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RESEARCH ARTICLE

Improving Attitudes Towards Breaks from Sitting using Affective and Cognitive Messages

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This study tested for (mis)matching effects between affective and cognitive messages promoting breaks from sitting at home (H) and work (W) and attitude basis. Working adults (*n*=198) were randomised into an affective or cognitive message group and completed a pre- and post-message questionnaire assessing overall, affective, and cognitive attitudes. The main outcome was change in attitudes towards breaks (H/W). Participants with weak-to-strong affective attitudes and moderate-to-strong cognitive attitudes showed greater attitude change (H) after exposure to the matching message, but not participants with weaker attitude bases. No (mis)matching effect was found for attitude change (W). This study suggests that the need to match messages to attitude basis may depend on how strong the attitude basis is and the decision-making context.

Keywords: affective, cognitive, messaging, attitudes, breaks from sedentary behaviour

'Sitting is the new smoking'. This phrase has been repeated in news articles (Hutchinson, 2014; Manger, 2014), TED talks (Matthews, 2013), infographics (Fitness Interactive Experience, 2014), and academic articles (Yoder-Wise, 2014) to draw a comparison between the degree to which smoking and excessive sedentary behaviour negatively impact our health, and subsequently persuade people to reduce their sedentary time. This phrase was likely unheard of less than 20 years ago when sedentary behaviour was considered the same as physical inactivity. However, now understood as sitting, reclining, or lying down while expending ≤1.5 metabolic equivalents (Tremblay et al., 2017), sedentary behaviour has received much attention of late, as studies published over the past decade and a half reveal its association with serious negative health outcomes (independent of physical activity (PA)) such as cardiovascular disease, all-cause mortality, breathing difficulties, chest pain, and psychological distress (Hamilton et al., 2008; Katzmarzyk et al., 2009; Kilpatrick et al., 2013; Owen et al., 2010; Peeters et al., 2013; Saunders et al., 2020; Tremblay et al., 2010). Studies of Canadian and American adults indicate that these groups spend a large portion of their day being sedentary (Colley et al., 2011; Matthews et al., 2008). Canadian adults in particular engage in over 9 hours of sedentary behaviour per day (Prince et al., 2020).

Researchers have suggested that taking standing and walking breaks from sitting may help combat the effects of sedentary behaviour. There is evidence linking breaks from sitting to improved blood glucose and triglyceride levels and waist circumference, even after controlling for PA level (Dunstan et al., 2012; Healy et al., 2008; Peddie et al., 2013). Breaks have also been linked to improved mood states and decreased upper back pain (Matic et al., 2011; Pronk et al., 2012). Thus, substituting sedentary behaviour with breaks from sitting might be an effective strategy for reducing some of the negative outcomes associated with sedentary time.

The majority of interventions targeting sedentary behaviour have focused on changing environmental factors, particularly in the workplace, to allow for more opportunities for standing. For example, many studies have tested the effectiveness of replacing traditional desks with standing, height-adjustable, or treadmill desks (Alkhajah et al., 2012; Dutta et al., 2014; Neuhaus et al., 2014; Pronk et al., 2012). However, there have been minimal studies testing other important factors affecting standing behaviour,

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particularly individual level factors such as motivation to engage in breaks from sitting or attitudes towards breaks. While some interventions have included an individual-level educational or persuasive component (Evans et al., 2012; Healy et al., 2013), to our knowledge no study has investigated which types of persuasive messages would be effective for motivating people to take breaks from sitting. Given the ubiquity of sedentary behaviour among working adults and the negative health consequences associated with this behaviour, there is a need to understand how we can motivate adults to reduce sitting time through taking standing and walking breaks. Thus, this study will compare affective and cognitive messages to determine their effectiveness in improving adults' attitudes towards breaks from sitting. It will take into account pre-existing individual attitude basis. We will also explore the effects of these messages across two domains, home and work, given that the determinants of sedentary behaviour likely vary across the physical and social contexts in which the behaviours occur (Owen et al., 2011).

Theoretical Development

In the following subsections, we review existing literature related to the effectiveness of affective and cognitive messages, focusing specifically on the health behaviour change context. Then, we define attitudes and attitude basis and provide a short discussion on the vulnerability of affectively- and cognitively-based attitudes to change. Finally, we describe the different types of matching/mismatching scenarios that could arise between message type and attitude basis, and review existing research related to matching/mismatching effects.

Affective and Cognitive Messages and Attitudes

Traditionally, health messages have conveyed the cognitive beliefs associated with a behaviour (e.g., reduced risk of heart disease). These messages were often guided by health behaviour change models that assumed that health decision making is based on rational and deliberate consideration of the benefits and costs associated with a behaviour (Conner et al., 2011; Keer et al., 2010, 2013; Kiviniemi et al., 2007). As a result, health messages largely ignored the affective associations with a behaviour and the role of affect in persuasion. More recently, the central role of cognitive beliefs has been challenged by findings demonstrating the superiority of affective associations over cognitive beliefs in predicting intentions and behaviours (Keer et al., 2010, 2013; Kiviniemi et al., 2007; Lawton et al., 2009). This has triggered an interest in comparing the effectiveness of affective and cognitive messages on changing attitudes, intentions, and behaviour. Affective messages are messages that convey the sensorial, social, and/or emotional experiences associated with a behaviour in order to elicit emotions within the audience (e.g., stretching soothes your aching muscles and helps you feel relaxed). In contrast, cognitive messages relay the rational, fact-based information and beliefs about a behaviour (e.g., standing breaks reduce your overall risk of heart disease; Dubé & Cantin, 2000; Rosselli et al., 1995).

