WalkMore: Exploring the Role of a Personalization Humorous Nudge Architecture on People's Walking Behavior

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Abstract

Approximately 31% of the global population is insufficiently active, leading to 3.2 million deaths annually. Sedentary behavior increases the risk of cancer, heart disease, and metabolic disorders. To improve adherence to behavior change interventions, this study introduces personalized humorous nudging for walking behavior. Following a Randomized Control Trial (RCT) design, participants (N=100) received either humorous or non-humorous nudges via a Telegram-based chatbot, "WalkMore," encouraging daily walks for 7 days. We used the AICTP smart nudge framework (Activity, Influence, Content, Time frame, Presentation) and added humor to the presentation component. Results showed a significant relationship between walking and humor ($F=6.48$, $p<0.05$). Manipulation check items reported the nudges' average funniness rating as 3.48 in experimental group and average personalization rating as 3.64 in control group. The findings indicate efficacy of the proposed augmented nudge framework for behavior change.

Keywords: psychology; behavioral science; field study; quantitative behavior; comparative analysis

Introduction

Waking and walking may differ by just a letter, but they can have a profound impact on one's health. Sedentary lifestyle is defined as any waking behavior such as sitting or leaning with an energy expenditure of 1.5 metabolic equivalent task (MET) or less (Sedentary Behavior Research Network, 2020). Examples of sedentary behavior include playing video games, watching television, using a computer, sitting at work/school (Jochem et al., 2019). Prolonged sedentariness increases the prevalence of non-communicable diseases. Physical inactivity is the fourth leading cause accounting for 6% global mortality (World Health Organization, 2010). As per WHO, 81% of adolescents and 27.5% of adults do not meet recommended levels of physical activity, affecting individual's lifespan and health services (World Health Organization, 2022).

Before the 1990s, public health recommendations emphasized the health benefits of increasing physical fitness by means of vigorous activities. In 1995, Centers for Disease Control (CDC) and the American College of Sports Medicine (ACSM) published physical activity recommendations that highlighted that substantial health benefits accrue from moderate-intensity activity (3-6 METs), which included walking (Pate et al., 1995). Walking is encouraged as one of the most accessible ways to be physically active (Hillsdon et al., 1995). Additionally, walking for physical activity is seen relatively common among groups that are typically sedentary (Siegel et al., 1995).

WHO's Global Action Plan on Physical Activity (GAPPA) indicates that 42% of the countries have a national policy on walking and cycling, with no data on change since 2019. Additionally, 52% of countries have national communication campaigns on physical activity; however, it has decreased since 2019 (World Health Organization, 2022). Additionally, 40% of countries promote walking and cycling by providing opportunities and programs for physical activity, however there has been no change in the data since 2019 (World Health Organization, 2022).

To address this challenge, nudging is increasingly used in public health interventions to produce health-promoting behavior changes (Ledderer, Kjaer, & Fage-Bulter, 2020). Nudging is a widely used construct stemming from behavioral economics which focuses on a wide range of behaviors such as prudent financial decision making, healthy nutrition, sustainable behaviors, and many more. Nudge interventions are designed to influence people's behavior without restricting their freedom of choice, applying pressure or drastically altering their economic incentives (Lembeke, Engelbrecht, Brendel, & Kolbe, 2019).

There has been a proliferation of behavioral nudges delivered via wearable devices and mobile applications that help remind people to drink water, stand up as they have been sitting for long or allow them to track their exercises at gym or their daily step-count (Gravert, 2021). Currently digital nudging is used for influencing decisions and behaviors of users through suggestions, positive reinforcement, and other non-coercive means. These nudges are categorized as "smart" nudges (Karlsen & Andersen, 2019), indicating that these nudges are personalized and context aware as they are tailored to the current situation of each user.

