Want to prime exercise? Calorie labels work better than activity ones!

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Abstract

'Activity-equivalent' food labels are believed to encourage consumers to partake in exercise. This may occur by semantic priming, where featuring images of physical activity increases the mental accessibility of the concept of exercise, making it more 'fluent' and therefore more influential on people's behaviour. We tested how the format of labels (image vs. text) and representation of energy ('activity' vs. 'calorie) affected mental accessibility of exercise in a word-fragment completion task and participants' behavioural intentions for exercise (N = 142). Participants exposed to calorie labels produced more exercise-related words and viewed an imagined exercise scenario as shorter and more enjoyable. Images led to higher intentions to exercise than text when they described activities but they led to lower intentions to exercise than text when they described calories. Findings suggest that activity labels do not trigger more activity related thoughts, but could increase exercise intentions only if presented in pictorial format.

Keywords: priming; exercise; obesity; health; food labels; behavioural intentions

Introduction

Obesity is a serious global issue, with nearly 40% of the world's population as overweight or obese in 2014 (World Health Organisation, 2016), a condition that is a major risk factor for noncommunicable diseases such as cardiovascular conditions and stroke (Grover et al., 2015). Physical inactivity has been identified as a main contributor to the obesity epidemic, due to the structure of work and transport become more sedentary in nature (WHO, 2004). People mostly agree explicitly that physical activity is good for health, but in the UK, about 40% of adults still do not achieve minimum recommended levels of physical activity in their daily life (Craig & Mindell, 2012). While there may be various reasons for this discrepancy between attitudes and behaviour, closing the gap by increasing physical activity remains an important applied challenge.

The Royal Society for Public Health (RSPH, 2016) recently proposed to target obesity in the UK by the introduction of food labels that reflect the amount of physical activity required to burn off calories in the food. This label is intended to be easier to understand and to nudge people into exercising more. In this project, we assess which aspect of the new label would increase physical activities. We propose some hypotheses about the effect of using the concept of exercise instead of calories to represent food energy, and presenting an image instead of a text. We posit that mentioning exercise instead of calories could act as a semantic prime that increases the accessibility of activity-related thoughts (Meyer & Schvaneveldt, 1971) and therefore the intention to engage in physical activities. Compared to text, using an image may also influence the meta-cognitive processes involved in processing the label. Research suggests that the distinctive nature of pictures enhance their recollection over words (Curran & Doyle, 2011), may generate more interactive information processing (Domke, Perlmutter, & Spratt, 2002), and are superior to words in activating conceptual understanding (McBride & Dosher, 2002). Images of a concept are thus more likely to increase its mental accessibility, priming it to be processed more quickly, or more 'fluently' when next encountered.

Concepts that have been activated are subsequently perceived more easily (i.e. more fluent) and are better liked (Winkielman, Schwarz, Reber, & Fazendeiro, 2000). Factors that increase perceptual fluency, such as improved clarity of presentation, also increase liking of stimuli (Oppenheimer, 2008). Notably, exercise that was presented in a passage with easy-to-read font (high fluency) was estimated to take less effort to perform than when the font was illegible (low fluency) and this influenced people's willingness to engage in it (Song & Schwarz, 2008).

Manipulating the accessibility of different options has also shown positive effects on healthy related behaviours. Environmental cues can increase the salience of healthy choices and subtly prime people to view these options more favourably (Marteau, 2011; Wilson, Buckley, Buckley, & Bogomolova, 2016). For example, placing fruit instead of chocolate snacks at supermarket checkouts increased purchase of the healthier food options (Foster et al., 2014). Featuring healthier sandwiches in a more prominent and unhealthier ones in a less prominent spot on a menu made people more likely to order the healthy sandwiches (Wisdom, Downs, & Loewenstein, 2010).

In sum, variables that increase perceptual fluency (such as familiarity and clarity) as well as variables that increase conceptual fluency (such as exposure to associatively related concepts) can influence the subjective ease with which a stimulus can be processed. We therefore hypothesised that image and activity labels would result in greater mental availability of exercise than text and calorie labels. Additionally, image and activity labels would result in exercise being rated as less effortful and more enjoyable, leading to greater willingness to engage in exercise behaviours than with text and calorie labels.

Methods

Participants

One hundred and forty-two English-speaking participants were recruited online through snowball sampling in the UK and Singapore, and sharing through social networking sites and online forums. Age ranged from 18 to 74 years (M = 40.30, SD = 15.47). Ethnicity was 58% Asian and 23% percent white/Caucasian (19% other races). Body Mass Index (BMI) estimates based on weight and height categories of participants ranged from 15.82 to 43.51 (M = 22.501, SD = 4.66).

