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Article

Message Reminders Encouraging Brisk Walking by Considering the Dynamic Factor of Cognitive Fatigue

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Abstract

Physical inactivity and sedentary behaviours are leading risk factors for preventable health problems worldwide. Therefore, several smartphone-based interventions have tried to enhance physical activity (PA) through goal reminders based on relatively stable characteristics. However, time-varying factors, such as cognitive fatigue, may act as barriers to engagement in PA. This study aims to unravel what type of goal reminder messages are effective for enhancing PA in situations of cognitive fatigue. First, using a 3 x 3 between-subjects design, we evaluated the effectiveness of goal reminders matched with real-time goals under different levels of cognitive fatigue. This study did not find evidence that the tested goal reminders, intended to be adapted to the real-time goals of the participants, were more effective in promoting PA than goal reminders not adapted to individuals' real-time goals. Second, to better understand how to design future reminders, two questions explored what format and what content participants considered to be helpful when feeling cognitively fatigued. Results show that GIFs, textual reminders, and pictures are suitable formats in smartphone-based interventions and that humorous content is preferred when feeling cognitively fatigued. These findings contribute to the development of just-in-time adaptive interventions that consider dynamic factors to promote PA.

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Keywords
Physical activity, cognitive fatigue, goal reminders, dynamic factors.

The World Health Organisation defines physical activity as "any bodily movement produced by skeletal muscles that requires energy expenditure" and refers to all movement during leisure time, for transport and as part of a person's work (World Health Organization, 2020). Guidelines are provided for different age groups to define how much physical activity is needed for good health, for example adults aged between 18 and 64 years old should exercise at least 150 minutes of moderate-intensity physical activity or at least 75 minutes of vigorous-intensity physical activity per week (World Health Organization, 2010). Globally, one in four adults do not meet these recommendations and therefore are called "insufficiently active" or "inactive". Additionally, according to Eurostat (2017), 43% of the Belgian population has a sedentary job and often engages more in passive (sedentary) activities (e.g., watching television) after working hours instead of participating in active activities, such as going for a brisk walk (Rieger et al., 2014). Brisk walking is a common type of moderate-intensity activity, walking at three to four miles per hour (or on average five to six kilometres per hour) for most adults (Johansson et al., 2011; Lee & Buchner, 2008). This specific type of physical activity is often promoted in health interventions because it produces substantial health benefits without specific equipment or money (Lee & Buchner, 2008). Promotion of brisk walking can help overcome inactive and sedentary behaviours, which are found to be leading risk factors for worldwide preventable health problems such as cardiovascular diseases, cancer, and diabetes (World Health Organization, 2018; World Health Orgnaization, 2020).

Furthermore, a national survey of the Belgian population revealed that the use of sports and health apps, with accompanying wearable technologies, as a tool for well-being and health had increased over the years (Vandendriessche et al., 2020). In addition, 39% of these Belgian users said that using health apps or wearable technology has helped them live a healthier and more active life (Vandendriessche et al., 2020). However, studies worldwide have repeatedly highlighted high abandonment rates—suggesting that there is still room for improvement (Becker et al., 2014; Krebs & Duncan, 2015). In this respect, although the effectiveness of physical activity apps is often considered as the main interest, not much attention has been paid to improving the messages used by smartphone-based interventions (Hardeman et al., 2019). However, previous research emphasizes that testing messages might be beneficial as well because the majority of these smartphone-based interventions have only focused on the relatively stable factors of individuals when tailoring messages, thereby collecting the information needed for support in advance (e.g., through a self-reported questionnaires) and providing the individual with feedback based on that information during the intervention (for an overview, see Brug et al., 2012). This is also called customisation, where messages are adapted to the specific individual by explicitly selecting between certain options (Conroy et al., 2019; Sundar & Marathe, 2010). For example, an effective messaging strategy that is already successfully implemented in the work setting, as well as during leisure time (Baker et al., 2008; Gilson et al., 2008; McEwan et al., 2016; Michie et al., 2015), is goal setting: "setting or agreeing on a goal defined in terms of the behaviour to be achieved" (Michie et al., 2015, p. 117). According to Prestwich and colleagues (2010), goal message reminders are effective in promoting brisk walking in sedentary populations in contrast to regular reminders. Whilst regular reminders aim to prompt the intended behaviour (e.g., this is a reminder to take a walk),

goal message reminders strengthen the mental link between goals and behavioural intentions (Prestwich et al., 2010; Wicaksono et al., 2019). This is because a reminder of one's goals might enhance the accessibility of the goal, which in turn can help individuals retrieve the goal and temporarily activate the necessary motivation to implement their intentions (Gollwitzer, 1993). Most of the smartphone-based interventions relying on goal setting to implement specific *performance goals* (Swann et al., 2020), which can be defined in terms of the behaviour to be achieved (e.g., going for a 20 minute walk each day) or in terms of a positive outcome for the desired behaviour (e.g., having more energy after a 20-minute walk; Michie et al., 2015, pp. 117-118). In other words, these messages focus on pre-set physical activity goals and are being sent without considering the real-time context of the individual. However, the development of mobile health and wearable technologies has enabled the ability not only to ask participants about their rather stable traits and goals in advance, but also to measure more real-time or dynamic factors during smartphone-based interventions, such as a health behaviour that has already been performed (e.g., steps taken), the context that individuals are in (e.g., with or without friends) and ultimately individuals' emotional states (e.g., fatigue or vital). This knowledge offers the possibility of sending more appropriate messages, adapting messages to dynamic factors. In addition, previous literature on persuasive messages such as text message reminders indicates that messages are more effective when there is a fit or match between the characteristics of the message and the psychological characteristics of the receiver (Sar & Anghelcev, 2015), such as compatibility between the message and motivational orientation of the receiver (Lin & Shen, 2012), the accessible self-construal of the receiver (Sung & Choi, 2011) and the mood of the receiver (Sar & Anghelcev, 2015). Thus, although studies show that goal setting is an effective strategy to tailor messages (Michie et al., 2015), we suggest in this paper that new technologies and measurements have the potential to take the tailoring of messages to a whole new level by adapting the messages to the users with a focus on dynamic factors to create specific message content (Guthrie, 2017; Nahum-Shani et al., 2018; Scholz, 2019). Giving individuals the right type of messages and adapting interventions to time-varying information will help in designing even more successful smartphone-based interventions (Nahum-Shani et al., 2015; Nahum-Shani et al., 2018).

