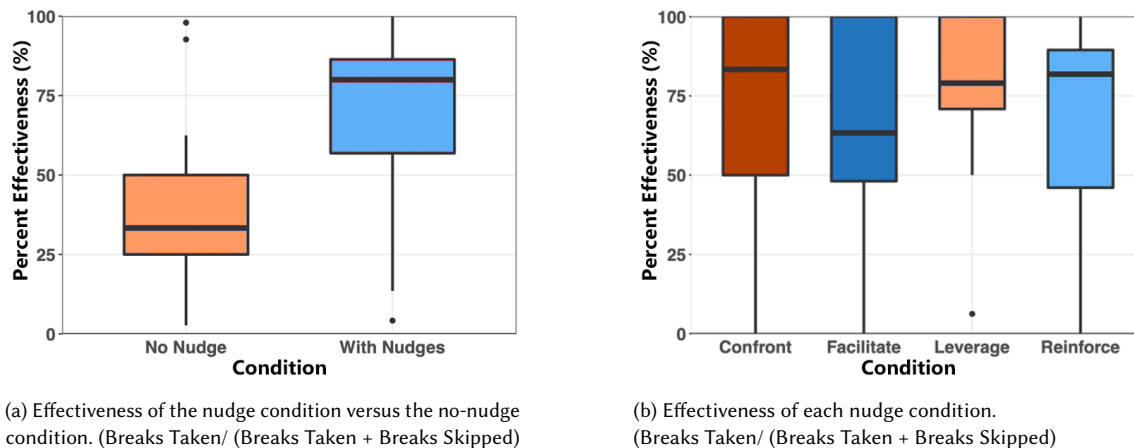
(a) Effectiveness of the nudge condition versus the no-nudge condition. (Breaks Taken/ (Breaks Taken + Breaks Skipped)

(b) Effectiveness of each nudge condition. (Breaks Taken/ (Breaks Taken + Breaks Skipped)

Fig. 2. Results

4.2 Which nudge techniques are most effective in motivating users to take breaks?

To compare the effectiveness of each individual nudge, we compared the four nudges in a within-subjects comparison based on the data points from only those who participated in the nudging condition (n=18). We expected that people would be significantly more motivated to take breaks while interacting with the reinforcement nudge. However, a Friedman non-parametric test failed to find evidence to reject the null hypothesis (Fig. 2b). We could not find evidence that any particular nudging technique was better than another in boosting users' motivation. This may have been due to the confirmation bias effect (e.g., any additional information made the nudge more effective). This effect may fade over time as users get acclimated to the additional information.

5 CONCLUSION AND FUTURE WORKS

We found nudges to be an effective way to promote healthy break-taking during use of the Pomodoro Technique. While no specific nudge that we tested was determined to be more effective than another, nudges as a whole proved to be a valuable persuasion tool. Future work will involve a larger population as only 19 participants used the interface with nudges. In addition, we plan to run the study for a longer period of time so that participants can spend more time with each nudge. We also plan to explore other nudges that may have greater effectiveness on user break-taking.

REFERENCES

[1] Ana Caraban, Evangelos Karapanos, Daniel Gonçalves, and Pedro Campos. 2019. 23 Ways to Nudge: A Review of Technology-Mediated Nudging in Human-Computer Interaction. *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (2019), 1–15. https://doi.org/10.1145/3290605.3300733

[2] Francesco Cirillo. 2009. *The pomodoro technique.* Creative Commons.

[3] Tawanna Dillahunt, Olga Lyra, Mary L Barreto, and Evangelos Karapanos. 2017. Reducing children's psychological distance from climate change via eco-feedback technologies. *International Journal of Child-Computer Interaction* 13 (2017), 19–28. https://doi.org/10.1016/j.ijcci.2017.05.002

[4] Min Kyung Lee, Sara Kiesler, and Jodi Forlizzi. 2011. Mining Behavioral Economics to Design Persuasive Technology for Healthy Choices. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (2011), 325–334. https://doi.org/10.1145/1978942.1978989

[5] Tehila Minkus, Kelvin Liu, and Keith W Ross. 2015. Children Seen But Not Heard: When Parents Compromise Children's Online Privacy. *Proceedings of the 24th International Conference on World Wide Web*, 776–786. https://doi.org/10.1145/2736277.2741124

[6] Mintra Ruensuk. 2016. An implementation to reduce internal/external interruptions in Agile software development using pomodoro technique. *2016 IEEE/ACIS 15th International Conference on Computer and Information Science (ICIS)*, 1–4. https://doi.org/10.1109/ICIS.2016.7550835

[7] William Samuelson and Richard Zeckhauser. 1988. Status quo bias in decision making. *Journal of Risk and Uncertainty* 1 (1988), 7–59. Issue 1. https://doi.org/10.1007/BF00055564

[8] Lee Smith, Louis Jacob, Mike Trott, Anita Yakkundi, Laurie Butler, Yvonne Barnett, Nicola C Armstrong, Daragh McDermott, Felipe Schuch, Jacob Meyer, Rubén López-Bueno, Guillermo F López Sánchez, Declan Bradley, and Mark A Tully. 2020. The association between screen time and mental health during COVID-19: A cross sectional study. *Psychiatry research* 292 (10 2020), 113333. https://doi.org/10.1016/j.psychres.2020.113333

[9] Richard H. Thaler and Cass R. Sunstein. 2009. *Nudge: Improving decisions about health, wealth, and happiness.* Penguin Books.

[10] Anja Thieme, Rob Comber, Julia Miebach, Jack Weeden, Nicole Kraemer, Shaun Lawson, and Patrick Olivier. 2012. "We've Bin Watching You": Designing for Reflection and Social Persuasion to Promote Sustainable Lifestyles. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (2012), 2337–2346. https://doi.org/10.1145/2207676.2208394

[11] Chee Wai Wong, Andrew Tsai, Jost B Jonas, Kyoko Ohno-Matsui, James Chen, Marcus Ang, and Daniel Shu Wei Ting. 2021. Digital Screen Time During the COVID-19 Pandemic: Risk for a Further Myopia Boom? *American journal of ophthalmology* 223 (3 2021), 333–337. https://doi.org/10.1016/j.ajo.2020.07.034