Materials[1]

Food labels We manipulated label format (image vs. text) and energy representation (activity vs. calorie) to create four labels as shown in Figure 1. The image labels were derived from existing activity-label depictions that have been proposed and tested in previous research (e.g. Swartz, Dowray, Braxton, Mihas, & Viera, 2013; Van Kleef, Van Trijp, Paeps, & Fernandez-Celemin, 2008). In order to keep image quality consistent, we standardised the walking image across both activity-image and calorie-image labels. Equivalent activity values were calculated from the chosen calorie value based on the mean weight of a UK individual (70kg).

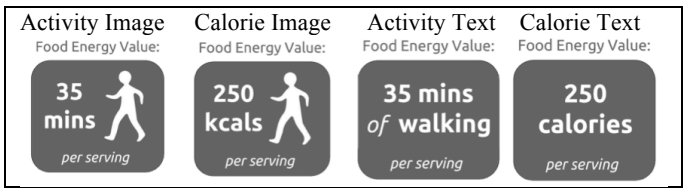

Figure 1: Labels used as stimuli.

Word fragment completion task Participants read 17 word fragments, of which 12 could be completed with either exercise-related or neutral words. For example, the fragment 'S _ ORT' could be completed as SPORT (exercise-related) or SHORT (unrelated). This type of task has previously been used as a measure of mental availability (Tulving, Schacter, & Stark, 1982). The fragments were chosen to keep the overall word frequency for potential completions as balanced as possible. Each word fragment was presented on a separate page. Participants were told that both speed and accuracy were important in the task.

Perception of exercise We measured participants' perception of exercise as an indicator of exercise favourability. Participants were asked to imagine they had agreed to go for a 5km walk with their neighbour, and indicate how long (on a slider scale from 0 to 120 minutes) and how enjoyable they thought it would be on a 5-point Likert scale (1: not at all, 5: extremely).

Exercise intentions In addition to direct questions about their intentions to exercise (defined as a sustained period of activity of at least 10 minutes) in the next week (likelihood and duration), participants were also given a role-play scenario where they could decide between a sedentary or active option to carry out the scenario task. For example, '*You leave your [2nd storey] flat and must go downstairs. You can either take the lift or the stairs. Both are equally accessible from your door. Which would you choose?*' Participants' answers in this role-play scenario were scored on a 6-point scale between sedentary and active options (1: sedentary, 6: active). This was averaged to create an overall score for active choices.

Procedure

The experiment was delivered online via Qualtrics survey platform. Participants were randomly assigned to view one of the four labels and they answered filler questions about the labels to ensure that they processed it. Then the participants took the word fragment completion task presented as part of a separate study on language ability. After this, they completed the measures for perceptions of exercise, followed by the role-play and direct questions about their exercise intentions. Finally, they provided demographic information, which included scales assessing attitudes towards health (Steptoe, Pollard, & Wardle, 1995) and exercise (Courneya, Conner, & Rhodes, 2006).

Results

The dependent variables in the experiment were analysed in a MANOVA with energy representation and label format as independent variables.

Mental availability of exercise As shown in Figure 2, more exercise-related word completions were observed for activity than calorie labels, $F(1, 124) = 3.94$, $p = .049$, $\eta^2_p = .03$. Label format had no significant effect on number of exercise-related words produced, $F(1, 124) = .17$, $p = .682$, $\eta^2_p < .01$. The interaction was not significant, $F(1, 124) = .12$, $p = .730$, $\eta^2_p < .01$.

[1] We have provided a full set of our materials on the Open Science Framework, which can be accessed via the following link: https://osf.io/49nf7/

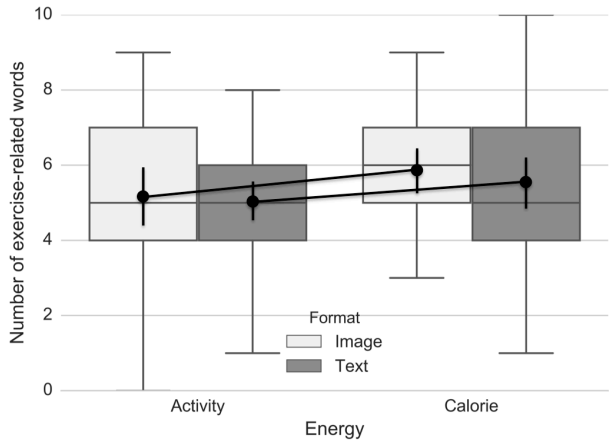

Figure 2: Number of exercise-related words produced by energy and format of label. Individual points reflect means and 95% confidence intervals.