Designing a smart nudge consist of various components (Karlsen & Andersen, 2022). Starting with the nudge goal, for instance nudging for a healthier lifestyle or nudging for using more environmentally friendly transportation (Lembeke, Engelbrecht, Brendel, & Kolbe, 2019), followed by understanding the user and their context, select targeted activity, selecting relevant information sources, designing the nudge and evaluating the nudge (Lembeke, Engelbrecht, Brendel, & Kolbe, 2019). Variables used by the smart nudge include user personal data, nudge goal, user context (location and time), and user feedback (Karlsen & Andersen, 2022). For a physical activity nudge, personal data of the user consists of interest, capabilities, previous physical activities, previous activity behavior. The nudge goal includes relevant physical activities and information collection related to the context. The user context includes user preferred time and location for their physical activity. In smart nudges,

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personalization is achieved by designing the nudge to understand the user and their context. This step involves understanding the user in general, such as understanding the psychological effects that subconsciously influence user's behavior and decision making, along with other environmental factors such as time of the day, location, weather and mobility conditions that will influence the target goal (Lembeke, Engelbrecht, Brendel, & Kolbe, 2019). To motivate the user to perform the targeted activity, the presentation of the nudge is very important. Presentation combines the user relevant information with the recommended targeted activity which is presented using positive reinforcement and non-coercive means. Therefore, nudge presentation will motivate the users by gently pushing them towards the goal.

To support lifestyle changes for promoting physical activity, healthcare practitioners often utilize Behavior Change Techniques (BCTs). These techniques encompass intervention-specific strategies grounded in psychological theories and supported by empirical evidence from behavioral science research. While BCTs employed in health interventions play a crucial role, a strong alliance between the user and the healthcare professional is equally essential. Within this alliance, humor has emerged as a significant tool, often integrated by healthcare professionals to enhance message efficacy, foster engagement and fortify the therapeutic relationship in the clinical setup (Sun, Teljeur, Li, & Bosch, 2024).

Research indicates that behavioral nudging employing BCTs have been successful in enhancing physical activity and minimizing sedentary behavior among users. Nonetheless, smart nudges may become too information-focused and lack empathy, personal connection and human touch characteristics.

However, adherence to smart nudges tends to lower over time, as people often ignore or miss their reminders or do not log into the app to track their progress. Low adherence thus indicates that these reminders are unable to capture users' attention, requiring strategies such as hyper personalization. To address these limitations, recent work has identified alternative approaches to the design and delivery of smart nudges.

Related Work

Infusing Humor into a Nudge

A study by Olafsson et al reveals that infusing humor into the message for behavioral intervention can enhance user motivation and engagement (Olafsson, O'Leary, & Bickmore, 2020). Humor goes beyond simply being amusing; it serves as a versatile tool for organisations that can help achieve a variety of goals (Romero & Cruthirds, 2006). However, existing research primarily demonstrates that humorous nudges can elevate user engagement and motivation without clarity on their real impact on behavioral change. Moreover, different users prefer different humorous styles, however existing literature show no or less evidence on integration of user's humor preference along with the BCTs in the nudge design (Olafsson, O'Leary, & Bickmore, 2020).

Therefore, this study examines the role of humor preferences in influencing people to engage in walking behavior. Utilizing the {A, I, C, T, P} smart nudge framework, the study explores the role of personalized humor styles in the "I"/influence component of the nudge. The integration of humor into the framework is intended to examine how existing interventions can be further personalized to positively engage and influence real world behavior change. Accordingly, our study seeks to answer the following research questions:

- What was the impact of the humor-augmented AICTP framework in influencing greater walking behavior for participants (RQ1)?
- Does humor style-based nudge personalization lead to perceptions of greater funniness and personalization of the nudge (RQ2)?

We hypothesized that a health behavior intervention delivered for influencing people to walk more would exert stronger influence on people who receive humor-based nudges as compared to non-humorous nudges (H1). Moreover, we expected that people who receive humorous nudges would have a higher mean of perception of nudge as funny (H2a) and personalized (H2b) as compared to the people who receive non-humorous nudges. To address these research questions and hypotheses, we designed a randomized controlled trial involving 100 participants divided into two groups: humorous and non-humorous groups. Participants were onboarded on the WalkMore chatbot, which was used to deliver the nudges for a span of 7 days.