To our knowledge, there have been no studies comparing the effectiveness of affective and cognitive messages within the context of sedentary behaviour. However, several studies have tested the effects of these message types on other health behaviours, with the most prevalent being PA. Although affective messages generally emerge as more effective than cognitive messages in the PA literature, some studies indicate that this is not always the case (Keer et al., 2013; Morris et al., 2015; See et al., 2008). In two similar studies, Conner et al. (2011) found that the affective message was more effective than both the cognitive message and no-message control in improving PA levels among university students. In addition, they found affective attitudes to be partial mediators of the effect of the affective message on behaviour change (Conner et al., 2011). Similarly, in their two-week mobile intervention, Sirriyeh and colleagues (2010) found that affective messages were more effective at changing inactive adolescents' PA behaviour than were cognitive messages, combined affective/cognitive messages, and neutral control messages. However, the researchers did not find any effect of intervention on active adolescents who were already meeting the PA guidelines (Sirriyeh et al., 2010). They explain that the superiority of affective messages hinges partly on the temporality of affective outcomes – people tend to favour short-term outcomes more than long-term outcomes, and affective messages, which commonly communicate these short-term benefits, target this preference more directly compared to cognitive messages. Finally, Morris and coauthors (2015) found affective messages that communicated short-term affective outcomes and cognitive messages that communicated long-term cognitive outcomes were more effective than affective messages that communicated long-term outcomes and cognitive messages that communicated short-term outcomes. However, the short-term affective and long-term cognitive messages were not significantly different from one another.

Research on the effectiveness of affective messages in the context of health behaviour change,

and on sedentary behaviour specifically, is still in its infancy and additional research needs to be conducted to determine how we can effectively encourage people to take breaks from sitting. The current research addresses this by testing the effects of these messages on attitude change among working adults who report high levels of sedentary behaviour (while controlling for individual attitude basis). As described in more detail below, there is evidence that the attitude change that one experiences in response to seeing an affective or cognitive message may be moderated by whether they hold an affectively- or cognitively-based attitude (e.g., Fabrigar & Petty, 1999; Keer et al., 2013; Ryffel & Wirth, 2016). Thus, the following is our first research question:

RQ1: After controlling for attitude basis, which message type – affective or cognitive – is more effective at producing greater positive change in working adults' attitudes towards taking breaks from sitting at home and at work?

Attitude Basis & Structure

Affective and cognitive messages primarily target an individual's attitudes, which links an attitude object (product/service, issue, behaviour) and the evaluation of the object in one's memory (Krosnick & Petty, 1995). For example, one's attitude towards engaging in PA (behaviour) is that it is fun and healthy (evaluations). Overall attitudes are composed of two structural components: an affective component, which represents the feelings or emotions that one associates with a behaviour (e.g., happiness), and a cognitive component, which includes the beliefs one has about the attributes of a behaviour (e.g., healthy, easy to perform). Thus, an attitude can be understood as being an integration of both what one *believes* (e.g., PA is good for my health) and *feels* (e.g., PA makes me happy) about an attitude object. Although both components have an influence over the overall attitude, one component may dominate over the other, thus becoming the primary basis of the overall attitude (Edwards, 1990). Overall attitudes that are primarily based on their cognitive component are called 'cognitively-based attitudes' and those based primarily on their affective component are termed 'affectively-based attitudes'.

Scholars have argued that cognitively-based attitudes are much more difficult to change than attitudes whose bases are predominantly affective (Edwards, 1990; Drolet & Aaker, 2002). Although more research is needed to explain these findings, attitude scholars explain that this may be due to the structure of affective and cognitive attitudes (Drolet & Aaker, 2002; Edwards, 1990; Fabrigar & Petty, 1999). For example, Edwards' argument, for which Drolet and Aaker (2002) provided some experimental evidence, was that affectively-based attitudes, although made up of multiple emotional evaluations (e.g., relaxing, enjoyable), take on a more hedonic, global structure (negative-positive). In contrast, cognitively-based attitudes are more complex and specific in that they are based on evaluation of various instrumental attributes of an object or issue that may be unrelated to each other (Drolet & Aaker, 2002), such as how healthy a behaviour is or how easy it is to perform. Thus, scholars have argued that in order for a persuasive message to change a cognitively-based attitude, it must target the cognitive dimension on which the attitude is based, which can be a difficult task if it is unclear or unknown to the message creators what this dimension relates to (Drolet & Aaker, 2002). In contrast, there are studies that suggest that affective attitudes are often held with greater confidence than cognitive attitudes (Edwards & Vonhippel, 1995; Seligman et al., 2018), meaning that they may be more persistent and resistant to change. Thus, the question of which attitude type is more malleable or responsive to persuasion attempts and under what conditions, as well as what the role of attitude basis structure is in facilitating/hindering attitude change, is still unclear. This is particularly true in studies exploring persuasive messages related to health behaviours, which are minimal in the literature, but important for understanding the nature of attitudes and attitude bases within the context of complex attitudinal objects such as health behaviours. Thus, the second research question in this study is:

RQ2: When controlling for message type, which attitude type, affectively- or cognitively-based, shows more change in response to persuasive messages promoting breaks from sitting?

Given that this study includes multiple types of messages (affective and cognitive) that might differentially affect the degree of attitude change in people with different attitude bases, we will answer this question while controlling for message type.

Matching and Mismatching Message Type with Attitude Basis

In comparing affective and cognitive message effectiveness, our study takes individual attitude bases into account. The most common types of investigations into the persuasiveness of affective and cognitive messages involve testing for the presence of a matching or mismatching effect between message type (i.e., affective/cognitive) and attitude basis (i.e., affective/cognitive). These studies investigate whether matching a message type to an individual's attitude

basis will result in a greater or lesser degree of attitude change, or if a mismatching scenario would produce better results. This has implications for persuasion and for understanding message effects. Since affective and cognitive messages target affective and cognitive attitudes, knowing whether one type of message is more congruent with a type of attitude basis (the matching or mismatching) can help determine which message to show those who hold affective and cognitive attitudes.