Perception of exercise As shown in Figure 3, in the calorie condition, images led to higher walk estimates (suggesting greater perceived effort) than text, but the reverse was true in the activity condition, $F(1, 124) = 3.94$, $p = .049$, $\eta^2_p = .03$. Both main effects were not significant (energy, $F(1, 124) = .01$, p .941, $\eta^2_p < .01$; format, $F(1, 124) = .37$, $p = .546$, $\eta^2_p < .01$). The MANOVA found no significant effect on enjoyability ratings, $F(3, 124) = 1.24$, $p = .300$, $\eta^2_p = .03$.

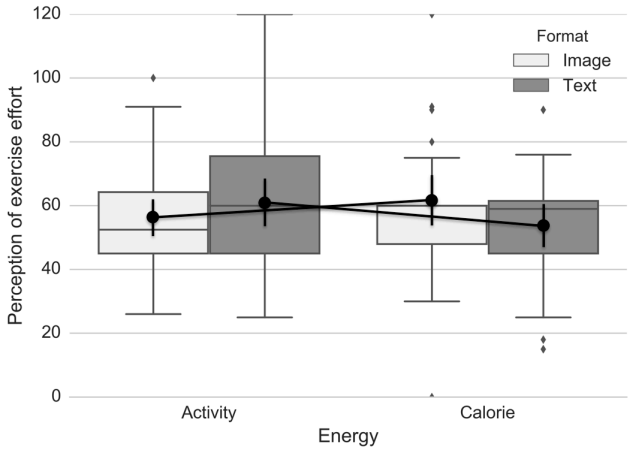

Figure 3: Perception of exercise effort (in minutes to walk) by energy and format of label. Individual points reflect means and 95% confidence intervals.

Exercise intentions Participants' estimates of exercise time per day were multiplied by their judgements of exercise likelihood to form a combined measure for intention to exercise. We excluded 15 extreme scores with estimated intention to exercise of 10 hours or more (more than 1.5 standard deviations above the mean.) The resulting distribution is shown in Figure 4.

The analyses showed no significant effect of label conditions on scores for active choice, $F(3, 124) = .37$, $p = .776$, $\eta^2_p = .01$. However, we found that energy and format interacted to determine intention to exercise. In the activity condition, choices and intentions to exercise were greater when viewing images, but in the calorie condition, they were higher when viewing text, $F(1, 124) = 8.14$, $p = .005$, $\eta^2_p = .06$. The individual main effects were not significant (energy, $F(1, 124) = .29$, $p = .591$, $\eta^2_p < .01$; format, $F(1, 124) = .77$, $p = .382$, $\eta^2_p < .01$).

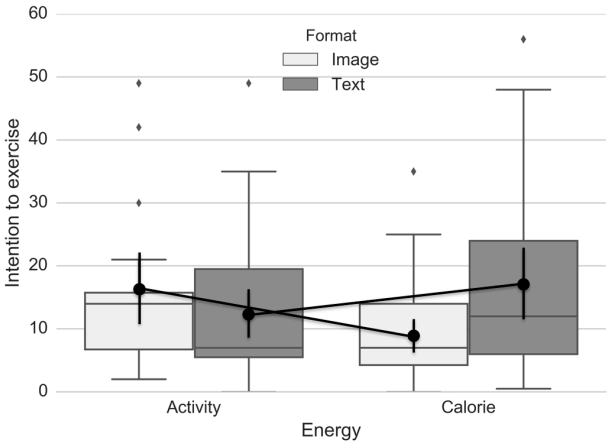

Figure 4: Exercise intentions (likelihood x intended duration) by energy and format of label. Individual points reflect means and 95% confidence intervals.

We replicated the MANOVA with age, BMI, and attitudes towards health and exercise. The analysis showed that the interaction effect for label format and energy on exercise intentions remained significant, $F(1, 117) = 6.43$, $p = .013$, $\eta^2_p = .05$. The effect of energy on number of exercise-related word completions and interaction effects for perception of exercise was no longer significant, $F(1, 117) = 2.75$, $p = .100$, $\eta^2_p = .03$; $F(1, 117) = 3.75$, $p = .055$, $\eta^2_p = .03$). The effects of the covariates on the dependent variables were also non-significant (age, $F(5, 113) = .66$, $p = .652$, $\eta^2_p = .03$; BMI, $F(5, 113) = .28$, $p = .922$, $\eta^2_p = .01$; health attitude, $F(5, 113) = .06$, $p = .255$, $\eta^2_p = .06$; exercise attitude, $F(5, 113) = .04$, $p = .422$, $\eta^2_p = .04$). We also analysed the effect of ethnicity. While Asian participants were less likely in general to pick active options in the scenario-based tasks, $F(3, 112) = 3.58$, $p = .016$, $\eta^2_p = .09$, using Pillai's trace, we found no other main effects or interactions of ethnicity with label format, $F(10, 218) = 1.16$, $p = .317$, $\eta^2_p = .05$ or energy representation, $F(10, 218) = .97$, $p = .47$, $\eta^2_p = .04$.