Guidelines for nudging in digital contexts

Nudging was first introduced by Thaler and Sunstein (Thaler & Sustein 2022). who define it 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. To count as a mere nudge, the intervention must be easy and cheap to avoid". **Nudging** can exist both in non-digital contexts e.g. placing food at eye level, or within digital contexts e.g. notifications on phones. Previous studies have either focused more on nudging within digital environments (Meske & Potthoff, 2017) or within real world environments. However, recent work by Delcke & Karlsen, (2020) have guidelines for designing personal nudges and how they influence behavior in both online and offline contexts.

Humor and Behavior Change

Humor is known to be a tool that people generally use to relieve tension and build trust, it appears to moderate perceived intensity of negative life events (Galloway & Cropley, 1999). Use of humor by salespersons have shown to positively influences costumer trust, a fundamental human ability which enhances creativity and developing strong

relationships (Lussier, Grégoire, & Vachon, 2017). Active use of humor can be a potent tool to successfully cope with and appropriately recover from stressful situations, especially if it becomes a habitual response to adverse circumstances (Papousek, 2018). Companies and brands use humor as a strategic persuasive tool to enhance audience engagement with their content online (Borden & Suggs, 2019). However, humor is subjective, and its effectiveness tends to vary when it comes to engagement across people with different humor styles (Veatch, 1998).

There has been a surge in the use of push notifications and messages through smart phone applications to influence the behavior of users. These messages serve as prompts that nudge users to go to the app and perform a behavior like making a purchase (Sandeep & Moulya, 2022).

There have been studies conducted where the use of humor has proven effective even in contexts of health and wellbeing either to perform a particular behavior (self-breast examination) (Liu & Chen, 2024) or to improve acceptability and persuasiveness in health promotion materials (Suka & Shimazaki, 2023).

Use of Large Language Models

With the rise in conversational agents (CAs) like ChatGPT and Alexa, and there has been a discourse around how humor can play a role in making these agents more human-like (Zargham et. Al 2023). Studies have been conducted where humor is introduced to chatbots (Sun, Teljeur, Li, & Bosch, 2024) to influence user engagement, motivation and behavior change (increasing physical activity).

Large Language Models (LLMs) have also been used to generate a variety of ideas and aid in the creative process. We see studies that harness LLMs to consolidate that user's information and provide informed recommendations (Bhavsar & Patel, 2024) based on established behavior change techniques (Michie et al., 2013). There is potential to look at how one can use LLMs to generate humorous messages in the form of nudges by aggregating the user's personality, humor style and other info that can make the nudge more suited to the individual.

Methodology

The study utilized a randomized control trial (RCT) design (between-subjects) in which participants were randomly assigned into the experimental group who received personalized humorous style BCTs driven nudges and control group who received non-humorous BCTs driven nudges. The dependent variables of the study were walking behavior, perceived funniness and personalization of the message assessed via self-report measure. The independent variable of the study was humor. The time of the nudge and medium of nudge delivery were control variables as the nudge time was schedule as per participant preference and the nudges were delivered on Telegram WalkMore chatbot for both the groups. The overall study flow followed in this study is presented in Fig. 1.