Matching and mismatching effects can be classified as either absolute or relative (Fabrigar & Petty, 1999). When an individual with a given attitude basis (e.g., affective) shows greater attitude change in response to a matching message (e.g., affective) than to a mismatching message (e.g., cognitive), this is classified as an *absolute* matching effect. When the opposite scenario occurs, we see an *absolute mismatching* effect. In contrast, a *relative* matching effect is concerned with the differential effects of a message type on attitude change for *each* type of attitude (affectively- and cognitively-based). Thus, we find a relative matching effect to occur when a message (e.g., affective) is more effective at changing the matching attitude (e.g., affective attitude) than at changing the mismatching attitude (e.g., cognitive attitude). Another relative matching scenario occurs when one message is more effective at changing its matching attitude, but the other message has no effect on its matching attitude. In other words, there is a matching effect, but for only one message-attitude basis pair. The relative mismatching effect occurs when the opposite of these scenarios takes place (Fabrigar & Petty, 1999).

Results of the matching/mismatching effects literature are mixed. While there are some studies that provide support for matching effects (Dubé & Cantin, 2000; Fabrigar & Petty, 1999; Mayer & Tormala, 2010; Morris et al., 2015; See et al., 2008), there are those that provide evidence for mismatching effects (Keer et al., 2013; Millar & Millar, 1990; See et al., 2013). For example, in their classic matching/mismatching studies, Fabrigar and Petty (1999) found evidence for a relative matching effect where affective persuasion attempts were more successful against affectively-based attitudes than cognitively-based attitudes, but cognitive persuasion attempts were not any more effective for changing cognitively-based attitudes than affectively-based attitudes. On the other hand, See et al., (2013) found evidence for mismatching effects-particularly among individuals who had strong opposing attitudes to the message being promoted.

The discrepancies in the matching/mismatching literature may be linked to a variety of factors. Mayer and Tormala (2010) argued that processing fluency plays a role in facilitating matching effects. Their study found that processing fluency mediated the effects of the "think" and "feel" messages on the matching attitudes and theorized that information that matches the attitude base of the message receiver may be easier to process than information that goes against or is dissimilar to the attitude base, and this ease in processing the matching message in turn facilitates persuasion. Other scholars have suggested that the strength and direction of the attitude is important for determining whether a matching or mismatching message is more effective. Fabrigar and Petty (1999) and See et al. (2013) suggest that matching messages may be less effective at changing corresponding attitudes that strongly oppose the message because the message can be more easily resisted or counterargued. Instead, a mismatched message may be more effective because the new information in the message may be less easily counterargued and therefore is more easily accepted and integrated into the attitude, since it does not directly attack the more dominant (and stronger) attitude basis,

Finally, the mixed results may be linked to the various ways overall attitudes and affective and cognitive attitude bases have been operationalized (Keer et al., 2013; See et al., 2013). Some researchers have assessed attitudes and attitude bases towards several behaviours and created an average score for attitudes across these behaviours (e.g., Keer et al., 2013). Others have operationalised attitudes at the object level based on research suggesting that some attitude objects are typically associated primarily with affect or cognition (Eagly et al., 1994; See & Khoo, 2011, as cited in See et al., 2013). Finally, some researchers have operationalized attitude basis on the individual x object level, which involves assessing attitudes and attitude bases for only one attitude object rather than several (e.g., Mayor and Tormala, 2010).

With the growing interest in affective and cognitive messages in health behaviour change research, more studies have emerged that explore matching and mismatching effects in this context (Keer et al., 2013; Mayer & Tormala, 2010; See et al., 2008). Yet, these studies are limited and to our knowledge, none have explored matching/mismatching effect in the context of motivation to engage in breaks from sitting. Thus, in addition to testing differences in effectiveness between affective and cognitive messages and assessing the potential for change between affective and cognitive attitudes, our study asks:

RQ3: Are matching or mismatching messages more likely to produce greater attitude change toward breaks from sitting?

As with the previous research questions, we will investigate RQ3 in the home and work domains. See et

al. (2013) postulated that individual x object level attitude bases, which are used in this study, may vary across different situations depending on situational factors such as the salience of affect and cognition. Persuasion studies, including those involving affective/cognitive messages, rarely consider the domain in which the target behaviour occurs, or use attitude objects that are not typically domain specific (e.g., in blood donation drives). Thus, there is a need to understand whether persuasion and matching/mismatching effects are consistent across domains or not, particularly in cases where determinants of behaviour vary across domains, as in the case of sedentary behaviour (Owens et al., 2010).

Methods

Participants and procedure

198 (53.5% female) participants took part in this study. The majority of participants worked full-time in service-providing jobs (over 80%) and nearly all the participants reported being from the USA. The demographic information is presented in Table 1.

This study was part of a larger study on breaks from sitting and was approved by the Queen's University General Review Ethics Board. It utilized a 2 (message type: affective/cognitive) x 2 (attitude basis: affective/cognitive) factorial design. Participants were recruited from Amazon Mechanical Turk (MTurk), a crowdsourcing internet marketplace, and compensated $1.00 for their time. To participate, individuals were required to meet the following inclusion criteria: 1) write, read, and understand English, 2) be between 18 and 64 years old, 3) reside in North America, 4) be a part- or full-time employee whose primary workplace is outside the home, and 5) be always or almost always sitting at work. Individuals were not included in the study if they: 1) were students, 2) were unable to stand or walk independently, 3) work at home or were unemployed, 4) were on leave from work during study completion or in the two weeks following, 5) completed the message pre-test (given that they had seen earlier versions of the messages and were asked questions that required more deliberate review of the messages than the participants in the full study).