Cognitive Fatigue

An important dynamic factor that should be targeted when developing messages for interventions is fatigue. Overall, fatigue contributes to energy depletion processes on a day-to-day basis (Ilies et al., 2015) and is often explained as a combination of physical fatigue and cognitive fatigue (Chalder et al., 1993). Physical fatigue, also known as peripheral fatigue, results from repeated muscle actions (Mizuno et al., 2011). During the past decades, various theories have emerged to explain cognitive or central fatigue. The best known may be the theory of loss of energy resources or 'batteries running down'. This theory suggests that cognitive fatigue is caused by the exhaustion of mental resources from carrying out work (Baumeister et al., 1998). In relation to physical activity, cognitive fatigue makes it hard to initiate and maintain a regular exercise routine when energetic resources are already depleted (De Vries et al., 2016; Sonnentag, 2018).

However, other theorists do not see cognitive fatigue as a depleted battery and subsequently the inability to engage in exercise, but rather as a lack of will or desire. In this way, cognitive fatigue can be seen as an aversion to activities that demand high levels of effort (Bartley &

Chute, 1947; Rabinbach, 1990). Research shows that cognitive fatigue limits exercise tolerance and engagement in humans through a higher perception of effort (Marcora et al., 2009). Furthermore, the study of Niermann and colleagues (2016) found that high levels of cognitive fatigue and low levels of vigour in the afternoon predicted a reduced likelihood to engage in physical activity after work, using both objective and subjective methods to measure physical activity, namely accelerometers and self-reported questions. Thus, the high cognitive demands of work and other daily activities leave individuals in a state of cognitive fatigue, experiencing high levels of effort which impair their motivation and abilities to engage in adequate amounts and intensities of physical activity (Brown & Bray, 2019).

Last, instead of looking at cognitive fatigue as a problem in the management of energy, some scholars refer to cognitive fatigue as a problem of control (Hockey, 2011). Cognitive fatigue may be the result of a conflict between competing behavioural tendencies—a competition between doing one thing or the other (Bartley & Chute, 1947; Hockey, 2011). Although cognitive fatigue might arise through a conflict of goals, experiencing cognitive fatigue brings a goal in itself, namely a goal to recover, which can be fulfilled by relaxing (Ragsdale et al., 2011; Sonnentag & Fritz, 2007; Zijlstra & Sonnentag, 2006). This leads us to a paradoxical situation because this relaxation goal can be fulfilled in two ways: on one hand, relaxation can manifest itself in low effort, rather passive activities such as watching television (Rieger et al., 2014); on the other hand, higher-effort dynamic activities such as brisk walking also have the potential to fulfil this relaxation goal (Rokade, 2011; Spinler, 2015). Given the high levels of physical inactivity, going out for a brisk walk is the preferred option in this situation. Additionally, research shows that physical activity can overcome cognitive fatigue (Feuerhahn et al., 2014), and regular engagement in physical activity leads to lower levels of cognitive fatigue overall (De Vries et al., 2017). Therefore, it is of utmost importance to stimulate cognitively fatigued individuals to exercise with the right message reminder: focussing on a goal that is adapted to the real-time characteristics and needs of the individual. Due to the high perception of effort in exercise for cognitively fatigued individuals (Marcora et al., 2009), the performance goal does not adequately match the state of the individual (Sar & Anghelcev, 2015). However, a relaxation goal should potentially create a mental link between the real-time relaxation goal and the relaxing potential of physical activity behaviours such as brisk walking (Prestwich et al., 2010; Wicaksono et al., 2019). Therefore, we suggest:

> *H1:* Compared to a regular reminder and a performance goal reminder, a relaxation goal reminder is more effective when individuals feel cognitively fatigued.

Instead, the opposite of being cognitively fatigued is having cognitive energy, which is defined as vitality (Ryan & Deci, 2008). It represents cognitive energy that is available to the self and that one can regulate for purposive actions (Ryan & Frederick, 1997). In other words, when individuals feel vital, they have enough energy to initiate actions (Baumeister et al., 1998). Therefore, they will not prioritise relaxing; on the contrary, the goal of cognitively vital individuals is to maintain or even enhance their cognitive energy. Through pursuit of pre-set physical activity goals, this cognitive energy will remain and potentially increase (Thayer, 1987). By emphasising the performance aspect of a brisk walk in a reminder, a mental link will be created between a real-time performance goal and brisk-walking behaviour (Prestwich et al., 2010; Wicaksono et al., 2019), which leads to formulating the following hypothesis:

> *H2:* Compared to a regular goal reminder and a relaxation goal reminder, a performance goal reminder is more effective when individuals feel cognitively vital.

Additionally, in this research we analyse some relatively stable variables as covariates because the literature shows that the effectiveness of an intervention depends on the combination of stable and dynamic factors of an individual (Cerrada et al., 2017; Nahum-Shani et al., 2015). Therefore, we will ask participants about their current physical activity levels, past walking behaviours, intention in real life to follow a 20-minute walk reminder, and goal commitment as these variables were found to influence future walking behaviours directly and indirectly (Dishman et al., 1985; Hagger et al., 2001; Moon et al., 2017).

While considering cognitive fatigue, we discuss in this paper an online study consisting of an experimental part on the one hand, and an exploratory part on the other. In the experimental part, we test theory-based messages matching different goals and corresponding to different levels of cognitive fatigue. In the exploratory part, we ask participants to describe the perfect message to stimulate them to exercise when feeling cognitively fatigued. In these two ways, we hope in this study to contribute to the design of suitable messages adapted to the prevailing state of individuals to engage in physical activity.

PART I: Experimental Study
Method

Design and Participants

This study was an online experiment making use of a scenario-based 3x3 between-subjects design, with the dynamic state (cognitively fatigued, cognitively vital, neutral) and goal reminder (relaxation, performance, or regular reminder) as factors. The neutral state and regular reminder were control conditions, where it is expected that individuals do not have specific goals in the neutral state and regular reminders are used to prompt the intended behaviour instead of reminding users of their goals (Prestwich et al., 2010; Wicaksono et al., 2019). An a priori power analysis using G*Power 3.1.9.2 (Faul et al., 2007) for ANCOVA with fixed effects, main effects, and interactions considering nine conditions ([vignette: cognitively fatigued, cognitively vital, neutral] x [reminder: relaxation goal, performance goal, regular]), indicated that with 536 participants, an effect size of 0.15 can be captured with 80% of power (Buchanan & Kock, 2001; Crutzen, 2010). Participants were recruited through the recruitment agency Bilendi. People who had a sedentary job, resided in Belgium, could speak, and read the Dutch language, and were aged between 25 and 45 years were eligible to participate. Long working hours are considered a risk factor for physical inactivity in Belgium (DeMorgen, 2015). In addition, the combination of working long hours and being inactive is associated with higher risk of burn out, which is caused by prolonged periods of cognitive fatigue (Hu et al., 2016). In Belgium, the risk of the prevalence of burnout is highest within the 25-45 year age group (Volksgezondheidenzorg, 2019). Within this age category, we also found that people are most familiar with smartphone applications and wearables in Belgium (Vanhaelewyn & De Marez, 2018). Participants were invited to complete the web-based survey administered through the survey platform Qualtrics by the recruitment agency via email between Wednesday, the 29th of January 2020, and Friday, the 7th of February 2020 (a ten-day period). A total of 950 respondents completed the online experiment. We obtained informed consent from all participants, and the Independent Ethical Advisory commission for research in Social and Human Sciences (EA SHW_18_81) approved the study procedures. Data from participants who reported that they were currently not working (n = 56; 6%), were sedentary for less than

50% of their working time ($n = 179$, 19%), were older than 45 years ($n = 5$; 0.5%) and responded incorrectly to the control question (*please indicate 'disagree' for this question*; $n = 57$, 6%) were omitted from analysis. Participants who completed the survey in less than 5 minutes ($n = 64$, 7%) or had missing data ($n = 19$, 2%) were also omitted. The final sample size was $N = 570$.