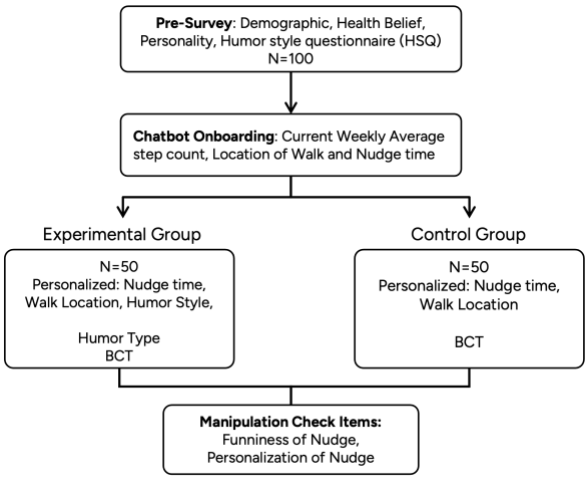

Figure 1: Study Flow

The nudges were based on seven different BCTs selected for their applicability in encouraging physical activity (i.e. walking behavior). These included prompt identification as role model, prompt anticipated regret, prompt self-talk, prompt use of imagery, stimulate anticipation of future rewards, facilitate social comparison, and information provision (general) (Michie et al., 2013). Moreover, the experimental group nudges also included seven humor types, i.e. comparison, personification, exaggeration, pun, sarcasm, silliness, surprise (Taecharungroj & Nueangjamnong, 2015) each randomly selected for seven days. These nudges were generated using LLM – ChatGPT (4.o mini). Chain of thought and role prompting strategies were used to create the notifications. Chain of thought prompting strategy was used as it facilitated step-by-step reasoning (Zhang, Zhang, Li, & Smola, 2022), while role prompting helped guide the style, tone and focus of the nudges (Gaur, Dagar, Punia, & Kumar, 2024). LLM was told that it is a part of behavior change support system thus assigning it a role. The reason the authors went with LLMs rather than a nudge specialist, was for a more consistent syntax when it came to the nudge content. The major differences from a linguistic point of view were that the syntax used by the LLM was more complex and consisted of compound sentences.

The study was conducted on Telegram chatbot "WalkMore" which was used solely for research purposes. All the communication with the participant happened on the WalkMore chatbot. The WalkMore chatbot was used to deliver nudges and collect study responses from the participants. The chatbot provided feature for participants to reschedule their nudge timing or discontinue the study.

We recruited 100 participants (N = 100) through convenience sampling. Participants were equally divided into both the groups (i.e. 50 participants in each group). In the study (N = 100), 65% were male and 35% were females. In the sample (N = 100), 52% of the participants were between 20 and 25 years old, 39% were between 26 and 30 years old, 6% were between 31 and 35 years old, and the remaining 3% were between 35 and 55 years old.

Materials

The data collection process was segmented into three phases: an initial pre-survey on the first day and daily survey for the subsequent seven days to measure participant's daily walking behavior and manipulation check for nudge funniness and personalization at the end of the study.

In the pre-survey, participants provided their demographic information (including participant ID, age range, gender, and occupation). Participants filled the Health-Belief Awareness self-reported survey, which measured the dimensions of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy of walking behavior using a 5-point Likert Scale. They also filled the Ten-Item Personality Inventory (TIPI) which measured the big five dimensions of personality namely, openness to experience, conscientiousness, extraversion, agreeableness, neuroticism using a 7-point Likert scale. They also provided their humor style preference by filling the Humor Style Questionnaire (HSQ-32) which measured four dimensions of humor i.e. self-enhancing, affiliative, aggressive, self-defeating using a 7-point Likert scale. Both the groups filled the HSQ however, only participants in experimental group were scored.

Participants reported their daily walking behavior on the WalkMore chatbot by responding to the nudge feedback question: "click here if you have walked" and "click here if you didn't walk". Participants who reported that they walked were further asked "Did the reminder help you to go for a walk?". These feedback questions were sent to the participant for seven days.

Once the participants completed the seven-day study period, they were given manipulation check items to assess perceived funniness and personalization of the nudges. These items were "The messages received were funny" and "Did you feel these messages were tailored specifically for you?". Manipulation check items were sent to both the groups.

Procedure

Following randomization, participants received study information without details about the specific group to which they were assigned, to prevent biased responses. After obtaining informed consent, participants were given instructions to download or scan QR for the WalkMore telegram chatbot. After the participants were onboarded on WalkMore, each participant was given a participant ID which was used throughout the study to maintain participant confidentiality. Participants received pre-study surveys on WalkMore and filled their demographic details, Health-Belief Awareness survey, Ten-Item Personality Test (TIPI) and Humor Style Questionnaire (HSQ). After the completion of the pre-study survey, participants filled in their current walking behavior (i.e. average weekly step count), their preferred time to receive the nudge, and preferred walk location. Participants started receiving nudges within 48 hours of completion of pre-study surveys.