After providing informed consent, participants completed a pre-message questionnaire that assessed their overall attitudes and affective and cognitive attitude bases towards breaks at home and at work. Attitude items (described in detail below) were adapted from Crites et al. (1994). Due to a limitation in the survey software, the presentation of home and work-related items could not be randomized and participants answered home-related items first and work-related items second for each attitude type. Participants were then randomized into one of the study conditions and viewed the corresponding message (i.e., affective or cognitive). Participants could view the message for as long as they wanted, however the 'next' button on the message page was disabled for 30 seconds to ensure that participants did not skip over the message. Following this, participants completed the post-message questionnaire, which reassessed overall, affective, and cognitive attitudes towards breaks from sitting. Constructs unrelated to this study were also assessed in the pre- and post-message questionnaire.

Table 1.
Descriptive Themes mapping onto Analytical Themes

	Message Type	
	Cognitive (*n*=100)	**Affective** (*n*=98)
Variables	*n* (%)	*n* (%)
Age (years; *M*±*SD*)	35.3±8.8	38.8±10.5
Gender		
Male	37 (37.0)	54 (55.1)
Female	63 (63.0)	43 (43.9)
Unknown	0 (0.0)	1 (1.02)
Geographic Location		
Canada	0 (0.0)	1 (1.02)
USA	99 (99.0)	96 (98.0)
Unknown	1 (1.0)	1 (1.02)
Education		
High school or under	17 (17.0)	16 (16.3)
Higher than high school	83 (83.0)	81 (82.7)
Unknown	0 (0.0)	1 (1.02)
Employment Status		
One full-time job	88 (88.0)	87 (88.8)
One part-time job	7 (7.0)	3 (3.06)
Two or more full- or part-time jobs	5 (5.0)	7 (7.14)
Employment Industry		
Goods-producing	11 (11.0)	8 (8.16)
Service-providing	89 (89.0)	85 (86.7)
Unclassified establishment/Unknown	0 (0.0)	5 (5.10)
Income ($)		
Less than 100,000	79 (79.0)	80 (81.6)
100,000 and above	21 (21.0)	17 (17.5)
Unknown	0 (0.0)	1 (1.02)

Materials and measures

Messages

Messages were pre-tested on MTurk with 29 participants who were screened using the same inclusion and exclusion criteria as the main study participants (results shown in Table 2) and the messages were adapted after the pre-test to strengthen the difference between the two messages. The messages were both gain-framed and included a heading, image, main text, and tag line that were either affectively- or cognitively-based and 'easy' suggestions for taking breaks (e.g., use a bathroom on another floor, set a timer to remind you to take breaks)

that were the same for both messages. Gain-framed messages, which emphasize the benefits of engaging in or quitting a behaviour, were used in this study because they have been shown to be more effective at encouraging engagement in PA and other disease-preventing behaviours in comparison to loss-framed messages, which communicate the losses one would sustain if they continue or quit a behaviour (Latimer et al., 2008; 2010; O'Keefe & Jensen, 2007). The affective message was designed as a vignette and attempted to elicit emotions within the participants as well as communicate the emotional or feeling-based benefits of breaks. Its main text described the story of a woman who began taking breaks and experienced positive physical, social, and emotional feelings (e.g., tense feeling in shoulders/back disappeared, became more energetic and cheerful) as a result of taking breaks. The cognitive message relayed the positive health benefits associated with taking breaks (e.g., stronger bones, healthier heart) to elicit the participants' thoughts about the utility and health benefits of breaks. Study manipulation checks conducted in the post-message survey indicated that the messages differed significantly on two items: "Please rank the advertisement you just read using the following word pairs: uninformative/informative" and "Please indicate the extent to which you agree with the following statement: "This message highlights the positive feelings and emotions one would experience by taking breaks from sitting". The cognitive message was perceived as more informative than the affective message (p = .011), while the affective message was perceived as having highlighted the emotions/feelings more than the cognitive message did (p < .001).

Attitude basis

Following Mayer and Tormala (2010), we employed the individual x object level operationalization for attitude basis by assessing attitudes towards only one attitude object: breaks from sitting. We chose this operationalization because it is closely aligned with the understanding of attitudes as being a link in memory between one attitude object and the evaluation of this attitude object. Operationalizing attitudes in this way also helps to reduce the chances of diluting the attitude of interest among other attitudes when attitudes towards several behaviours are assessed and aggregated into one score. The benefit of this is that we avoid losing important information about how the messages influence the target attitudes in question and can make more precise and practical recommendations about how messages affect attitudes towards our target behaviour. Thus, we assess overall, affective, and cognitive attitudes towards only taking breaks from sitting.

Table 2.
Pre-Test Results

	Condition	
	Cognitive	**Affective**
Variable	*M (SD)*	*M (SD)*
Believability	6.33 (0.90)	6.23 (0.73)
Credibility	6.00 (1.07)	6.14 (0.77)
Informativeness	6.07 (1.03)	6.00 (1.08)
Emotion felt	2.73 (1.03)	2.64 (0.84)
Relied on emotion to evaluate message	2.53 (1.30)	2.43 (1.02)
Relied on rationality to evaluate message	3.80 (0.86)	4.21 (0.43)
Considered feelings associated with breaks	4.87 (1.41)	5.29 (1.27)
Thought about rational reasons to take breaks	5.87 (0.92)	5.79 (1.63)
Highlighted positives feelings/emotions	4.73 (1.58)[a]	6.07 (0.73)[a]
Stimulate thoughts about why breaks would be beneficial	5.93 (0.88)	5.64 (1.51)

Overall attitudes towards breaks from sitting

Participants responded to the following scale 'I would describe my overall attitude towards taking breaks from sitting at home (at work) as…' using seven-point semantic differential scales anchored with four word-pairs: negative/positive, dislike/like, unfavourable/favourable, bad/good, consistent with Fabrigar and Petty (1999). Henceforth, these four word pairs are referred to as the "target items".