Procedure and Stimulus Materials

We assigned participants randomly to one of the three pre-designed vignettes (Wason et al., 2021), which were designed for this study to induce a cognitively fatigued, cognitively vital, or neutral state by adding adjectives and descriptions addressing these emotions (Volkman & Parrott, 2012) – see appendix. Afterwards, every participant randomly received one of the three pre-designed reminders. We added the neutral condition so that the experimental conditions could be compared with a control condition. Vignettes have already been used in previous studies to reflect the operationalization of moods (Tamir & Robinson, 2007) and fatigue (Karasz & McKinley, 2007). In order to assure validity of the hypothetical vignettes, we measured and used real-time cognitive fatigue as a covariate during the statistical testing process.

We asked participants to empathize as much as possible with the vignette that we presented to them. Each vignette was preceded by the following instruction: *Imagine the following: It's January and you've set yourself the goal of taking a 20-minute walk in your leisure time every working day starting this year. To achieve this goal, you will call upon the help of a smartphone application.* After this instruction, participants were randomly assigned to one of the three vignettes representing a cognitively fatigued, cognitively vital, or neutral state. All vignettes told the story of an easy to imagine end of the working day of an office worker, where the main character still had to finish one last task before tomorrow. Participants had to imagine they were the main character of the story and thus still had to finish one last working task. In the cognitive fatigue vignette, this appears to be hard and is taking forever, whilst in the cognitively vital vignette, it appears to be easy and is quickly finished. It is also emphasized that the main character is feeling rather mentally fatigued or rather mentally energetic. In the control condition (neutral vignette) the story is explained as consecutive events without any emphasis on particular feelings or emotions. Furthermore, we stated that at the end of the story the task is finished, indicating that leisure time has started, and the main character receives a smartphone message reminding the character to go for the 20-minute walk. For more information on the vignettes, we refer to the appendix at the end of this paper. Next, one of the three reminders was randomly presented (relaxation goal reminder, performance goal reminder, regular reminder). We worked with screenshots, aiming to be as realistic as possible (see Figure 1).

We pretested both the vignettes and the reminders among an independent sample of students ($n = 40$; $M_{age} = 20.38$, $SD = 1.65$). We selected and pretested the vignettes based on narrative engagement (De Graaf et al., 2011), perceived realism (Bae et al., 2012), and perceived credibility (De Graaf et al., 2011). We selected and pretested the reminders based on perceived message credibility (De Graaf et al., 2011) and message evaluation (Southern Center for Communication, 2019). During the pre-test, manipulations of the intended states produced the expected differences on the mental fatigue items of the fatigue scale (Chalder et al., 1993) and two visual analogue scales that asked to describe how cognitively fatigued and cognitively vital

participants felt on a scale of one to ten (Shahid et al., 2011). Furthermore, participants could give open feedback on each vignette, which was divided into positive, negative, and neutral based on writing style, ease in reading, and feelings of empathy for further improvement of the vignettes. Finally, participants could give open feedback on each reminder, which we divided into positive and negative to understand their evaluations better.

Measures

Demographic Measures. Participants reported their gender, year of birth, highest level of education, and employment status (full time, part-time, unemployed). As we were researching the physical activity levels of sedentary employees, we used this last question as a control; 'unemployed' responses led to the end of the survey. We also assessed perceived sitting time during work with one question: *How much time on average do you spend sitting at work (including driving for work such as taxi drivers and salesmen)?* Answer options included: on average for 50% of the time, more than 50% of the time, or less than 50% of the time. Responses of less than 50% indicated low sedentary behaviours and led to the end of the survey.

Covariates. We assessed physical activity through the Godin-Shepard leisure-time physical activity questionnaire, which has acceptable validity and reliability (Amireault & Godin, 2015; Godin, 2011). We assessed past walking behaviour with the question: *How many times in the past six months have you walked moderately intensively (= a brisk walk) for about 20 minutes during leisure time?* Participants indicated answers on a 5-point scale ranging from *never to very often* (Hagger et al., 2001). Subsequently, we asked participants what their intention would be in real life to follow their resolution to walk 20 minutes each day, independent from the given vignette (Hagger et al., 2001). Last, the questionnaire assessed the goal commitment of brisk walking through 10-items on a 5-point Likert scale (Hollenbeck et al., 1989), which indicated a Cronbach's alpha of 0.741. Additionally, we included cognitive fatigue measured before the manipulation to control for the initial prevailing state (i.e., did this state interfere with the manipulation or not?).

Figure 1. Stimulus Reminders: (Left to Right) Relaxation Goal Reminder, Performance Goal Reminder, Regular Reminder

Intention to Follow the Goal Reminder Message. Immediately after reading the vignette, participants read one of the three reminders to take a 20-minute walk. Participants were asked to rate what their intention was to follow up the reminding message using a response scale ranging from 1 (*not at all likely*) to 5 (*very likely*; Alley et al., 2019).

Manipulation. We checked the manipulations of the intended states with the mental fatigue items of the fatigue Scale on a 5-point Likert scale (Chalder et al., 1993), which had a Cronbach's alpha of 0.940. In addition, two visual analogue scales (VAS) were used to indicate levels of cognitive fatigue and levels of cognitive energy before and after manipulation (Shahid et al., 2011). These scales asked participants to describe mental fatigue and mental energy on a scale of one to 10, where one means not feeling mentally fatigued/energetic at all, and 10 means feeling very mentally fatigued/energetic. Cognitive fatigue before the manipulation was also considered as a control variable.

Results

Sample

Descriptive statistics of the sample are presented in Tables 1 and 2. A one-way ANOVA showed that there were no significant differences across the three experimental conditions. Participants were on average 36 years old, 89% of respondents perceived that they sat more than 50% of the time during working hours, and 40% of the sample was categorized as insufficiently active according to the leisure time activity scale formula (Godin, 2011). Just over half of the participants were women (55%), 94% of the respondents worked full time, and 82% had a bachelor's degree or higher.