Based on these sources of information, ChatGPT (4.o mini) was used to generate the nudges for both the groups. The nudges were generated using chain of thought and role prompting strategies. For seven days, the experimental group received personalized humorous style, and BCTs driven nudges whereas the control group received only BCTs driven nudges. Participants in both the groups received 7 text-based nudges, one nudge for a day at their preferred time. They responded to the continuous feedback questions which inquired whether the nudge influenced them to go for a walk or not. At the end of seven days, both the groups received manipulation check items to assess perceived funniness and personalization in both the groups.

Augmented AICTP Humorous Nudge Architecture

Design principles for persuasive technologies, such as personalization (Gao, Liu, & Wu, 2010), (Ghorab, Zhou, O'Connor, & Wade, 2013) system credibility, and social influence are essential for smart nudging. This includes strategies like unobtrusive data presentation and positive reinforcement. Nudge design cycles (Schneider, Weinmann, & Vom Brocke, 2018) and the DINU model (Meske & Potthoff, 2017) which focus on goal setting, user understanding, and evaluation. Other aspects considered are ethical guidelines emphasizing transparency, resistance and non-controllability. This study leverages new principles for smart nudge design which prioritizes personalization, context-awareness and adaptability (Karlsen & Andersen, 2022).

Utilizing the {A, I, C, T, P} smart nudge framework, in the study, the Activity (A) is defined as "go for a walk". Content (C) includes the practical information related to the activity, which is the location for walk. Time frame (T) is the time of nudge delivery, Influence (I) is defined as the information of nudge that affects the user towards the goal (i.e. walking) (Ledderer, Kjaer, & Fage-Bulter, 2020), seven selected BCTs are assigned as influence. Presentation (P) is defined as how the nudge is presented (i.e. the nudge guidelines). In this study, P is defined as the presentation of the nudge tone (i.e. humorous and non-humorous). Among these, Activity, Influence and Presentation are predetermined, however the Content and Time frame of the activity (i.e. walking) is assigned by the participants. The presentation component of the nudge consists of four personalized humorous styles and seven humor types (i.e. randomly assigned to participants). In this, experimental group participants have the autonomy to select their preferred humor style, however they cannot select humor type. Therefore, the content of the humorous nudge included one out of four personalized humor style and one out of seven humor type for each day.

Along with the {A, I, C, T, P} framework, user profile information consisting of the details from the pre-study survey (i.e. participant demographic details, health-belief awareness level and personality type) helps in gaining a comprehensive profile of the participant. Therefore, the smart humorous nudge comprises of activity, user profile, content, time frame, influence and presentation to nudge participant's walking behavior (presented in Fig 2).

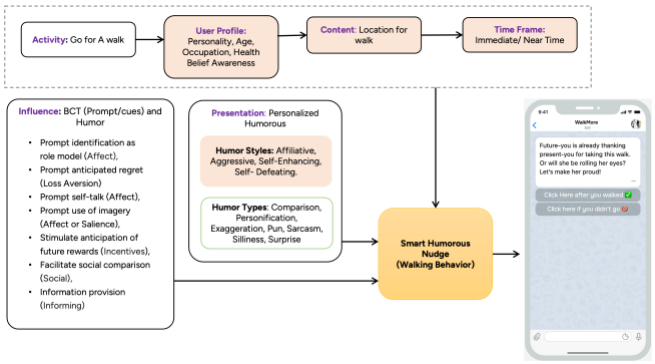

Figure 2 Augmented Smart Nudge Component Framework

The nudge format presented to the participant was based on the plan entry type (i.e. reminder), followed by the plan entry description (i.e. for mobile notification intervention to perform walking behavior), intervention type (i.e. randomly assigned BCTs for each day) and lastly, the message tone (i.e. content of the humorous message). One example of the experimental group nudge where humor type is sarcasm, BCT is stimulate anticipation of future rewards and participant humor style is affiliative: "*Future-you is already thanking present-you for taking this walk. Or will she be rolling her eyes? Let's make her proud!"*

Results

The study comprised 100 participants aged between 20 to 55 (M=25, SD=4.47), including 65 male and 35 female participants. Participants' occupation level varied: 84 were employed in private sector, 11 were students, 4 were self-employed and 1 was employed in public sector. Most participants were in the age range of 20 to 30 years (n = 91), followed by 30 to 40 years (n=7) and 40 to 55 years (n=2). 77 participants in the study reported high health-belief awareness, 23 participants in the study reported moderate health-belief awareness and none reported low awareness.