Some researchers have suggested that to accurately compare affective and cognitive bases and determine their influence on overall attitudes, the same word pairs should be used to assess overall attitudes and attitude bases (Giner-Sorolla, 2004; Peters et al., 2009; Verplanken et al., 1998). Thus, the four word pairs used to assess overall attitudes were also used to assess affective and cognitive structural attitude bases. However, additional affective and cognitive word pairs were included in the assessment of the affective and cognitive structural attitude bases, respectively, to provide an affective or cognitive context to the four target items that were used to calculate the attitude bases.

Attitude change

To calculate attitude change, the dependent variable in this study, we subtracted the pre-message overall attitude score from the post-message attitude score for each participant. Attitude change for overall attitudes towards breaks at home and overall attitudes towards breaks at work were calculated separately such that each participant had two attitude change scores, one for home and the other for work.

Affective structural attitudes

Participants responded to the following scale 'My

feelings about taking breaks from sitting at home (at work) are best described as…' using seven-point semantic differential scales anchored with the four target items and eight other word pairs, including sad/delighted, hate/love, unpleasant/pleasant, disgusted/accepting, sorrowful/joyful, bored/excited, tense/calm, and angry/relaxed. A total of 12 word pairs were used to assess the affective structure of the attitude.

Cognitive structural attitudes

Participants responded to the following scale 'My thoughts about taking breaks from sitting at home (at work) are best described as…' using seven-point semantic differential scales anchored with the four target items and seven other word pairs, including unhealthy/healthy, unsafe/safe, harmful/beneficial, imperfect/perfect, worthless/valuable, foolish/wise, and useless/useful. A total of 11 word pairs were used to assess the cognitive structure of the attitude.

Analysis

To answer our research questions, we adapted a method commonly employed in studies testing for matching/mismatching effects in the context of affective and cognitive messages (e.g., Mayer & Tormala, 2010; Keer et al., 2013; See et al., 2013). This method allows us to generate an attitude basis score for each participant that reflects how much the affective and cognitive components influence the overall attitude, as well as which component is dominant (i.e., has greater influence on the overall attitude). Following See et al. (2013), we first obtained the scores representing overall attitudes, affective attitudes, and cognitive attitudes by averaging the four target items from each of the overall, affective, and cognitive attitudes word pair sets (Cronbach's α = .92–.97). Then, two discrepancy scores (an affective and a cognitive score, respectively) were calculated by subtracting the affective target item score from the overall attitude target item score, the cognitive attitude target item score from the overall attitude target item score, and then each score was converted into an absolute score. These discrepancy scores represent the distance between the affective and cognitive components and the overall attitude; however, they do not tell us which component is dominant and consequently serves as the basis of the attitude. Thus, we subtracted the absolute cognitive discrepancy score from the absolute affective discrepancy score to obtain the final attitude basis score. Each participant was left with one score that represented their unique attitude basis on the broader attitude basis continuum. Positive values on this continuum represented affectively-based attitudes, with larger values indicating a greater influence of the affective basis on the overall attitude. Negative values represented cognitively-based attitudes, with more negative values indicating a greater influence of the cognitive basis on the overall attitude. In other words, a positive attitude basis score represents an affectively-based attitude and indicates that the affective component more strongly influences the individual's overall attitude towards breaks from sitting than does the cognitive component. A negative attitude basis score represents a cognitively-based attitude and indicates that the cognitive component more strongly influences an individual's overall attitude towards breaks from sitting. The advantage of operationalising attitude basis as a continuous variable rather than creating a categorical variable with two groups is that we can test for matching/mismatching effects at various intensities of the attitude basis, thereby preserving the differences between individuals who share an attitude basis orientation but have differing intensities of this orientation. The attitude basis scores were mean-centered, and an interaction term between the attitude basis and message type was created by multiplying the attitude basis score with message type. This procedure was performed for attitudes (home) and attitudes (work) separately.

As per Keer et al. (2013), See et al., (2013), and Mayer and Tormala (2010), we conducted two hierarchical regressions[1], one with attitude change (home) as the dependent variable and the other with attitude change (work) as the dependent variable. In both home and work models, message type and the corresponding mean-centered attitude basis scores were included as predictors in the first step (in order to answer RQ1 and RQ2, respectively) and the interaction term as the predictor in the second step (to answer RQ3). Significant interactions were followed-up with the Johnson-Neyman technique[2]. As with simple slopes analysis, the Johnson-Neyman technique tests the effects of the moderator (attitude basis) on the relationship between the predictor (message type) and outcome (attitude change) at multiple levels of the moderator. However, the advantage of the Johnson-Neyman technique is that it provides information about this effect for a more differentiated range of moderator values than does the simple slopes analysis, which typically provides information for only three levels of the moderator variable (-1SD, mean, +1SD)[3].

Results

Effects of matching and mismatching on attitude change (home)

Descriptive statistics related to attitude change at home are provided in Table 3. The regression analysis indicates that there was no main effect of message type (p = .17), suggesting that there was no significant difference in effectiveness between the affective and cognitive messages (RQ1). However, we did find a significant main effect of attitude basis (b = -1.27, t(197) = -4.0, p < .001); participants with cognitively-based attitudes displayed greater attitude change regardless of message type compared to those whose attitudes were affectively-based (RQ2). Finally, there was a significant interaction of attitude basis by message type (b = .73, t(197) = 3.71, p < .001).