Table 1. Descriptive Statistics: Continuous Study Variables

Variables	$M_{Cog.\ Vital}$ (*SD*)	$M_{Cog.\ fatigue}$ (*SD*)	$M_{Neutral}$ (*SD*)	M_{Total} (*SD*)
Age (years)	35.9 (5.9)	36.2 (5.7)	35.8 (5.8)	36.0 (5.7)
Past walking behaviour (possible range 1–5)	3.2 (1.0)	3.2 (1.0)	3.1 (1.0)	3.2 (1.0)
Intention in real life (possible range 1–7)	4.0 (1.6)	3.8 (1.5)	3.9 (1.5)	3.9 (1.5)
Goal commitment (α = 0.741)	2.8 (0.6)	2.9 (0.6)	2.8 (0.6)	2.8 (0.6)
VAS fatigue (before manipulation) (possible range 1–10)	5.5 (2.3)	5.2 (2.5)	5.6 (2.4)	5.4 (2.4)
VAS energy (before manipulation) (possible range 1–10)	5.3 (1.9)	5.2 (2.0)	4.9 (1.9)	5.2 (1.9)

Table 2. Descriptive Statistics: Categorical Study Variables

Variables	$N_{Cognitively\ Vital}$	$N_{Cognitively\ fatigue}$	$N_{Neutral}$	N_{Total}
	(% within the categorical variable)			*(% within scenario)*
Group size	188	193	189	570
Gender				
Men	81 (31.9)	90 (35.4)	83 (32.7)	254 (44.6)
Women	105 (33.5)	103 (32.9)	105 (33.5)	313 (54.9)
Other	2 (66.7)	–	1 (33.3)	3 (0.6)
Education				
Elementary education	–	1 (100.0)	–	1 (0.2)
Secondary education	23 (28.4)	30 (37.0)	28 (34.6)	81 (14.2)
Graduate	9 (42.9)	5 (23.8)	7 (33.3)	21 (3.7)
Bachelor's degree	62 (28.2)	82 (37.3)	79 (36)	223 (39.2)
Master's degree	88 (37.9)	71 (30.6)	73 (31.5)	232 (40.7)
PhD	6 (50.0)	4 (33.3)	2 (16.7)	12 (2.1)
Employment status				
Employed full-time	180 (33.8)	179 (33.6)	174 (32.6)	533 (93.5)
Employed part-time	8 (21.6)	14 (37.8)	15 (40.5)	37 (6.5)
Perceived sitting time at work				
More than 50% of the time	165 (32.5)	170 (33.5)	172 (33.9)	507 (88.9)
About 50% of the time	23 (36.5)	23 (36.5)	17 (27.0)	63 (11.1)
Physical activity				
Active (+ 24 units)	87 (36.6)	72 (30.3)	79 (33.2)	238 (41.8)
Moderately active (14–23 units)	35 (33.0)	33 (31.1)	38 (35.8)	106 (18.6)
Insufficiently active (- 14 units)	66 (29.2)	88 (28.9)	72 (31.9)	226 (39.6)

Manipulation

A non-parametric Wilcoxon signed-ranks test (assumptions for normality had been violated) indicated that in the cognitively fatigued vignette, after the manipulation, levels of mental fatigue (measured on a 10-point VAS scale) significantly increased ($Z = -8.92$, $p < .001$; $M_{BeforeManipulation} = 5.2$; $M_{AfterManipulation} = 7.3$) and levels of mental energy (also measured on a 10-point VAS scale) significantly decreased ($Z = -7.99$, $p < .001$; $M_{BeforeManipulation} = 5.2$; $M_{AfterManipulation} = 3.6$). The contrary was true for the cognitively vital vignette, whereafter the manipulation levels of mental fatigue significantly decreased ($Z = -6.46$, $p < .001$; $M_{BeforeManipulation} = 5.5$; $M_{AfterManipulation} = 4.2$) and levels of mental energy significantly increased ($Z = -6.58$, $p < .001$; $M_{BeforeManipulation} = 5.3$; $M_{AfterManipulation} = 6.5$). For the neutral vignette or control condition, no significant differences between the two measure points (before and after the manipulation) were found (Levels of mental fatigue: $Z = -1.45$, $p = 0.148$;

$M_{BeforeManipulation}$ = 5.6; $M_{AfterManipulation}$ = 5.8; Levels of mental energy: Z = -0.06, p = 0.952; $M_{BeforeManipulation}$ = 4.9; $M_{AfterManipulation}$ = 5.0). Further, a one-way ANOVA test with post hoc Bonferroni indicated that there were significant differences between the three vignettes for the mental fatigue items (with $\alpha = 0.931$), $F(2, 567) = 148.41$, $p < .001$; the 10-point VAS measuring mental fatigue, $F(2, 567) = 114.98$, $p < .001$; and the 10-point VAS measuring mental energy, $F(2, 567) = 98.10$, $p < .001$. The cognitive fatigue vignette scored highest on the mental fatigue scale items ($M = 3.7$, $SD = 0.72$, Scales 1–5) and the 10-point VAS measuring mental fatigue ($M = 7.3$, $SD = 1.8$, Scale 1–10) and lowest on the 10-point VAS measuring mental energy ($M = 3.6$, $SD = 2.0$, Scale 1–10), whereas the cognitively vital vignette scored the highest on the 10-point VAS measuring mental energy ($M = 6.5$, $SD = 2.0$, Scale 1–10). The three vignettes did not differ significantly in terms of levels of energy (or vitality) and levels of fatigue measured before the manipulation. Because these differences were only found after the manipulation, they indicated that our manipulation was successful.

Intentions to Follow the Goal Reminder Message

To test whether *goal reminders that are based on the real-time characteristics of the receiver are more effective than goal reminders based on pre-set activity goals*, we investigated whether the intention to follow the reminder was highest when participants in the cognitive fatigue vignette received the relaxation goal reminder (H1) and participants in the cognitively vital vignette received the performance goal reminder (H2). A Two-Way ANOVA was conducted with reminder and vignette as independent variables and intention to follow the reminder as the dependent variable. In addition, leisure time activity, past walking behaviour, goal commitment, intention in real life, and cognitive fatigue measured before the manipulation were added as covariates. No significant main effects for reminder on intention $F(2, 556) = 0.117$, $p = 0.890$, $\eta^2 = 0.000$ or for vignette on intention, $F(2, 556) = 0.719$, $p = 0.488$, $\eta^2 = 0.003$ were found. This means that the intention to follow the goal reminders (either performance goal reminder, relaxation goal reminder or regular reminder) did not differ based on the reminder or based on the received vignette. Likewise, the interaction between vignette and reminder on intention was insignificant, $F(4, 556) = 0.438$, $p = 0.781$, $\eta^2 = 0.003$, meaning that a relaxation goal reminder was not more effective when individuals felt cognitively fatigued compared to a regular reminder and a performance goal reminder, nor that a performance goal reminder was more effective than a relaxation goal reminder or regular reminder when individuals felt cognitively vital. These results do not support our hypothesis (H1 and H2). Moreover, one-sample t-test showed that overall, participants agreed significantly less to the intention to follow the reminders compared to the neutral agreement score (value of three; $M = 2.66$; $SD = 0.05$; $t(569) = -7.22$, $p < .001$), indicating that the intention to follow was low over all three conditions. For an overview of the mean scores, see Table 3.