Table 1 provides a comparative overview of walking behavior (due to external factors), walking behavior (due to the nudge), health-belief awareness, funniness and personalization scores across two conditions (i.e. experiment & control groups). Positive relationship was observed between walking behavior (due to external factors), walking behavior (due to the nudge) and funniness (table 2). Conversely, higher age was associated with reduced walking behavior (due to the nudge). Similarly, higher health-belief awareness showed reduced walking behavior (due to the nudge).

Table 1: Descriptive Analysis as per condition.

Variables	Experimental Grp Mean (SD)	Control Grp Mean (SD)
WB(External)	2.48 (2.38)	1.18 (1.59)
WB(Nudge)	1.92 (2.35	1.02 (1.79)
HBA	1.73 (0.44)	1.80 (0.40)
Funniness	3.48 (0.93)	2.12 (1.04)
Personalization	3.36 (0.98)	3.64 (1.16)

WB: Walking Behavior, HBA: Health Belief Awareness

No significant correlation was found between walking behavior and personalization. Walking behavior (due to external factors) and walking behavior (due to the nudge) showed statistically significant with funniness ($p = 0.003$, $p < 0.01$; $p = 0.015$, $p < 0.01$, respectively).

Change in outcome (i.e. walking behavior) was calculated as the average "days went on walk because of the nudge" for each participant for seven days. The average rating of walking behavior due to the nudge was 1.92 in experiment group and 1.02 in control group. Moreover, test for equality of variances revealed a statistically significant relationship between the outcome variable (i.e. walking) and predictor variable (i.e. humor) $F=6.48$, $p = 0.03$ ($p < 0.05$), thus rejecting the null hypothesis.

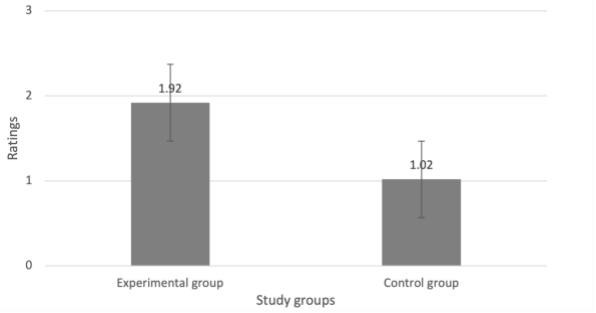

Figure 3 Analysis: Change in Outcome (Walking Behavior)

Variables	1	2	3	4	5	6
WB(External)		0.86	0.03	0.29**	-0.01	0
WB(Nudge)	0.86		S	0.24**	0	-0.08
HBA	0.03	-0.06		0.12	0.1	0.1
Funniness	0.29	0.24	0.12		0	0.45
Personality	-0.01	0	0.1	0		-0.1
Age	0	-0.08	0.11	0.45	-0.1	

**p<0.01 (sig-level, two tailed), WB=Walking Behavior, HBA= Health Belief Awareness

Table 2: Pearson Correlation of the measured variables

This result supports the initial hypothesis (H1) that the humorous nudge exerts stronger influence on participants to walk more than the non-humorous nudge. Additionally, to explore whether health-belief awareness levels of participants exert influence to walk more than the non-humorous group was analyzed. This indicates that there is no statistically significant relationship between health-belief awareness levels and walking behavior of the humorous group $F=2.02$, $p=0.48$ ($p > 0.05$).

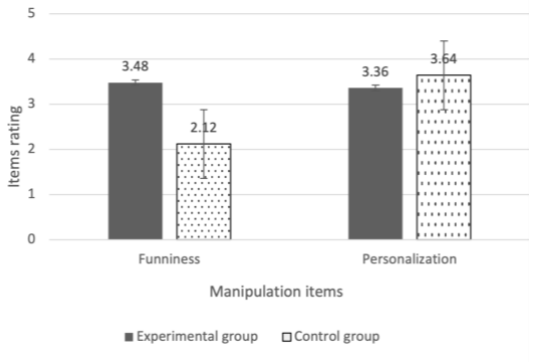

Figure 4 Comparison of Mean Rated Funniness and Personalization Between Conditions

Manipulation check items were used to ensure that the personalized humorous nudge was perceived funnier and more personalized than the non-humorous nudge. The average funniness rating was 3.48 in experimental group and 2.12 in control group. Indicating that participants in the experimental group perceived the nudges to be funny as compared to participants in the control group. Thus, supporting the initial hypothesis (H2a) that participants receiving humorous nudges would have a higher mean of perceived funniness compared to the participants who receive non-humorous nudges. However, the average personalization rating was 3.64 in control group and 3.36 in experimental group. Therefore, rejecting the initial hypothesis (H2b) that participants receiving humorous nudges would have a higher mean of perceived personalization than the participants who received non-humorous nudges.

Discussion

A smart nudge has the potential to be more relevant to an individual than a default (one-size-fits-all) nudge. Personalization allows contents and services being tailored to a user's preference and behavior, making it a useful tool for behavior change (Gao, Liu, & Wu, 2010). In this study, we have attempted to personalize humor as a presentation component of the nudge.

Therefore, this study investigated the influence of personalized humorous nudge on seven-day walking behavior with a focus on message tone. Our primary objective was to determine the impact of an augmented AICTP smart nudge framework in influencing greater walking behavior for participants. Additionally, we analyzed the role of health-belief awareness levels of participants in influencing them to walk and observed changes in walking behavior of participants from both the groups. Our study found that the participants receiving personalized humorous nudge exhibited walking behavior and perceived the nudges to be funnier compared to those receiving non-humorous nudges. The results indicate a statistically significant relationship between the outcome variable (i.e. humor and walking) $F=6.48$, $p = 0.03$ ($p < 0.05$), suggesting adherence to our nudge. In respect to the control group, expect the humor style and humor type, user profile (demographic details), content (i.e. location of walk), time frame (nudge receiving time), BCTs were personalized. Indicating a higher mean of perceived personalization in the control group.

Our research did have certain limitations that warrant further research. Firstly, participants' baseline walking behavior (i.e. participant daily step count) could be used to analyze pre- and post-change in step count of the participants. Secondly, we recognize that humor may exhibit variations across different demographic sectors and levels of technological proficiency. Therefore, the generalization of the findings is limited, considering the participants were majority from the age range of 20 – 25 years and employed private sector employees. Thirdly, nudges (humorous and non-humorous) were generated with the assistance of Chat GPT (4.o mini), and majority of the nudge components were predefined, limiting the organic and dynamic insertion and effectiveness of humor with the reminders.

Addressing these limitations, future work offers promising avenues for exploration and refinement. There is an opportunity for future studies to explore various psychological components of message in the principles of smart nudging. The influence (from AICTP smart nudge framework) of a nudge stem from psychological effects that drive behavior change (Karlsen & Andersen, 2022). Therefore, future work can explore various psychological effects (such as priming, anchoring & adjustment, status quo bias, loss aversion, etc.) in influencing health decisions among people.

Nudging is adaptive and can be triggered by user situation, environmental conditions or any activity that is relevant to the user (Karlsen & Andersen, 2022). Similarly, humor can be contextualized to the user. Humor types (i.e. comparison, personification, exaggeration, pun, sarcasm, silliness, surprise (Taecharungroj & Nueangjamnong, 2015)) can further be contextualize based on user's context. For example, topical (political) humor can gain user's attention and increase engagement of the nudge. Humor as a versatile tool (Romero & Cruthirds, 2006) can utilize Large Language Models (LLMs) to generate local idioms which are expressions, sayings or jokes that are specific to a particular area or community, thereby increase effectiveness of achieving behavior change.

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