Table 3.
Attitude Scores

Domain Condition	Overall Attitude Pre-Message *M (SD)*	 Post-Message *M (SD)*	 Change *M (SD)*
Home			
Affective	6.06 (1.07)	6.24 (0.99)	0.17 (0.66)
Cognitive	6.02 (1.25)	6.08 (1.23)	0.02 (0.79)
Work			
Affective	6.27 (0.88)	6.50 (0.71)	0.20 (0.58)
Cognitive	6.13 (1.13)	6.33 (1.00)	0.17 (0.59)

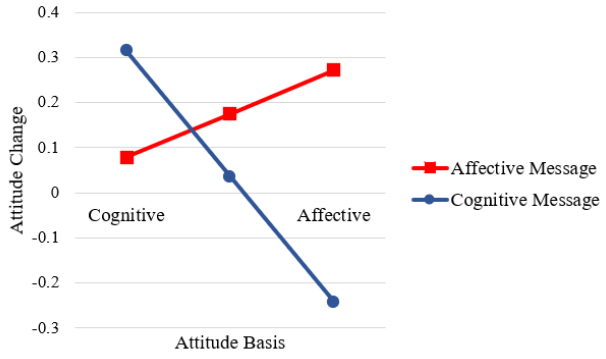

Figure 1. Attitude change (home) as a function of attitude basis and message type.

Results of the moderation analysis using the Johnson-Neyman technique (Table 4) reveal that for those with very weak affective attitudes and those with weak cognitive attitudes (attitude basis scores of -0.5803 to 0.1236), the type of message they were exposed to did not make a difference to their attitude change (ps ≥ .05). However, individuals with affective attitudes that were weak-to-extremely strong (≥ 0.1236; t(198)= 2.01, p = .046, b = .20) as well as individuals with cognitive attitudes that were moderate-to-extremely strong (≤ -0.6659; t(198)= -2.18, p = .03, b = -.37) experienced greater attitude change when exposed to the matching message in comparison to a mismatching message. This indicates the presence of a partial absolute matching effect where the affective message is more effective than the cognitive message at changing affective attitudes at all levels of the attitude basis except those that are extremely weak. The cognitive message is more effective than the affective message at changing cognitive attitudes that are moderate-to-extremely strong, but not those that are weak. Thus, attitude change was more pronounced for those with more extreme affective and cognitive attitude bases than for those with weaker attitude bases.

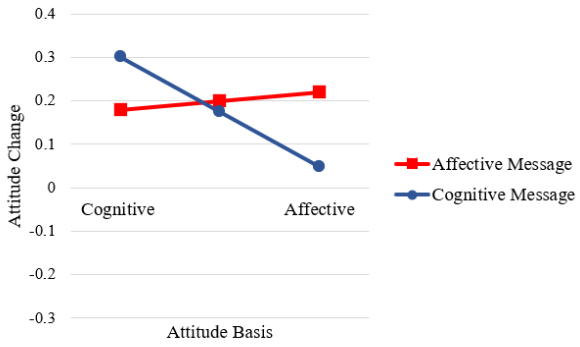

Figure 2. Attitude change (work) as a function of attitude basis and message type.

Effects of matching and mismatching on attitude change (work)

Descriptive statistics related to attitude change at work are provided in Table 3. Similar to the home context, regression analysis revealed no main effect of message type (p = .76), suggesting that both messages have comparable effects on attitude change (RQ1). The results again confirmed a significant main effect of attitude basis (b = -.847, t(197) = -2.07, p = .04), such that individuals with cognitively-based attitudes showed more change in their overall attitude towards breaks from sitting than those whose attitudes are affectively-based (RQ2). However, unlike the home context, we did not find a statistically significant interaction between the attitude basis by message type interaction (p = .08; see Figure 2), indicating no matching or mismatching effect between the messages and participants' attitude basis (RQ3).

Discussion

The purpose of this study was to compare the effectiveness of affective and cognitive messages on adults' attitudes towards breaks from sitting at home

and at work, while accounting for individual attitude basis. Message type did not predict attitude change for either home or work. In contrast, pre-existing attitude basis did significantly predict attitude change. Those with cognitively-based attitudes had greater improvements in attitudes towards breaks from sitting both at home and work compared to those whose attitudes were affectively-based, regardless of which message they saw. Finally, we found an absolute matching effect for attitudes at home but not for attitudes at work.

Table 4.
Results of Moderation Analysis

Attitude Basis Scores	p-value
-1.9817	.001
-1.7185	.002
-1.4554	.0035
-1.1922	.004
-0.9291	.009
-0.6659	.030
-0.5803	**.050**
-0.4028	**.173**
-0.1396	**.914**
0.1179	**.050**
0.1236	.046
0.3867	.001
0.6499	<.001
0.913	<.001
1.1762	<.001
1.4394	<.001
1.7025	<.001
1.9657	<.001
2.2288	<.001
2.492	<.001
2.7551	<.001
3.0183	<.001

Note. Negative values (shown in shades of blue) represent cognitively-based attitudes and positive values (shown in shades of red) represent affectively-based attitudes. Attitude basis scores that are further from zero and represented in more saturated red/blue shades are more dominated by their respective attitude basis than scores that are closer to zero and represented through more faded red/blue shades. Bolded values represent the range on the attitude basis continuum where there were no significant interaction effects (i.e., there were no matching or mismatching effects for individuals with attitude basis scores that fell in that range).

While participants who saw the affective message showed greater levels of attitude change and higher post-message attitudes for both home and work compared to participants who were exposed to the cognitive message, our analysis indicated no significant difference in attitude change between the groups across both domains. This is not entirely surprising. While several published studies provide support for the superiority of affective messages (Carfora et al., 2016; Conner et al., 2011, Sirriyeh et al., 2010), others have found no significant difference (Keer et al., 2013; Morris et al., 2015; See et al., 2008). This finding may be explained by the temporal salience of the outcomes relayed in each message. The affective message used in this study communicated mostly proximal affective outcomes associated with breaks, while the cognitive message relayed mostly distal cognitive outcomes. According to findings from Morris et al. (2015), when affective and cognitive messages are framed in these ways, they show similar persuasive power and are more persuasive than their opposites (i.e., short-term cognitive and long-term affective). They postulate that this may be related to how people generally think about affective experiences and cognitive information. While affect is often understood to occur over a short period of time (e.g., pleasurable, relaxing feelings of stretching a tight muscle), health outcomes (i.e., cognitive) are often thought of in the long-term (e.g., cardiovascular disease developing over time or showing symptoms in the future). Framing affective messages in the short-term and cognitive messages in the long-term such that they are more congruent with the way people often think about affective and cognitive health outcomes may put these messages at similar levels of effectiveness. Future studies should further investigate the interaction between affective and cognitive messages and temporal salience and explore the underlying mechanisms.