However, the five covariates resulted in significant relations. Intention was positively related to leisure time physical activity ($F(1, 556) = 5.996$, $p < .050$, $B = 0.002$, $\eta^2 = 0.011$, 95% CI [0.000, 0.004]), goal commitment ($F(1, 556) = 5.342$, $p < .050$; $B = -0.231$[1], $\eta^2 = 0.010$, 95% CI [-0.427, -0.035]) and intention in real life ($F(1, 556) = 20.185$, $p < .001$; $B = 0.173$, $\eta^2 = 0.035$, 95% CI [0.097, 0.248]). These results indicate that the scores given on leisure time physical activity, goal commitment and intention in real life were positively related to the intention to follow the reminder. Past walking behaviour ($F(1, 556) = 0.502$, $p = .479$; B = -0.036, $\eta^2 = 0.010$, 95% CI [-0.135 – 0.036]) and cognitive fatigue measured before the

manipulation ($F(1, 556) = 2.614$, $p = .107$; $B = -0.031$, $\eta^2 = 0.005$, 95% CI [-0.069, 0.007]) did not show significant relations, meaning these variables did not influence the intention to follow the reminder.

PART II: Exploratory Study

As the aim of this paper is to test and explore effective messages in terms of content and format that help individuals engage in brisk walking when they feel cognitively fatigued, we also want to explore what format and content in the reminders are helpful to the participants themselves when feeling cognitively fatigued, in addition to testing these theory-based hypotheses. To our knowledge, there are no studies or interventions tailored to cognitive fatigue.

Method

Measures

Closed Question – Format. We used a closed question to probe for the format of reminder messages that participants would like to receive via their smartphones, rather than a textual format: *Suppose you could send a message to yourself, to motivate yourself at a difficult moment – such as feeling (mentally) fatigued – to take a brisk walk of 20 minutes, what kind of message do you think is most appropriate?* Answer options were a picture, video, spoken message, GIF, TikTok, "I would still prefer to receive a text message" and others.

Open Question – Content. The previous question was followed by an open question where participants could indicate what the content of the reminder message would be. If they indicated a picture, they could state here what would be in the picture).

Table 3. Mean Scores of the Intentions to Follow the Goal Message Reminder

Goal Message Reminder	Vignette	$M_{Intention}$	$SD_{Intention}$
Performance goal reminder	Cognitively vital	2.8	1.3
	Cognitively fatigue	2.6	1.1
	Neutral	2.5	1.0
	Total	2.6	1.1
Relaxation goal reminder	Cognitively vital	2.6	1.2
	Cognitively fatigue	2.6	1.2
	Neutral	2.8	1.0
	Total	2.7	1.1
Regular reminder	Cognitively vital	2.6	1.1
	Cognitively fatigue	2.9	1.2
	Neutral	2.5	1.1
	Total	2.7	1.2
Total	Cognitively vital	2.7	1.2
	Cognitively fatigue	2.7	1.2
	Neutral	2.6	1.0
	Total	2.7	1.1

Results

Closed Question – Format

Figure 2 shows the frequency distribution of formats, answering the following question: Suppose you could send a message to yourself, to motivate yourself at a difficult moment—such as feeling (cognitively) fatigued – to take a brisk walk of 20 minutes, what kind of message do you think is most appropriate? This figure shows that 33.7% of the sample would rather receive a "GIF" to stimulate them to go for a brisk walk, followed by "text message" (27%), "picture" (24.4%) "other" (6.1%), "video" (4.4%), "spoken message" (3.7%) and "TikTok" (0.7%).

Additionally, a non-parametric Chi-square Test indicated that all observations were distributed equally for the vignette $\chi^2(2, 570) = 0.07$, $p = 0.96$ and for the reminder, $\chi^2(2, 570) = 0.22$, $p = 0.895$, but were not distributed equally for the format, $\chi^2(6, 570) = 439.57$, $p < .001$. The latter indicates that some categories were significantly more selected than other categories concerning the format of the message (e.g., GIF) amongst the overall sample of participants. In addition, the Pearson Chi-square reported a nonsignificant difference between vignette and format, $\chi^2(12, 570) = 19.43$, $p = 0.079$, and no significant differences were found between reminder and format $\chi^2(12, 570) = 9.78$, $p = 0.635$, which indicates that there were no answer options that were indicated significantly more often in a certain vignette or when receiving a certain reminder.

