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Dark user interface, dark behavior? The effect of 'dark mode' on honesty

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ABSTRACT

Situational factors affect human behavior, among which dishonesty. Previous studies linked darkness to an increase in immoral behavior. Simultaneously, 'dark mode' is increasingly offered in software. Accordingly it is important to investigate the moral behavioral effects of dark mode. In a high-powered, pre-registered, and economically incentivized experiment, users of 'dark' and 'light' user interfaces were compared on honesty. Results showed no general effect of dark mode on honesty. However, dark mode promoted honesty in users that were awake for a longer period of time. As such, implementation of dark mode is safe and may even be encouraged.

1. Introduction

Research from several disciplines shows that behavior is strongly impacted by the environment it takes place in. The foundational work of Cialdini (Cialdini, Martin, & Goldstein, 2015; Goldstein, Martin, & Cialdini, 2008), Tversky and Kahneman (Kahneman, 2011; Tversky & Kahneman, 1989, pp. 81–126), Thaler and Sunstein (2008), Dolan, Hallsworth, Halpern, King, and Vlaev (2010), and others, has illustrated the potential of altering situational factors for improving a broad range of decisions, such as health and financial choices. Crime prevention research similarly showed how environmental changes can have a major impact on criminal behavior, as has been demonstrated in experimental studies and time series analyses (Clarke & Felson, 2011; Clarke, Wortley, & Mazerolle, 2008; Farrell, 2013; Shane, 2021).

These research streams have led to a wide range of studies on risk factors for dishonest behavior (Jacobsen et al., 2018; Gerlach, Teodorescu, & Hertwig, 2019). Psychologists and behavioral economists conducted various lab and field experiments in which they studied when, how, and why people behave dishonestly. From this, we know that situational factors which influence dishonesty are various. In an overview, Gerlach et al. (2019) list for example normative cues (like an ethical reminder via recalling the Ten Commandments [Mazar, Amir, & Ariely, 2008]), social information about the dishonesty of others [e.g., Fosgaard, Hansen, & Piovesan, 2013]), physical distance to others (e.g., Ackert, Church, Kuang, & Qi, 2011), and (information about) how the dishonest act affects others (e.g., Gino, Ayal, & Ariely, 2013). An important belief held by some in the dishonesty field is that 'everybody lies', be it often subtly and not to the maximum extent possible (Ariely, 2012, p. 2; Mazar et al., 2008). If an altered situational factor 'nudges' people to be even a little more honest, this can thus create major socio-economic benefit for society (Jacobsen et al., 2018; Cialdini et al., 2015). Situational factors may however also stimulate dishonesty and so create damage.

The objective of the current study is to investigate one such situational factor: a 'dark mode' user interface (UI). As we discuss in the following section, light and darkness affect human behavior. A set of studies links darkness to immoral behavior, while another study demonstrates that even darkness embedded in a UI can trigger psychological-behavioral effects. From this follows the research question: does dark mode increase dishonesty in its users?

1.1. Background and hypotheses

Dark mode is a software feature which presents a user interface with lighter-colored elements on a darker-colored background. This UI style, which is also known as a 'night/light-on-dark mode/theme' or simply a 'dark UI', is increasingly offered as an alternative to the commonly standard 'light mode' UI (Pedersen, Einarsson, Rikheim, & Sandnes, 2020). Applications like Facebook, WhatsApp, Instagram, and Gmail have adopted dark mode recently, as well as complete operating systems like Apple's iOS 13 and Microsoft's Windows 10. Fig. 1 shows an example of a dark and light UI.

Users may prefer dark mode for diverse reasons (Eisfeld & Kristallovich, 2020). One is that they simply find a dark UI to be aesthetically pleasing. Another one is eye comfort: research has shown that, particularly in low-light conditions, the use of a dark UI may reduce visual