Discussion

Two aspects of food labels were examined for their ability to increase intentions for exercise: representing food energy value in terms of activity time instead of calories, and using images instead of text. Building on empirical findings that greater perceptual and conceptual fluency from prior exposure increases liking, it was predicted that image and activity labels would prime greater mental availability of exercise and thus increase intentions to exercise. No significant main effects of label format were found, however calorie labels generated more exercise-related word completions. Exercise was perceived as more effortful for calorie labels in image format, but more effortful for activity labels in text format. For activity labels, intentions to exercise were greater for image than text formats, but the opposite was true for calorie labels.

It has been demonstrated that priming effects in word fragment completions occur when semantic information about the prime is retrieved (Smith, 1991), which we hypothesised to be facilitated by the perceptual and conceptual fluency of image and activity labels. However, we found instead a higher number of exercise-related words generated in calorie condition. It therefore seems propitious to consider what concepts are primed by the idea of calories. This term has been used as the current standard to represent energy values on packaged food for several decades (Wartella, Lichtenstein, & Boon, 2010), and is also frequently associated with dieting and weight loss in popular media and health communications (e.g. Department of Health, 2015). While we assumed that people would have a more intuitive understanding of activity than calories, experience dealing with less intuitive but common conceptual representations may also affect semantic associations. For example, more people associate sugar amounts with grams instead of teaspoons, despite the latter being a more intuitive measurement (Vanderlee, White, Bordes, Hobin, & Hammond, 2015). We cannot rule out that repeated exposure to calories in the context of exercise allowed participants to automatically generate the concept of exercise from viewing calorie labels.

The finding that format did not affect mental availability or intended behaviours directly, but had different effects depending on whether an activity or calorie label was presented, was unexpected. We speculate that activity and calorie labels have a processing advantage in image and text form respectively. Activity image labels are suggested to be visually and conceptually easier to understand (Campos, Doxey, & Hammond, 2011), but the relative familiarity of calorie text labels (as opposed to calorie image ones) enhances its ease of processing (Zajonc, 1968). Since both calorie and activity labels showed an ability to prime exercise-related words, it is possible that the relative processing ease of activity image and calorie text labels further increased their fluency over activity text and calorie image labels and therefore the fluency of exercise associated with the label. This would subsequently drive more favourable emotions towards exercise (Song & Schwarz, 2008) and explain the increased intentions to exercise in these conditions.

Practically, our results replicated previous survey findings of increased intentions to perform exercise after viewing activity labels (RSPH, 2016) for image labels but not for text labels, where calories outperformed activity. Overall, our data indicate that activity labels did not meeting the expectations of the RSPH, albeit with small effect sizes. Nonetheless, we question whether swapping existing calorie-based food labels for activity equivalent ones would be a wise investment. The use of images with the activity labels may generate a greater influence on people's association of energy with exercise over time, since pictures have been shown to improve memory performance over repeated trials more than words (Erdelyi & Becker, 1974). However it is uncertain how long this effect would need to take hold in the population, or whether it would even surpass the current greater ability of calories than activity to generate exercise associations in text format.

However, before condemning activity labels, it would be prudent to compare activity and calorie labels to a control condition to determine if the mere presence of either label is indeed sufficient to prime exercise concepts and related behaviours. Previous work has indicated that the presence of either label on a menu can reduce energy ordered compared to a no-label condition (James, Adams-Huet, & Shah, 2015), with activity labels being slightly (but not significantly) more effective than calorie labels. This also suggests that the effects of labels could extend beyond participants' intentions to influence their behaviour, which is not a foregone conclusion from our results. Indeed, a gap between intentions and behaviour often exists, especially for exercise-related behaviours (Sniehotta, Scholz, & Schwarzer, 2005). The reporting of exercise intentions needs to be interpreted with caution, especially given the possibility that the social desirability of physical activity may prompt participants to overestimate their exercise intentions—although such an effect is likely to be consistent across experimental manipulations. Nevertheless, future research would do well to include measures that provide a more reliable indication of participants' actual exercise and food choice behaviours post exposure to different labels.

Further research should also look to replicate results with a variety of image samples for more robust consideration of the different types of activity images, as well as on a sample with more varied income and literacy levels. In our sample, nearly all respondents had completed tertiary education, which is often an indicator of higher literacy and income (McCoy, 2013). Groups with low literacy or income understand nutrition labels less well and are less familiar with calories, all of which could affect label fluency (for familiarity with calories, see Bleich & Pollack, 2010; for income, see Rothman et al., 2006, also Viswanathan, Hastak & Gau, 2009; for literacy, see Signal et al., 2008). Nevertheless, our study demonstrates the importance of psychological research in informing policy decisions and population-level health interventions.

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