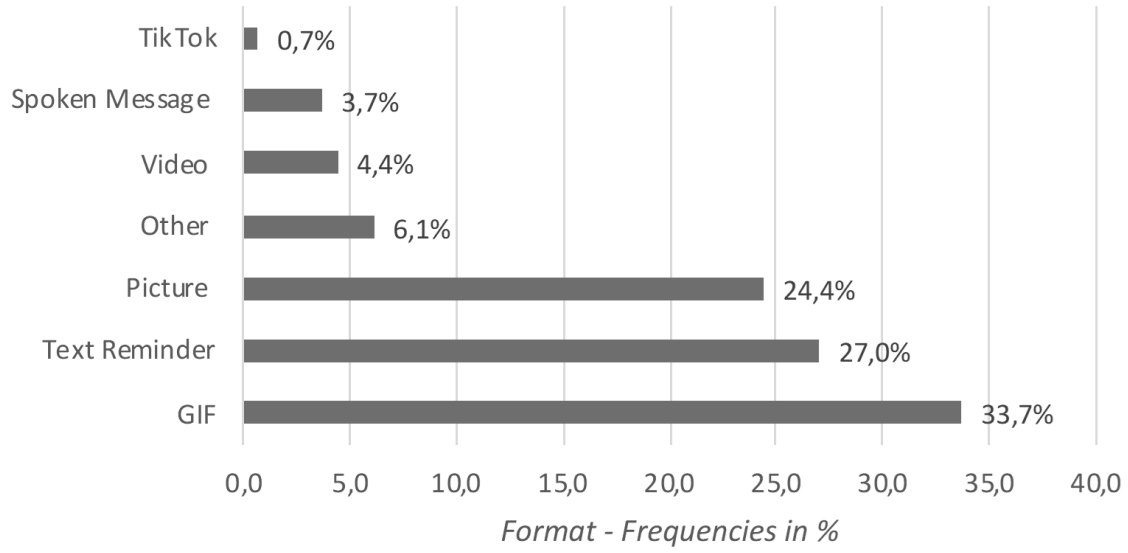

Figure 2. Format of Physical Activity Reminders

Open Question – Content

Out of the 570 respondents, 348 filled in the open question: *What (kind of) content would this message consist of?* Participants were restricted to go further without replying to this question, however it was communicated that participants could also type X or / if they did not want to answer. Most of the answers to this question consisted of some words or a short sentence, which made independent coding by two researchers redundant. Thematic analysis was used to examine the results. The answers were then analysed per vignette. Per vignette, feedback was sorted alphabetically to easily distinguish the same feedback; in this way, all replies stating, for example, 'funny' or 'dog' were easily clustered. Afterward, the content was coded a first time based on the content of the feedback. In other words, the feedback was described as neutrally as possible. For example, feedback such as 'A picture of my daughter' was coded as: 'Containing child(ren)'. The second time, this initial coding was revised and categorised. For example, all content about family and friends was categorized under a number that represented '*beloved persons'*.

A non-parametric chi-square test indicated that observations were not distributed equally for the content of the reminder, $\chi^2(12, 348) = 786.21$, $p < .001$, which indicates that some answers were significantly more prevalent than others amongst the sample. Table 4 shows the frequency distribution of answered contents, indicating that individuals would most like the content to be '*humorous*' (44.0%) or '*motivating*' (19.8%). Other types of content were '*comparison*' (8.6%; e.g., others taking up the same challenge), '*landscape*' (6.0%; e.g., 'a nice picture of nature in my environment would motivate me to go out'), '*beloved person*' (5.7%; e.g., 'a video message of someone whom I love encouraging me'), *'movement, sport, exercise*' (3.4%; e.g., an active person who is doing well), '*music*' (3.2%; e.g., 'Eye of the Tiger'), '*goal*' (1.2%; e.g., 'a picture with the goal you have in mind'), '*animals*' (1.7%; e.g., someone who is enjoying a walk with his or her dog), '*celebrity*' (1.7%; e.g., 'a celebrity from a series you are following at the moment'), '*other*' (1.7%; e.g., a paid walking break), '*benefits*' (1.4 %; e.g., emphasis of the health benefits) and '*reward*' (0.6%; e.g., 'a photo of a reward that you would like afterwards').

Table 4. Content of Physical Activity Reminders

Reminder Content	Frequency (%) (*N* = 382)
Humour	44.0%
Motivation	19.8%
Comparison	8.6%
Landscape	6.0%
Beloved person	5.7%
Movement, exercise, sport	3.4%
Music	3.2%
Goal	2.0%
Animals	1.7%
Celebrity	1.7%
Other	1.7%
Benefits	1.4%
Reward	0.6%

Discussion

Nowadays, interactive interventions are developed with the aim of investigating how to steer individuals efficiently and effectively towards healthier lifestyles. Therefore, the objective of this paper was to test and explore effective messages in terms of content and format to promote brisk walking amongst cognitively fatigued individuals. The first part of this paper consisted of an experimental part – testing theory-based messages. The second part of this paper was more exploratory and aimed at examining what people consider to be an appropriate message to motivate them while feeling cognitively fatigued.

Previous studies have found that goal reminders are effective in promoting brisk walking in sedentary populations (Prestwich et al., 2009, 2010). However, these reminders only take into account pre-set physical activity goals, or performance goals, instead of linking physical activity goals with real-time goals (Hardeman et al., 2019; Nahum-Shani et al., 2018), such as the goal to relax when feeling cognitively fatigued (Zijlstra & Sonnentag, 2006) or the goal of maintaining energy when feeling cognitively vital (Thayer, 1987). Additionally, previous literature has indicated that reminders are more effective when there is a fit or match between the characteristics of the message and the psychological characteristics of the receiver (Sar & Anghelcev, 2015). Based on this, the premises of the experimental part of this study were that *a goal reminder that related to the real-time goal of the individual would be more effective than a goal reminder that was not related to the real-time goal of the individual when promoting brisk walking behaviours. More specifically, we formulated that a relaxation goal reminder would be effective when individuals felt cognitively fatigued (H1) and that a performance goal reminder would be effective when individuals felt cognitively vital (H2).* Contrary to expectations, we did not find that goal reminders related to the real-time goal of the individual were more effective in promoting brisk walking behaviour than goal reminders that were not adapted to the real-time goals of individuals.

A possible explanation for this might be that the differences in manipulation between the three text message reminders were too subtle. Moreover, mean scores for the intention to follow the reminders were low (between unlikely and neither unlikely nor likely) for all conditions. Future research might take into consideration greater variations of the reminders and might try to make the reminders more appealing. By adapting the reminders to the goals corresponding to the current states of the individuals, the reminders might have come across as generic, which is less effective than a personalized reminder (Bull et al., 1999; Ghanvatkar et al., 2019). Therefore, indicating the fatigued or vital state in combination with the goal could have been more personalized and therefore more effective, such as "*We know you are feeling fatigued; a 20-minute walk will help you to relax*". Moreover, in retrospect, the link with relaxation might not have been strong enough just by stating that a brisk walk is relaxing. Therefore, messages could focus more on the relaxing aspect of the walk, for example referring to a nature walk: *"Having a slump? You should take a relaxing walk in the woods nearby!"* or emphasising the outcome of the walk *"If you go for a brisk walk now, you will feel more vital and relaxed afterwards".* Subsequently, as we know that cognitive fatigue can arise from the conflict of current and competing goals (Hockey, 2011) and that cognitively fatigued individuals might not feel like taking a brisk walk even though they are especially in need of one (Bakker & De Vries, 2021; Sonnentag, 2018), simply acknowledging this contrast in a text message reminder might help in designing future messages, for example *"You might not feel like taking a brisk walk right now, but this will help you to overcome your fatigue / afternoon slump!".*