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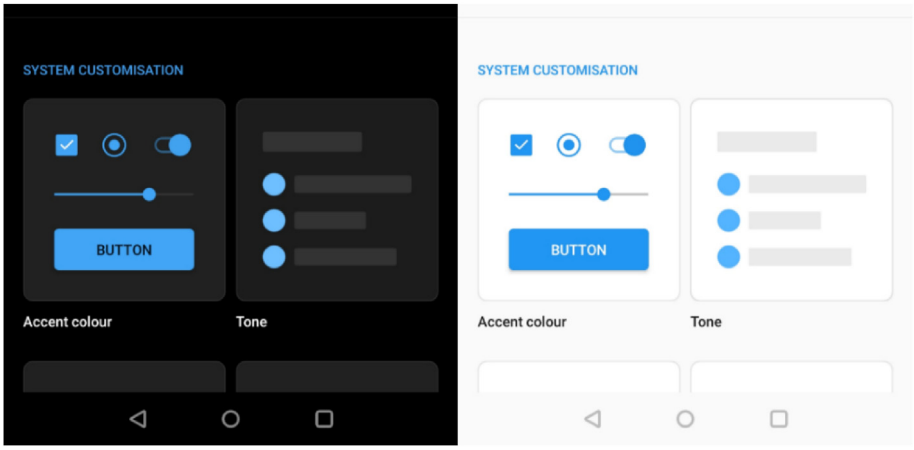

Fig. 1. Dark (left) and light (right) UI.

fatigue (Kim, Erickson, Lambert, Bruder, & Welch, 2019, pp. 1–9; Xie, Song, Liu, Wang, & Yu, 2021). Relatedly, some people use a dark UI because the dimmed light it produces may be less disturbing to their circadian rhythm (see also Duraccio, Zaugg, Blackburn, & Jensen, 2021; Mulvin, 2018). Finally, a dark UI may be beneficial because it reduces device power usage (Dong, Choi, & Zhong, 2009). Given these benefits, it seems logical and only beneficial for developers to implement dark mode in their software. A dark UI may however also affect the behavior of its users, potentially for the worse.

Light and darkness have had strong cultural-metaphorical meanings throughout history (see, e.g., Dunn & Edensor, 2020; Marks, 1982; Bille & Sørensen, 2007; Forceville & Renckens, 2013). Perhaps relatedly, psychological studies found that light and darkness also affect many kinds of human behavior. For instance, consumers make healthier and more virtuous choices in bright light (versus dim light) (Biswas, Szocs, & Lehmann, 2013). Being in dim or bright lighting may also affect taste perception and food intake (Bschaden, Dörsam, Cvetko, Kalamala, & Stroebele-Benschop, 2020). In dim lighting gamblers may play longer and take more risk than in bright lighting (Ilicic & Baxter, 2019). Creative performance may be enhanced in the dark and dim lighting (Steidle & Werth, 2013), and ambient brightness may make people more emotional (Xu & Labroo, 2014).

Concerning dishonesty, a set of experimental studies found that darkness may negatively affect moral behavior. Most notably, Zhong, Bohns, and Gino (2010) found in one experiment that participants in a dimmed room showed increased cheating behavior. In another experiment, Zhong et al. (2010) found that participants looking through shades performed more self-interested behavior and perceived themselves to be more anonymous. In a classic psychological experiment, Page and Moss (1976) found that subjects delivered higher intensity shocks to victims in dimly lit settings. Chiou and Cheng (2013) ran three experiments in which participants in brighter environments showed more prosocial behavior. Steidle and Werth (2014) found that brightness leads to higher self-awareness and more self-regulation, which subsequently limits socially undesirable behavior. These studies show that immoral behavior is to be expected under dark conditions.[1]

Furthermore, Löffler, Giron, and Hurtienne (2017) ran an experiment in which a dark and light UI were compared in terms of how participants perceived digital communication. Participants perceived communication as significantly more negative when displayed in a dark UI compared to a light UI. This experiment, among other behavioral research on color in UIs (see Löffler, 2017), indicates that even darkness as embedded in software's dark mode UIs may be able to trigger important psychological effects in people.

Thus, combining findings from darkness research on moral behavior (Chiou & Cheng, 2013; Page & Moss, 1976; Steidle & Werth, 2014; Zhong et al., 2010) and the dark mode study of Löffler et al. (2017), a dark UI may lead to negative moral behavioral effects in its users. Think of cyberbullying on social media or fraud in online tax forms. To date, no studies have investigated such effects of dark mode. The current study sets out to fill this research gap, focusing on one form of immoral behavior: dishonesty. This leads to the main hypothesis:

Hypothesis 1. Users of a dark UI are more dishonest than users of a light UI

A potential explanation for darkness leading to immoral behavior lies in perceived anonymity. Participants in the study of Zhong et al. (2010) experienced more anonymity while wearing shades, though their anonymity was objectively unaffected.

Anonymity has been long linked to self-interested and criminal behavior (Hite, Voelker, & Robertson, 2014; Pfattheicher, Schindler, & Nockur, 2019; Schitter, Fleiβ, & Palan, 2019). Assuming a rational choice model (e.g., Becker, 1968, pp. 13–68), anonymity removes negative consequences of immoral behavior (like the risk of punishment which would happen after getting caught). Therefore, darkness may promote immoral behavior via increasing perceived anonymity. This leads to the following hypothesis:

Hypothesis 2. Perceived anonymity mediates the effect of a dark/light UI on honesty

Finally, people may not always be susceptible to the effect of lighting. Other influences may be considered paramount to perhaps subtle environmental effects. Biswas et al. (2013) for instance found that hunger moderates the effect of bright/dim lighting on healthy food choice; high (vs. low) hunger participants in dim lighting more often chose the food that was otherwise preferred in bright lighting regardless of hunger. Relatedly, Bhanot (2017) concluded that a psychological honesty intervention aimed at promoting loan repayment failed not because borrowers were dishonest, but because they suffered from true financial hardship and simply could not repay.

In the context of a financially incentivized honesty experiment, as in the current study, a similar moderator may be financial well-being. Financial well-being is defined as the extent to which individuals experience financial security and freedom of choice in the present and future (CPFB, 2015). People that experience poor financial well-being may be drawn to profitable dishonesty regardless of using a dark or light UI. This leads to the following hypothesis:

[1] However, the amount of previous darkness studies on moral behavior is small. The cited darkness experiments have relatively low power and they have not yet been replicated (successfully nor unsuccessfully). Some studies also find positive effects: darkness may increase cooperation (Werth et al., 2012) and affectionate behavior (Gergen et al., 1973).

Hypothesis 3. A dark UI mode has less (or no) effect on profitable honesty of participants with worse financial well-being

2. Method

A high-powered, pre-registered, and economically incentivized honesty experiment was conducted. The pre-registration plan, experiment materials and data are freely and openly available at https://osf.io/bjgka/ (DOI: 10.17605/OSF.IO/BJGKA).

800 participants of 18 years and older were recruited on Amazon Mechanical Turk.[2] MTurk is commonly used in academic research and delivers a significantly more diverse and attentive sample than other subject pools (Buhrmester, Kwang, & Gosling, 2011; Chandler & Shapiro, 2016; Hauser & Schwarz, 2016). It is also commonly used in dishonesty research (Gerlach et al., 2019). To ensure data quality, >= 90% HIT approval rate, >= 50 previous tasks, and a U.S. location were set as the MTurk participation criteria. Each participant received a base rate of 0.30 $ for participation.

To measure honesty a die roll game was employed (based of the experiments of Fischbacher and Föllmi-Heusi [2013] and Rahwan, Hauser, Kochnawoska, and Fasolo [2018]). In this game, participants are instructed to roll a fair, six-sided die and report the outcome. Reporting a roll of 1–5, participants earn a bonus of that number in dollar cents. Reporting a roll of 6, participants earn nothing. Participants play ten rounds and are thus able to earn a maximum extra of 0.50 $.[3] This task allows participants to act dishonestly and claim more bonus than they deserve; dishonesty is detectable on the group level, but not on an individual level.

The experimental procedure was as follows (variables indicated with *cursive underlined text*):

Participants opened an online survey, the 'main survey'. They provided informed consent, entered their MTurk ID, and passed a reCAPTCHA. They were then given instructions for the die roll game. Participants were told that they could use any die (physical/virtual) for the die roll game, as long as it was fair and six-sided (three links to suitable online die websites were provided). Understanding of the instruction was ensured with four attention checks.[4] Participants were then randomly assigned to a dark or light *UI condition* for the duration of the die roll game, forming the main independent variable. From the main survey participants were directed to a separate die roll game survey with according dark or light UI aesthetics (see Fig. 2). The *bonus* (in $) that participants claimed in the die roll game formed the main dependent variable as a representation of honesty. After the game and back in the main survey, *perceived anonymity* as experienced during the die roll game was measured with a scale of Hite et al. (2014). *Financial well-being* was measured with a scale of the Consumer Financial Protection Bureau (CPFB, 2015). Participants then self-reported their current *physical environment lighting* (dark or light), their number of *hours since waking up*, and their general *UI preference* (dark or light). Using participants' location (as derived from their IP address, excluding participants that self-reported the use of IP-altering software [e.g., VPN, Tor browser]), *solar position* at the time of survey submission was determined as a percentage of max height at noon (using Pysolar [Stafford, n.d.]; 0% = before sunrise/after sunset, 100% = at solar noon). Finally demographic info was collected (*age*, *sex*, *education level*, and *country of origin*).

Hypothesis 1 was tested with a two-tailed *t*-test comparing the bonus (dependent variable) of participants between the dark and light UI condition (independent variable). Hypothesis 2 was tested with a Sobel test for mediation (with bonus as the dependent variable, UI condition as the independent variable, and perceived anonymity as the mediator variable). Hypothesis 3 was assessed through a linear regression model (with bonus as the dependent variable and UI condition, financial well-being, and an interaction term between UI condition and financial well-being as independent variables); with a significant effect of the interaction term between UI condition and financial well-being, the hypothesis would be accepted. Exploratory analyses were further conducted with the background variables.

3. Results

Participants' mean claimed bonus in $ cent (hereafter: 'bonus') (M = 29.08, SD = 7.07) significantly differed from the expected bonus based on the outcome distribution of a fair six-sided die (M = 25), a one sample two-tailed *t*-test showed (t (799) = 16.313, p < .001, mean difference = 4.078 [95% CI: 3.59 <-> 4.57]). In other words, dishonesty took place.

Bonus did not differ between dark (N = 407, M = 28.76, SD = 7.27) and light (N = 393, M = 29.41, SD = 6.49) UI condition, an independent samples two-tailed *t*-test (equal variances assumed) showed (t (1.306) = 798, p = .192, mean difference = −0.653 [95% CI: −1.634 <-> 0.328]). Hypothesis 1 was therefore rejected: a dark UI did not increase dishonesty.

Linear regression analyses showed that UI condition did not affect perceived anonymity, and that perceived anonymity did not affect bonus (see Table 1). A Sobel test hence indicated no mediation of perceived anonymity between UI condition and bonus (F (1, 796) = 0.018, p = .894). This rejected Hypothesis 2.

Linear regression analyses showed that financial well-being did not affect bonus, and that there was no interaction effect on bonus of financial well-being with UI condition or with perceived anonymity (see Table 2). As such, financial well-being did not moderate an effect on bonus. Hypothesis 3 was thus rejected.

Exploratory linear regression analyses revealed no independent effect on bonus of physical environment lighting (p = .447), hours since waking up (p = .331), UI preference (p = .938), or solar position (p = .165). Adding UI condition and an interaction term with UI condition to these analyses, no interaction effect on bonus was found of physical environment lighting (p = .687), dark/light UI preference (p = .133), or solar position (p = .149). However, of hours since waking up an interaction effect on bonus was found (p = .04).[5] It appeared that dark UI users (but not light UI users) became more honest as they were awake for longer (see Table 3 and Fig. 3): per extra hour awake, dark UI users averagely claimed 0.2 $ cent less bonus.[6]

Finally, exploratory linear regression analyses revealed no independent effect on bonus of sex[7] (p = .115) or education level[8] (p = .181). Age had an independent effect on bonus (B = −0.071 (SE = −0.02) [95% CI:

[2] A sensitivity power analysis for the main hypothesis (conducted with GPower 3.1), using a two-tailed alpha of .05, a power criterion of 0.8, and two groups of 400 participants in an independent means *t*-test, showed an effect size of 0.2 (Cohen's d) (regarded as 'small' [Cohen, 1988]).

[3] Previous research found that a higher stake size only very limitedly affects cheating behavior (Rahwan et al., 2018). We therefore opted for more participants instead of a higher stake size per participant, as to maximally reduce a type 2 (false negative) error.

[4] The four attention checks were two multiple choice questions about the bonus payment result of specific die rolls and two multiple choice questions about the requirements of the die participants could use (see materials at https://osf.io/bjgka/). Upon failing to correctly answer, participation would be terminated and a new participant was recruited.

[5] Two extreme outliers that reported being awake for 36 h (1 light UI [bonus: 34 $ cent], 1 dark UI [bonus: 25 $ cent]) were excluded from the analyses involving hours since waking up. Reported p values remained (in)significant with the outliers included (α = .05).

[6] Such an interaction effect on perceived anonymity was not found (p = .384), indicating that perceived anonymity did not mediate the interaction effect on bonus. Linear regression analysis in the dark UI sample with a model predicting bonus using hours since waking up (p = .867), financial-well being (p = .785), and an interaction term of hours since waking up with financial-well being (p = .744) showed no moderation of financial-well being.

[7] Male/female. 10 participants that indicated 'other' were excluded.

[8] Low/high, where high means possession of at least a bachelor's degree.

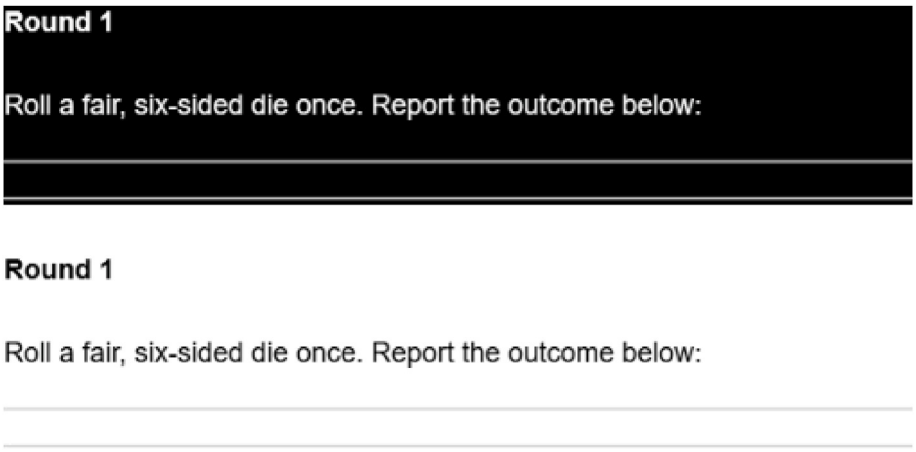

Fig. 2. Dark (top) and light (bottom) UI condition.

Table 1
Linear regression analysis, investigating mediation of perceived anonymity ('ANON').

Model 1[a] DV = ANON	B (SE) [95% CI]	p (t)	Model 2[b] DV = bonus	B (SE) [95% CI]	p (t)	Model 3[c] DV = bonus	B (SE) [95% CI]	p (t)
(Constant)	5.923 (.053) [5.819 <–> 6.028]	<.001 (111.061)	(Constant)	30.612 (1.397) [27.87 <–> 33.354]	<.001 (21.913)	(Constant)	30.273 (1.421) [27.484 <–> 33.062]	<.001 (21.307)
UI (ref. = light)	-.026 (.076) [-.176 <–> .123]	.731 (−.344)	ANON	-.26 (.233) [-.716 <–> .197]	.265 (−1.116)	UI (ref. = light)	.646 (.5) [-.335 <–> 1.627]	.196 (1.293)
						ANON	-.256 (.232) [-.712 <–> .2]	.271 (−1.101)

[a:] $R^2 = .012$;[b:] $R^2 = .002$;[c:] $R^2 = .004$.

Table 2
Linear regression analysis, investigating moderation of financial well-being ('FIWE').

Model 1[a] DV = bonus	B (SE) [95% CI]	p (t)	Model 2[b] DV = bonus	B (SE) [95% CI]	p (t)	Model 3[c] DV = bonus	B (SE) [95% CI]	p (t)
(Constant)	30.394 (3.276) [23.963 <–> 36.825]	<.001 (9.277)	(Constant)	34.752 (4.679) [25.568 <–> 43.936]	<.001 (7.428)	(Constant)	14.436 (16.725) [-18.393 <–> 47.266]	.388 (.863)
FIWE	-.025 (.061) [-.145 <–> .096]	.687 (−.403)	FIWE	-.113 (.088) [-.286 <–> .06]	.199 (−1.285)	FIWE	.306 (.315) [-.311 <–> .923]	.331 (.973)
			UI (ref. = light)	−8.171 (6.553) [-21.034 <–> 4.692]	.213 (−1.247)	ANON	2.732 (2.785) [-2.734 <–> 8.198]	.327 (.981)
			FIWE * UI (ref. = light)	.166 (.123) [-.075 <–> .407]	.177 (1.352)	FIWE * ANON	-.057 (.052) [-.159 <–> .046]	.281 (−1.079)

[a:] $R^2 = 0.014$; [b:] $R^2 = 0.068$; [c:] $R^2 = 0.057$.

−0.109 <-> −0.032], $p < .001$, $t = -3.602$), revealing that older participants were significantly more honest. Adding UI condition and an interaction term with UI condition to these analyses, no interaction effect on bonus was found of sex ($p = .898$), education level ($p = .89$), or age ($p = .76$).

4. Discussion

The current study was built on a body of research which shows that situational factors affect human behavior, among which dishonesty. Previous studies showed that darkness may boost immoral behavior, as well as that even darkness embedded in a UI, 'dark mode', can produce a psychological-behavioral effect. This led to the research question: does dark mode increase dishonesty in its users? To answer this, we conducted a high-powered, pre-registered, and economically incentivized honesty experiment which compared the behavior of dark and light UI users.

Our findings show that a dark UI did not stimulate dishonesty, unlike previous darkness studies that found negative moral behavioral effects (Chiou & Cheng, 2013; Page & Moss, 1976; Steidle & Werth, 2014; Zhong et al., 2010). This despite Löffler et al. (2017) showing that a dark UI is capable of producing a psychological-behavioral effect in users (with users more negatively perceiving communication displayed in a

Table 3
Linear regression analysis, investigating moderation of hours since waking up ('AWAKE').

Model 1[a] DV = bonus	B (SE) [95% CI]	p (t)	Model 2[b] DV = bonus	B (SE) [95% CI]	p (t)	Model 3[c] DV = bonus	B (SE) [95% CI]	p (t)
(Constant)	29.58 (.575) [28.451 <–> 30.709]	<.001 (51.426)	(Constant)	30.305 (.814) [28.705 <–> 31.905]	<.001 (37.239)	(Constant)	28.822 (.808) [27.232 <–> 30.411]	<.001 (35.658)
AWAKE (dark & light UI)	-.065 (.066) [-.195 <–> .066]	.331 (−.972)	AWAKE (dark UI)	-.2 (.095) [-.387 <–> -.014]	.036 (−2.108)	AWAKE (light UI)	.073 (.092) [-.109 <–> .254]	.43 (.789)

[a]: $R^2 = 0.034$; [b]: $R^2 = 0.104$; [c]: $R^2 = 0.04$.

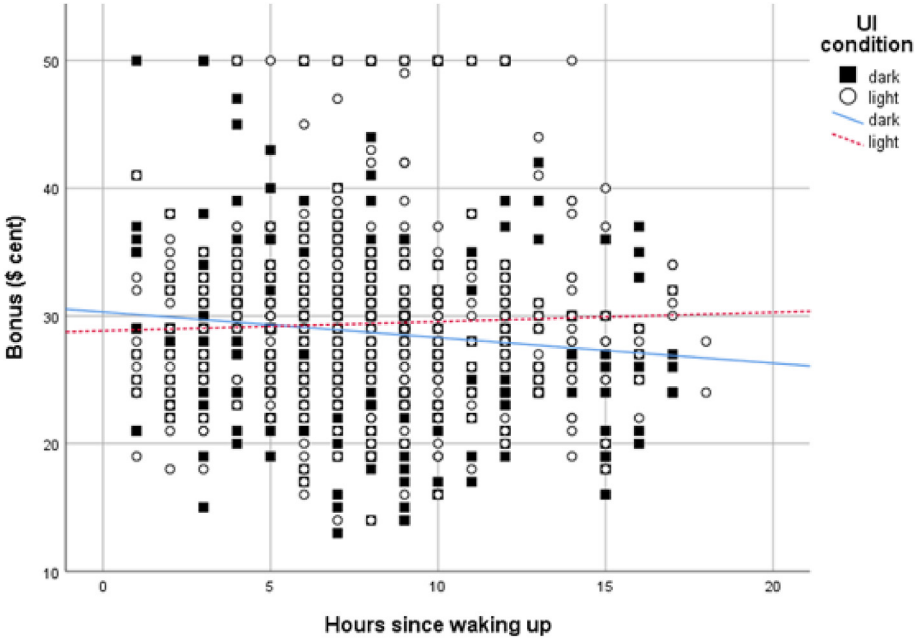

Fig. 3. Fit line and each case plotted (split per UI condition).

dark UI). Perhaps the latter simply does not hold true for honesty-related behavior. Or, the influence of a dark UI is subtler than that of the darkness operationalizations of the previous darkness morality studies. Previous darkness morality studies made use of shades and dimmed rooms. Consider that a dark UI is displayed on a screen, and takes up only a limited part of one's full visual perception. A dark UI may therefore have no or less influence on the decision-making process. It should also be considered that the cited darkness morality and UI studies were limited in both quantity and statistical power, so it is not evident that their findings were not false positives. Furthermore, there are also studies which found positive effects of darkness on social behavior. Werth, Steidle, and Hanke (2012), for example, show that darkness may increase cooperation. A classic psychological experiment titled 'deviance in the dark' (Gergen, Gergen, & Barton, 1973) found that subjects placed in a dark room showed more affectionate behavior. Gergen et al. (1973) concludingly wrote that "anonymity itself does not seem to be a social ill (…) [It] seems to encourage whatever potentials are most prominent at the moment – whether for good or for ill" (p. 130). This idea that darkness does not necessarily stimulate negative behavior is in line with our rejected main hypothesis; a dark UI did not increase dishonesty in its users.

In fact, exploratory analysis revealed that a dark UI may even promote honesty in users that have been awake for a longer period of time. As this finding was not hypothesized, it is not entirely clear why this is the case. It could stem from a psychological by-effect of the (eye) comfort that a dark UI may offer near the end of one's day (see Kim et al., 2019, pp. 1–9; Xie et al., 2021). This makes sense given that negative emotions may fuel unethical behavior (Shalvi, Van Gelder, & Van Der Schalk, 2013, p. 179); a light UI could cause irritation in users that have been awake for longer, and so justify dishonesty. Another explanation may be that the observed effect is related to an ego depletion (fatigue) effect on honesty, which is counteracted by a light UI but not by a dark UI. Fatigued users might be more prone to being honest; the bright light of a light UI may wake the user and counter such fatigue. Ego depletion theory is however highly controversial (see Dang et al., 2021; Friese, Loschelder, Gieseler, Frankenbach, & Inzlicht, 2019). While the observed effect is interesting it should be interpreted with caution, because it stems from exploratory (rather than pre-registered confirmatory) analysis and the underlying mechanism is unclear.

In absence of the main dark UI effect on honesty, hypothesized mediation of perceived anonymity and moderation of financial-well being could not be confirmed. It also could not be confirmed for the honesty influence of hours awake under a dark UI, though the specificity of this effect limited the statistical power of mediation and moderation analysis. Therefore it cannot be definitively concluded that perceived anonymity and financial well-being do not play a role.

Concerning mediation, future research may consider measuring other variables besides perceived anonymity. Lamba and Mace (2010) found that people recognize when they are truly anonymous in an economic game. Huang, Dong, and Labroo (2018) found that ambient darkness increases hedonic choice even in a situation in which choice is already anonymous (similar to our experiment). Huang et al. (2018) find

evidence for darkness reducing the feeling of social connection to others. Social connection, rather than (perceived) anonymity, may thus drive a darkness honesty effect.

Concerning moderation, an effect of financial well-being would have potentially shown under stronger financial incentives. Rahwan, Hauser, Kochanowska, and Fasolo (2018) showed that stake size only limitedly affects cheating behavior, but this could be different for those in financial hardship. Relatedly, the sample's variance in financial well-being could have been insufficient for an effect to be uncovered. Future research may also consider different moderating factors; for example, computer proficiency and frequency of use.

With regards to age, the collected data are in line with established ideas about criminal decision-making. Older participants were significantly more honest in our experiment. A meta-analysis by Defoe, Dubas, Figner, and Van Aken (2015) shows that adolescents take more risk than adults, and that young adults take more risk than old adults. Several prior honesty and deception studies show that older participants are more dishonest (see review in Jacobsen & Fosgaard, 2018, p. 365; Debey, De Schryver, Logan, Suchotzki, & Verschuere, 2015).[9] This supports the validity of our conducted honesty experiment.

5. Conclusion

Our experiment shows no general difference in honesty between users of a dark and light UI (H1). We find no evidence for mediation of perceived anonymity (H2) or moderation of financial well-being (H3). Exploratory analysis even revealed that when awake for a longer period of time, dark UI users were more honest than light UI users.

Dark mode may therefore not decrease positive moral behavior, but instead boost it. This means that dark mode is safe and perhaps even beneficial to implement in software where moral behavior is desired, such as for online tax declarations and social media. Thus, in line with the work of Werth et al. (2012) and Gergen et al. (1973), the current study shows that darkness can actually lead to something good instead of bad.

Declarations of competing interest

The ethical committee of the University of Twente (BMS faculty) approved the study protocol.

The authors have no competing interests to report.

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