We also found that, regardless of the message seen, participants with more cognitively-based attitudes showed greater attitude change (at home and at work) compared to those with affectively-based attitudes. As mentioned previously, some scholars argue that cognitively-based attitudes, because they are built on evaluations of various (sometimes independent) attributes of the attitude object, can be difficult to target and change, especially compared to more global affective attitudes (Drolet & Aaker, 2002; Edwards, 1990). However, if a message were to target the specific dimensions(s) upon which the cognitively-based attitude is based, it may be able to influence that attitude (Drolet & Aaker, 2002). The messages in this study may have done just that. The study messages communicated how physically or

emotionally valuable breaks from sitting can be and listed several 'easy' break ideas. It is possible that participants with cognitively-based attitudes had constructed their initial attitudes about breaks on how valuable they are and/or on whether breaks were easy to perform or fit into their home or work routines. If this is the case, then the messages and the attributes on which participants based their attitudes would be congruent, thus facilitating improvements in participants' cognitively-based attitudes. In addition to this, participants had overall positive attitudes towards breaks from sitting, indicating they were already in favour of breaks. Seeing a matching message that promoted a behaviour that was already favourable, using arguments that match participants' mental schema related to the behaviour, may have contributed to the enhancement of attitudes towards breaks from sitting.

Upon exploring the interaction between attitude basis and message type, we found an absolute matching effect for attitudes (home) for participants with affectively-based attitudes (except those with an extremely weak affective basis) and for moderate-to-extremely strong cognitively-based attitudes (but not those with weaker cognitive bases). This matching result confirms some studies (e.g., Dubé & Cantin, 2000; Fabrigar & Petty, 1999; Mayer & Tormala, 2010; See et al., 2008) and challenges others (e.g., Keer et al., 2013; See et al., 2013). This may be explained in part by the participants' initial attitudes and attitude bases. Previous research suggests that when participants disagree with the message position (i.e., have unfavourable attitudes towards a target behaviour), they are more motivated to resist persuasion in comparison to those who agree with what the message is saying (See et al., 2013). In contrast, when people agree with a message (as is the case in this study) matching messages may be more likely to produce attitude change in comparison to mismatching messages. This matching/mismatching dynamic may be a function of information accessibility. There is evidence that affective information (e.g., emotions associated with a behaviour) is more accessible in memory for those who hold an affectively-based attitude, and cognitive information is more accessible for those holding a cognitively-based attitude (Giner-Sorolla, 2004). This accessibility to information may make it easier for someone who opposes a message to resist matching messages because they are able to summon arguments that counter the message. Indeed, See et al. (2013) study found that participants who had unfavourable attitudes towards the message argument generated more 'intense' counterarguments when exposed to a matching message than when exposed to a mismatching. In contrast, for someone who supports a message, being exposed to a message that matches their attitude basis may actually reinforce and support existing attitudes, in turn, strengthening them. This could be a possible explanation for what occurred in our study, since participants had positive attitudes towards breaks from sitting, thus producing a matching effect.

It is important to note that this matching effect was *absolute*, meaning that a matching effect was present for individuals with both a cognitively-based and affectively-based attitude. However, this absolute matching effect was only partial, in that only some individuals experienced increased attitude change in response to seeing their matching message. Individuals with very weak affective attitudes and those with weak cognitive attitudes showed no significant difference in attitude change between the messages, while those with stronger affective and cognitive bases did. This is a novel and interesting finding. It may be that individuals whose affective and cognitive attitude bases exert similar levels of influence on their overall attitudes are responsive to both message types to a similar degree because their attitudes are not biased towards one type of information more than another. In other words, whether they see an affective or cognitive message, both types have the potential to match and reinforce some aspect of their attitude. It is notable that individuals with *weak* cognitive attitudes did not react differentially to the messages while the same can be said only for individuals whose attitudes were only very weakly affective. Scholars have suggested that although affective evaluations contain little to no cognitive aspect, cognitive evaluations incorporate affect to some degree (Fabrigar & Petty, 1999; Zajonc, 1980; Zajonc & Markus, 1982). For example, someone's knowledge that a behaviour they engage in is unhealthy and regularly puts them at high risk for having a heart attack may be accompanied by fear that they will indeed have a heart attack. These findings might suggest that affect may still play a strong enough role in evaluation even at weak levels of the cognitively-based attitude such that it still has a significant influence over the overall attitude. This presents as the affective message continuing to influence the attitude to a similar degree as the cognitive message. In contrast, for attitudes dominated by their affective component, the cognitive component may have much less influence over the overall attitude except among individuals whose attitudes are very weakly affective. Together these results suggest that the threshold at which the overall attitude becomes more influenced by its dominant component is higher for cognitive attitude than

affective attitudes, making affective and cognitive attitudes more susceptible to their matching message at differing levels of attitude basis intensity. Further research should be conducted to determine at what levels of the attitude basis matching/mismatching effects manifest themselves and as well as the role of affect in influencing the overall attitude at various levels of cognitive basis.

Interestingly, we found a matching effect for attitudes towards breaks at *home* but not for attitudes towards breaks at *work*, although the interaction did approach conventional levels of significance. In other words, participants with affectively-based attitudes reacted similarly to the affective and the cognitive messages, as did participants with a cognitively-based attitude. The differential findings for work and home may be related to varying situational and domain factors. See et al. (2013) indicated that one's attitude basis (at the individual x object level) may vary across situations as a result of factors unique to each situation (such as the salience of affect or cognition) and this, in turn, could have an effect on persuasion and matching effects. The ecological model recognizes that the factors that influence people's decision-making process and their behaviour are not uniform across domains (Owen et al., 2011). That is, a factor that has significant influence over someone's attitudes and behaviour in one domain may have little to no influence, or may not even exist, in another. Thus, factors that facilitate or hinder attitude change at work in response to persuasive messages may be different from those that do so at home, or may do so to different degrees. For example, while ease of breaks or social norms surrounding taking breaks at work may be important determining factors in the workplace, they may not be so important at home. Instead, physical and emotional benefits of taking breaks may be more salient and important in the decision process at home where one has more autonomy and freedom to do what he or she thinks and feels is right. Therefore, it may not matter a great deal if someone sees a cognitive or affective message when physical and emotional benefits are not central in the decision-making process.

Limitations and future recommendations

This study was not without limitations. The participants' pre-message attitudes were relatively high, meaning that, on average, they had favourable attitudes towards breaks from sitting in both domains before they were exposed to the messages. The messaging and sedentary behaviour literatures would benefit from testing the effects of these messages among individuals who have unfavourable attitudes towards breaks. These fields would also benefit from studies that expose participants to messages multiple times. Messaging studies that track the effects of messages over time are not common but would greatly enhance our understandings of these effects and provide us with more practical knowledge about the effectiveness of the messages (i.e., since mass media campaigns usually happen over time with multiple exposures). Research suggests a curvilinear relationship between message effectiveness and message repetition, such that message effectiveness is greater at moderate levels of repetition than at low and very high levels of repetition (Cacioppo & Petty, 1979, 1989; Campbell & Keller, 2003). It would be valuable to investigate this dynamic within the cognitive/affective messaging and sedentary behaviour context. In addition, future research should replicate this study with a larger sample size. Although the matching effect for attitudes at work did not reach conventional levels of statistical significance, it did approach it and the direction of the effect (cross-over) was as predicted. We would also recommend that the Johnson-Neyman technique be used to probe significant interactions instead of more limited analyses, such as simple slopes, because it can provide information about the effect of message type on attitude change for individuals with more extreme affective and cognitive attitude bases. Finally, we tested the effects of affective and cognitive messages on adults' *attitudes*. While attitudes, and even intentions, often predict behaviour indirectly and directly (Ajzen, 1991; Keer et al., 2010, 2013; Kiviniemi et al., 2007), the magnitude of change in these predictors does not always translate into the same magnitude of change in behaviour. Thus, it is of vital importance for us to understand the effects of affective and cognitive messages on behaviour in addition to its determinants.

It may also be valuable to investigate whether breaks from sitting are generally considered affectively or cognitively, and whether this differs depending on the type of break or the domain in which breaks are taken. Exploring the attributes upon which people base their attitudes towards breaks, the emotions they associate with breaks, and the factors that influence break-taking behaviour and attitudes in different domains would be valuable for creating comprehensive and effective interventions. Finally, future studies may consider testing the impact of affective and cognitive messages that are delivered via other forms of communication, including television or social media.

From a practical perspective, our results suggest that it may be beneficial to present messages to individuals that are tailored towards their attitude

basis when targeting sitting, particularly in the home context. Further, practitioners should take into consideration the strength of the attitude basis when determining which message to provide to individuals, given that our results indicate that considering the type of attitude basis is not enough and that intensity matters as well. Additionally, practitioners and professionals may be well advised to target adults whose attitude and intentions towards taking standing breaks are weak, as this population may especially benefit from intervention.

This is the first study of its type to address breaks from sitting. It provides preliminary evidence related to the effects of affective and cognitive messages on working adults' attitudes towards breaks from sitting at home and at work. Studies replicating and building on our investigation would benefit public health researchers and experts and, by extension, the health of the general population.

Notes

1. As part of the larger study on breaks from sitting, we conducted ANCOVAs to compare the effects of the cognitive and affective messages on attitude change at home and at work. The independent variable was message type while the outcome was overall attitude change at home or overall attitude change at work. Affective meta-cognitive attitudes were included in the ANCOVA testing attitude change at home while perceived behavioural control, break frequency, and social norms were used as covariates in the ANCOVA testing attitude change at work. Covariates were only included in the model for which they met the ANCOVA assumptions. Similar to the regressions presented in this paper, the ANCOVAs showed no significant differences between the messages in both home and work contexts. Regressions, instead of ANCOVAs, were used for the final analysis of this study because they are more commonly used and suitable when one or more of the predictors is a continuous variable, which, in our case, was attitude basis. Thus, we report only on the results of the hierarchical regression in this paper as this analysis allows us to address all of our research questions.

2. Thank you to the reviewer for suggesting that we use the Johnson-Neyman technique instead of simple slopes analysis as a follow-up to the significant interaction.

3. We conducted simple slopes analysis to probe the significant interaction and found, instead of a partial absolute matching effect, a relative matching effect. Individuals with affectively-based attitudes showed significantly more change when exposed to a matching message than a mismatching message, but there was no difference for individuals with cognitively-based attitudes. This is likely due to the limits of the simple slopes analysis that fails to capture effects at more extreme levels of the moderator. Thus, we would recommend that future studies examine matching/mismatching effects using the Johnson-Neyman technique in order to capture the moderation effects at more extreme levels of the moderator and avoid missing crucial information.

Conflicts of Interest

The authors have no conflicts of interest to declare.

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