Furthermore, research has found that gain-frame messages and self-efficacy messages support strong evidence for enhancing physical activity behaviours (Latimer et al., 2010). Tailoring the messages as a gain or as a loss might be more appealing than just stating goals, such as "*Taking a 20-minute walk will help you to recover mentally from your day*" versus "*If you're not going to take your 20-minute walk, you might not be able to mentally recover from your day*" or "*We know you are feeling fatigued, but you can still achieve your 20-minute walking goal! You can do it*!" However, the appeal of a gain or loss frame might also depend on an individual's prevention or promotion focus, meaning that promotion-oriented individuals benefit more from promotion or gain frames, while prevention-oriented individuals benefit more from prevention or loss frames (cf. regulatory fit theory; Latimer et al., 2008). This indicates that we should not only consider stable and dynamic factors when designing messages, but also control for more dispositional characteristics of the receiver. Overall, this suggests that only a combination of multiple elements will increase the persuasiveness of a message and lead to behavioural change. Although this study initiates research on text message reminders that are tailored to more internal dynamic variables, instead of external dynamic variables (e.g., steps taken) and rather stable variables (e.g., personality traits), future work is still required to assess which tailoring interventions, combined with dynamic variables, would work best to enhance (or promote more) physical activity. The importance of assessing dynamic variables is vital because timing is of the utmost importance when developing health interventions (Nahum-Shani et al., 2018). The right time to intervene and provide support does not depend on stable factors, but the psychological state of an individual (Scholz, 2019). Therefore, being able to tailor to states is of crucial importance in mobile health interventions (Hardeman et al., 2019; Nahum-Shani et al., 2015). Moreover, it might be beneficial to look at other states that are, for example, associated with relapses in unhealthy behaviours, such as stress, cravings, desire, and effects (Millar, 2017; Sinha, 2009).

Another explanation for not finding significant differences between the reminders might be explained by the design of the study. First, we manipulated cognitive fatigue instead of using real-time cognitive fatigue. However, we did measure cognitive fatigue in real time and manipulated it after measuring the real-time results. To make sure the initial state of the participants did not intervene with the design and aim of the study, we controlled for cognitive fatigue before the manipulation in the statistical model. By manipulating cognitive fatigue and randomising participants across conditions, all participants were equally likely to be in one condition or another. In this way, we ensured that the study consisted of a cognitively fatigued, cognitively vital, and neutral group as opposed to unequal distributions of cognitive fatigue. There are two reasons for manipulating fatigue. First, it is rather likely that participants are not willing to participate in an experiment precisely because they feel cognitively fatigued, resulting in a biased non-linear sample. Second, other studies examining cognitive fatigue also rely on manipulations to ensure a controlled experiment (Karasz & McKinley, 2007; Rieger et al., 2014). The main advantage of this experimental design is that it is a controlled research method in which subjects are randomly assigned to conditions and everything is equal except the independent variable. As a result, it was possible to establish causal relationships, which was the main aim of this study. A disadvantage of this design was that we used hypothetical situations (vignettes), which may have made it difficult for the participants to ignore their current state. For example, when a participant already felt cognitively fatigued at the beginning of the experiment, we could not know for sure how long the cognitively vital vignette suppressed this initial cognitive state—although the vignettes resulted in positive

manipulations. Directions for future research might be, on one hand, to choose another way to manipulate fatigue such as using tasks (e.g. reading span task or operation span task; Daneman & Carpenter, 1980; Turner & Engle, 1989) or using real-time cognitive fatigue. When using real-time cognitive fatigue, the distribution of the sample must be carefully monitored during the data sampling. Ideally, the best way to measure real-time cognitive fatigue would be to work with a field experiment. A method that is often used is ecological momentary assessment (EMA) in which states are measured repeatedly in daily life (Degroote et al., 2020). There exists a broad variety of scales all suitable to measure cognitive fatigue, for example the study of De Vries et al. (2003) compares six scales all appearing to be valid to measure (cognitive) fatigue. Overall, scales that are used to measure cognitive fatigue in other studies are the Maslach Burnout Inventory (De Vries et al., 2015), The Brunel mood scale (BRUMS; Brandt et al., 2016), the fatigue and vital subscales of the POMS-15 (Niermann et al., 2016), the 10-item fatigue assessment scale, need for recovery scale and the emotional exhaustion scale (De Vries et al., 2017). However Degroote et al. (2020) explain that items from traditional questionnaires cannot simply be selected for EMA measures as they are often not suited for short, repeated assessments in daily life. Therefore, these items are not valid by default for use in EMA studies, and content validation of the items is required. When designing a field experiment, it is recommended that researchers use items for which validity is already tested in other EMA studies, for example The daytime insomnia symptom scale (DISS; Abdel-Kader et al., 2014; Buysse et al., 2007). In addition, a field experiment would also make it possible to measure behaviour (physical activity), for example by means of an activity tracker.

This leads us to the third reason why this study may not have found significant results between the reminders. This study was an online experiment that tested intentions instead of actual behaviours. Although it is well established that intentions are predictors of actual behaviours (Ajzen, 1991), other interventions examining the effectiveness of messages and the effects of text messages on the promotion of physical activity, consist mostly of experimental designs (Muller et al., 2016; Williamson et al., 2020). Further, the mean scores of the covariates—past walking behaviour (M = 3.2; range 1–5), intentions in real life (M =3.9; range 1–7), and goal commitment (M = 2.8; range 1–5)—were very low. As these variables are predictors of intended and future physical activity behaviours (Dishman et al., 1985; Hagger et al., 2001; Moon et al., 2017), it is plausible that the intention of the respondents could not be changed by reading just one reminder message. Further studies should therefore consider a randomized trial or field experiment with a variety of messages. In addition, instead of imposing a goal (what the vignette suggested), respondents should be able to set a (preferably intrinsic) goal themselves, which could then be implemented based on implementation intentions because they strengthen the link between planned situations and goal-directed responses (Michie et al., 2015). In this way, the behaviour is more likely to be initiated when encountering the planned situation (Prestwich et al., 2010). Furthermore, we looked at promoting physical activity after work during leisure time. However, in hindsight, this might not be the only moment individuals could benefit from a nudge to go for a brisk walk. As cognitive fatigue arises with mentally demanding tasks, this state fluctuates throughout the day considering the workload and wear and tear of the day (Millar, 2017). Future research should take into consideration different times of day to stimulate individuals to go for a brisk walk (Scholz, 2019). In addition, this study was conducted at the end of January / beginning of February, which are winter months in Belgium. Although there was no reference made in the vignette to the weather, it should be mentioned that the weather can be perceived as a barrier

to engaging in physical activity (Chan & Ryan, 2009). Nudging individuals to participate in exercise during bad weather conditions will probably only be effective when individuals experience high self-efficacy with regards to exercise (Hagger et al., 2001). Future research should take these two factors, weather conditions and self-efficacy, into consideration.

Last, in the exploratory part of this study, participants were asked what format and content in a message they would like to receive from their smartphones to be helped at a difficult time—such as when feeling cognitively fatigued—to go for a brisk walk. Most of the respondents indicated they would prefer a message that contained some form of humour, for example in the format of a GIF. However, a regular text message as format also scored high. In the past two decades, humour has been used increasingly as a strategy in health interventions such as healthy eating (Bleakley et al., 2015), (binge) drinking (Skalski et al., 2009), smoking (Abril et al., 2017) sun protection (Mukherjee & Dubé, 2012), cancer prevention (Nabi, Ahangar, Akhtar, Akbar, & Mustafa, 2016), and organ donation (Weber et al., 2006). The integration of positive emotions in health messages, especially humour, is effective to reduce reactance (Skalski et al., 2009). Furthermore, research shows that humour can promote acceptance of weak persuasive messages (Griskevicius et al., 2010) and humorous health messages are found to be processed with greater attention (Weinberger & Gulas, 1992). However, because of the entertaining format, it remains questionable whether the information will be received as relevant (Nabi, Moyer-Guse, & Byrne, 2007). Nevertheless, research trends are suggesting that new technologies should use non-traditional approaches such as storytelling, humour, and parody to build appealing messages that try to empower and engage individuals instead of only being concerned with education and persuasion (Lister et al., 2015). Research that focuses on educating and persuading individuals to be more active assumes that individuals do not know they are physically inactive. Alternatively, interventions should recognize that individuals are aware that they are not active enough and should focus on the fact that there are barriers, such as fatigue, leading individuals not to want to engage in physical activities (Lister et al., 2015). When focusing on these barriers, we must acknowledge that new and better messaging is necessary. Moreover, these messages hold a significant position in health intervention designs (Nahum-Shani et al., 2015), and studies concerning physical activity communication do underline the importance of research in innovative design and testing of evidence-based messages (Bergeron et al., 2019). Future research should be undertaken to investigate the possibilities and effectiveness of alternative messages, such as humour, parody, and storytelling, that try to engage individuals instead of persuading and educating them.

Although several questions remain unanswered at present, this combination of findings might be useful in the development of future interventions that consider internal dynamic factors, such as just-in-time adaptive interventions to promote physical activity (Hardeman et al., 2019). These interventions may provide individuals with the right type of support, at the right time based on internal and external dynamic factors and the stable factors of users (Nahum-Shani et al., 2018). This study takes a first step in including internal dynamic factors.

Conclusion

In this paper, we have argued that a *goal reminder relating to the real-time goal of the individual would be more effective than a goal reminder not relating to the real-time goal of the individual when promoting brisk walking behaviours. The second aim of this study was to*

explore what format and content of reminders the participants considered to be helpful when having a difficult time engaging in physical activities. In this study, a goal reminder relating to the real-time goal of the individual was not more effective than other goal reminders. An interesting finding was that participants evaluated GIFs, text reminders, and pictures as suitable formats and preferred humorous content. These findings might be useful in the development of future interventions considering dynamic factors, such as just-in-time adaptive interventions, to promote physical activity.

Notes

1. Goal Commitment is reversely coded: the lower you score on goal commitment (= the more you are committed to your goal), the more likely you are to follow the reminders.

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Conflict of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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Appendix: Materials

Table A. Elements in the Vignette

Element	Cognitively Fatigued	Cognitively Vital	Neutral
Agenda of the past few weeks	Overloaded	Busy but still fun	Not too busy but enough to do
	Not knowing where to start first	Time has passed quickly	Time passed
To-do-list	Endless	Only one task	Some tasks
Workday	Long & intensive	Short & interesting	There were meetings
Time	5 minutes takes forever	Time flies	No information concerning the time
	Easily distracted	No distraction	
Looking at meeting notes	Reading is hard	Reading goes easy	Read what is written
	Fail to make meaning of the words	The meaning of the words is clear	Recalls what was explained during the meeting
	Do not remember what the president of the meeting explained	Remembers perfectly what the president of the meeting explained	
	Remembers the meeting was difficult to follow & hard to understand	Remembers smoothly everything that was told	
Writing report (preparation for tomorrow)	The sentences you write make no sense	The sentences you write are immediately good	The sentences you write are okay
	Repetitive trying	Right at first try	No particular feeling
	Feeling dissatisfied	Feeling satisfied	
Ending	Your work will not get any better today	Your work looks great	Your work is done
	Workday is finally over	Workday is already over	Workday is over

Vignette: Cognitively Fatigued

In the last couple of weeks, your agenda has been so full, that you did not know where to start first. Also, today, your to-do list feels to be endless. Moreover, after a long day filled with intensive meetings, you also have to prepare a report for tomorrow. To do so, you take out your notes from this afternoon's meeting and try to read what they say. The words appear before your eyes, but you don't seem to be able to take in their meaning. You are having a hard time remembering what was said during the meeting. The only thing you remember is that it was difficult, and you did not understand much of it. You take a look at the clock: only five minutes have passed but it appears to be an eternity. Maybe you should check your social media first? You start scrolling, but nothing is interesting to see. Suddenly you realise that you really need to get on with your work. While sighing, you open the notes you took during the meeting, and with much effort, you finally manage to read the notes. However, after reading it feels like you have no idea whether you have remembered anything. To prepare the report for tomorrow, you start typing. However, the sentence you type does not appear to make much sense. You try again and again but remain dissatisfied with your work. After working for a while, you think to yourself: "Well, this report is not going to get any better today" and you close your laptop. Your working day is finally over!

At that moment, your smartphone vibrates, and you receive the following message:

Vignette: Cognitively Vital

In the last couple of weeks, you have had a busy but fun agenda. It feels like the days have flown by! Also, today, there is only one task on your to-do list. After what felt like a short day full of interesting meetings, you just need to make one little report as a preparation for tomorrow. You take out your notes from this afternoon's meeting and go through them quickly. The words appear clearly before your eyes, their meaning is immediately understood. You remember perfectly what was told by the president of the meeting. While looking at the clock, you see that an hour has already passed, and think by yourself 'How time flies! Enthusiastically, you take another look at the notes you made during the meeting, and you realise that you have been reading more than necessary to make the preparation report. However, you don't mind. This way you will definitely know what you are talking about! To prepare the report for tomorrow, you start typing. The sentences you type are immediately correct. After your first draft, you are already almost satisfied with your report. A little later, you think to yourself: "This report looks great!" and you close your laptop. Your working day is already over!

At that moment, your smartphone vibrates, and you receive the following message:

Vignette: Neutral

In the last couple of weeks, you were not too busy but managed to keep your days filled. Also, today, there were only a couple of tasks on your to-do list. After a day with some meetings, you have to prepare one last report for tomorrow. You take out your notes from this afternoon's meeting and read what you have written down. Meanwhile, you think about what was explained during this meeting. To prepare the report for tomorrow, you start typing. You type a sentence, and it seems to be okay. After working for a while, you think to yourself: "My report is done" and you close your laptop. Your working day is over!

At that moment, your smartphone vibrates, and you receive the following message: