Contributing or receiving – the role of social interaction styles in persuasion over a social networking platform

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Abstract

In this paper, the use of the social network platform Twitter is explored in relation to behavior change (BC) for health. We studied the effect of participation style (tweeters vs. non-tweeters) on perceived health behavior change through the constructs "social influence," "efficacy," and "pre-test health behavior." In the experiment (N = 30), participants were given a basic health message, and the tweeters were then asked to actively search, think up, and share tips and guidance with non-tweeters. Results indicate that for both tweeters and non-tweeters, efficacy and social influence were positively related, but that efficacy and perceived health behavior change are only positively related for non-tweeters. From this, we concluded that participation style can impact the effect of efficacy on target behavior. To understand the information processing in the two groups in terms of higher or lower need for cognition, we also studied the participants' thought elaboration. We found that tweeters were more distracted from elaboration on the health message, in particular those tweeters presenting a higher need for cognition. From this, we concluded that taking an active content creating role in peer-to-peer e-coaching systems may lead (a) to higher efficacy appraisal without a positive impact on BC and (b) to reduced attention on the intended behavior change message. In other words, the position of producing content may not translate into better intake of that content. In conclusion, there is a need for investigating strategies for overcoming the distracting nature of an active sharing role in e-coaching systems presented by a social network platform.

Keywords

Persuasive technology; behavior change; e-coaching; need for cognition; social network; structural equation modeling.

1 Introduction

Social media users can engage in social interaction on the Web in different ways. Some prefer to stay silent and observe what others say and do while others prefer to contribute by voicing opinions and sharing information. In the context of the social Web, sharing is interaction, a series of "mutual or reciprocal actions or influence" (Collins English Dictionary): it is an essential form of communication of thoughts, opinions, moods and other information, and ranging from general interest to the very personal in the degree to which the content being shared relates to the person sharing it. Such online interaction can be real-time, where all participants are present in the interaction situation at one and the same moment, or it can be less time-specific, with individuals simply leaving their offerings on a social platform for other individuals to find and perhaps even respond to.

Interaction involves influencing others, as described for example by Bandura's Social Cognitive Theory [3]. Such social influence has already been studied in the context of persuasive systems and technology [20, 38,51]. However, beyond recognizing the features and elements that have the potential to influence others, there is also the recipient of that influence to consider: are there some contexts of use that are better suited than others for accepting persuasive information?

Another aspect to consider is the intention of the interaction: when the focus and the purpose of the interaction are very goal-oriented, and the interaction assumes one party providing help, support, and expertise to another, we are essentially talking about coaching. Such coaching can be mediated by technology or the support role can be offered as a specific ICT system that caters for its users, as can be seen in the thousands of e-health apps available on mobile devices today. Whether the coaching is done person-to-person and is mediated by technology, or if it is a system built to persuade, the technology context defines the behavior change support as e-coaching. On social networks all interaction participants can provide and receive support which is mediated over the Web: while with one issue one participant has more knowledge or expertise, in another the support can come from someone else. One person, source or entity does not need to be the sole expert and authority. What benefits or restrictions can be found in such distributed e-coaching in a peer-to-peer network? Is coaching dependent on the coach's perceived authority and expertise [48], and can such expertise be determined based on social interaction? For example, an earlier research on more conventional lesson

and e-mail based intervention [23] found that directive coaching provided better results in a target population than nondirective or minimal coaching. But what happens when both these aspects (directive/nondirective) are present in the social situation but without a definitive authority to provide it?

While the overall context of use (where, when, how) for mobile devices is a highly necessary avenue of research in its own right, we were interested in the effects of different behavioral roles in social interaction over the Web. Namely, what is the relevance of interaction styles on the information processing for those who are active contributors and those who are more prone to simply viewing and taking in the content without actively taking part? Is the learning or persuasion result different depending upon whether a system user is a silent observer or an active contributor?

In the present study we examine the effects of different information processing styles on health behavior when the interaction takes place on a social networking platform (Twitter). The experiment observes differences between active contribution style (tweeters) and passive recipient role (non-tweeters) in the light of their information processing style (need for cognition). While the experiment itself is conducted in a very specific context of persuasion over social media, we propose that the implications are applicable in both practice and in further research in other interactive contexts that involve social media and cognitive resources. In the context of mobile HCI we see implications for any cognitively demanding content or tasks, such as e-coaching, mobile learning or collaboration over the social Web, as well as in using cognitive styles in tailoring systems to user groups.

2 Background

2.1 Social influence

In a system like Twitter that has not been built for persuasion as such there are very few purposefully persuasive system features [37]. What it does have is the ability to leverage social influence through its own core features of message delivery and network forming by means of comparison, cooperation, competition and even recognition when other users re-tweet messages or "like" them, to use the Persuasive Systems Design (PSD) feature categories by [38]. Nevertheless, how users employ all these features is up to them – just as it is equally up to them whether they use these features at all or whether

they take part in anything in any way. All technology affects its users whether on purpose or not [38], and in a social system the users are in a position to influence each other with different degrees of intent.

Social influence features in a persuasive system [38] include social learning, social comparison, normative influence, social facilitation, cooperation, competition, and recognition. Bandura's theories on social learning [2,3] are realized in a social media setting like Twitter when users see not only that other people contribute but also what they contribute. It is possible to learn from the behavior of others how to conduct yourself on Twitter – or on any such system for that matter. Users know that their followers can see any content they share, which can affect the selection and style of sharing [52]. It is enough to be aware of the presence of others even if there is no certainty of their paying attention to an individual's activity for social facilitation to take place [31]. At the same time, knowing that others are sharing similar content can act as a further encouragement to share more. Cooperation can take place through, for example, charity appeals where users perform certain behaviors in order to fulfill a common goal. Competition can be seen, for example, where social platform members engage in vying over numbers of followers. Recognition from being liked or a message being shared further will in turn encourage more of the same behavior.

If typically these social influence features focus on how people can influence each other with the support of an information system, the other aspect to consider is the effect of the influencing act upon an individual performing that act. Based on Festinger's [16] Cognitive Dissonance Theory, an experiment by Festinger and Carlsmith [17] showed how a conflict between cognition and behavior was adjusted internally when no obvious external justification for an anti-cognition behavior was available. In the experiment dissonance was reduced by changing a personal opinion so that it would be more in line with the requested behavior: participants were asked to present a tedious task as a fun and interesting one, but with no significant external reward (cash) the participants tended to adjust their view of the task to appear less tedious more so than those participants who were offered a more significant cash reward for the same representation [18].

2.2 Efficacy

When receiving a recommendation to alter behavior, the recipient can (naturally) either accept the message or reject it. Protection Motivation Theory (PMT) explains the process of accepting or rejecting a behavior recommendation via a threat message in terms of protection motivation [46]. PMT was originally based on expectancy value theory [46] but was later amended and revised by adding reward

and self-efficacy variables [47]. According to PMT, individuals engage in behaviors that aim at reducing a given risk when they have high protection motivation 19]. In essence, PMT posits that upon receiving a message that presents a threat, for example negative health consequences of a bad diet, individuals will respond to the threat by considering the source, the severity and the cost of the threat and the behavior required to avoid it, reaching eventually a high or low protection motivation state [19]. Low motivation will lead to the threat being rejected, whereas high motivation will lead to acceptance of the threat and to potential behavior change (ibid.). The likelihood of that behavior change can be assessed through response efficacy and self-efficacy: is the recommended behavior likely to reduce the risk significantly enough in an individual's view, and how capable do such individuals see themselves of producing the recommended behavior (ibid.)?

2.3 Need for cognition

The two basic routes of information processing, according to the Elaboration Likelihood Model [43], are central and peripheral. In central processing careful consideration of a message or of issue-relevant information takes place and this consideration (elaboration) will result in generating positive or negative thoughts toward the issue [43,41]. Central processing requires both motivation and ability, and is susceptible to distractions, to how often a message is repeated, and to perceived personal relevance of a message [43,41]. Confidence in one's thoughts can also influence the formation or change of attitude [42]. One major factor in elaboration is the individual's tendency to enjoy engaging in analytical and effortful thinking, that is, the need for cognition (NfC) – which typically for those who use the central route tends to be high [43].

Peripheral thinkers rely more on cues and heuristics and as individuals are not so prone to enjoy effortful thinking and high elaboration [43]. The reasons for the tendency can involve a lack of motivation or ability, or both [41]. Peripheral processing does not mean that persuasion does not take place – it simply relies on different mechanisms, such as the above-mentioned heuristics and cues, and also affective states (eliciting a happy state that is associated with the advocated message, thus generating classical conditioning) [41]. The change that comes through the peripheral route is generally not considered to be as sustained as a change that is achieved through the central route [43] but can work in short term change and compliance [41].

2.4 Trailblazers and tracers

On the Web people have always had the option of participating or simply observing. Oinas-Kukkonen and Oinas-Kukkonen [39], building on concepts by Bush [7], discuss the roles of 'trailblazer' and 'tracer' in online interactions, and how the social web both needs and thrives on trailblazers. Such trailblazers make wading in the information flow of the Web easier for others and enable social navigation where other Web users know what information to pay attention to by following those users they have found capable of providing pointers to content that is relevant and interesting [39]. Such control affects how for example persuasive information is processed [28].

Those who do not wish to provide the trails, but prefer instead to follow and observe from the sidelines (tracers, also referred to as lurkers), tend to form a majority of users [32,34], but that is not to say that the roles are fixed: a tracer in one context may well be a participating contributor in another, and the two roles need each other in the ecosystem that is the social Web [39]. It is, then, this continuous dynamic of interaction where some contribute and others receive that creates a persuasive system in which one user can achieve a mastery experience by sharing the right things and another can assess information validity by selecting the right people to follow.

The power of opinion leaders in social media is widely acknowledged. For example, brands identify individuals who attract large numbers of followers on platforms like Instagram and then sponsor these individuals to include the brand in their communications to such an extent that this has become a veritable industry [8]. Little wonder that influence is considered a major asset on social media [29]. In marketing, the most valuable opinion leaders tend to be domain specific (not universally as influential in every topic) [30], which suggests that it might be possible for some individuals to rise to an opinion leadership in a social network setting through being perceived to have expertise or specific insights in the specific topic under discussion.

2.5 Twitter as a Behavior Change Support System (BCSS)

A Behavior Change Support System (BCSS) is a system that has behavioral and psychological outcomes as the basis of its design and that intends to "form, alter, or reinforce attitudes, behaviors or an act of complying without using coercion or deception" [37 p. 1225]. Such a persuasive system, then, has been created with the defined and analyzed intent of affecting its user's behavior or thinking in some way, and to do so openly. In the present experiment the information system selected is Twitter, which in itself does not comply with the definition of a BCSS. However, considering the social

influence that can be leveraged over Twitter together with the requirement of intention, we can see that, in some specific contexts, Twitter can indeed be regarded as a BCSS: there is an intent to change behavior by engaging users to interact around a set topic, in the present case that of healthier eating.

Using social media as a delivery channel for supporting health behavior change has also been studied for example by Pechmann, Delucchi, Lako, and Prochaska [40] in a Twitter-based experiment on smoking cessation, finding that such an approach was twice as effective as other methods in helping smokers to give up smoking. In view of the fact that systems can employ self-referential persuasion in order for users to keep using the system, and also the finding that by creating value and content and by involving others users remain active and more loyal to a system [36], it seems natural and even necessary to explore the benefits of using already familiar systems as instances of BCSSs. In the context of purposeful support and help towards improved health lifestyles, BCSSs can be seen as e-coaching systems.

3 Method

The present experiment was designed to observe the role of participation style (active vs. passive) in a behavior change context over the Web. A between-subjects design (N=30) divided participants in to one of two conditions for an experiment that involved either contributing by tweeting (group A) or merely reading the tweets in the specified Twitter feed (group B). The participants were assessed for their need for cognition as a part of the experiment.

3.1 Model and hypotheses

The research model developed for this study (Figure 1) illustrates the constructs of social influence (SOCI), efficacy (EFFI), relevant thoughts (RELT), pre-test fruit and vegetable intake (PRVI) and finally perceived health behavior change (PHBC), and their hypothesized relationships. Our central hypothesis and prediction in the present study focuses on the role of RELT on EFFI, leading to PHBC. Key interest in the present study is the process of persuasion and behavior change in the social Web environment, and we are therefore also interested in how SOCI contributes to EFFI. Participants' existing eating habits cannot be discounted when considering factors that influence post-test behavior, since it is reasonable to expect that participants who already before the experiment had the habit of eating plenty of fruit and vegetables would also be likely to carry on doing so after an experiment that

encourages such behavior. Group division for tweeters and non-tweeters (group A and group B, respectively) and need for cognition (NfC) appraisal (higher and lower) were used as category variables in the present experiment.

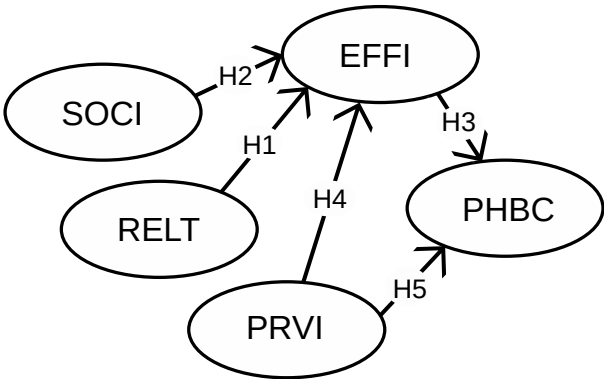

Fig 1 Research model and hypotheses.

Relevant thoughts (RELT). As discussed in the section Background, the Elaboration Likelihood Model (ELM) [43] proposes that individuals have different tendencies in how they engage in thinking and analytic activity. The basic description of these tendencies is high and low need for cognition (NfC) (Ibid.). Thought listing is a method for gauging an individual's elaboration activity and style regarding a topic [43,27,10]. The assumption behind the method is that high elaboration activity will produce a high number of thoughts, and high NfC individuals will produce a higher proportion of relevant thoughts to irrelevant thoughts. 'Relevant' here means thoughts that focus on and consider the persuasion topic in question. By observing the number of relevant to irrelevant thoughts we should be able to observe the elaboration activity and style during the tweeting (and reading the Twitter feed) task.

H1: High proportion of relevant thoughts in the thought listing procedure scores indicates high and meaningful level of topic elaboration, which shows as a positive effect on the efficacy appraisal.

Social influence (SOCI). A composite of a selection of social influence indicators that are based on the factors presented in the PSD model [38], this construct includes social influence features related to direct comparison. Social comparison, recognition and social facilitation are features where the influence is leveraged through an individual's comparing himself or herself to others in the social context. On the whole, social influence can take place when a person observes the behaviors of others. The theoretical basis for observation-based persuasion largely comes from Bandura's Social Cognitive Theory and Social Learning Theory [2,3,5], which propose that as social learners watching others we are presented with the models and patterns for different situations, and that we can then apply these

models and patterns to ourselves. Social influence can also take place merely through awareness that we are being seen or watched by others [52,31], or through knowing that there are other people, similar to us, who are engaged in some specific activity – such as donating money to charity, spreading a disaster fund appeal on Facebook, or revising for exams. Receiving praise or recognition from peers can offer an individual encouragement and confirm the present course of behavior in such a way that provides a boost for self-efficacy as regards that particular behavior.

H2: Social influence has a positive effect on the efficacy appraisal.

In order to maintain a parsimonious approach to our model development we have not included any relationship between social influence and the behavior change outcome in this model. These relationships have been studied in closer detail by Stibe and Oinas-Kukkonen [51] and Stibe, Oinas-Kukkonen, and Lehto [50].

Efficacy (EFFI). The efficacy construct in the present model comprises indicators for self-efficacy and indicators for health message promoting response efficacy. Protection Motivation Theory (PMT) proposes that both self-efficacy and response efficacy must be judged at a sufficiently high level in order for an individual to reduce a perceived (health) threat by means of adopting the behavioral recommendations of the message [47]. Sufficient belief in one's own ability to carry out the recommended behavior, combined with sufficient belief in the efficacy of the message (by doing this it is possible to avoid the health threat), leads to a higher likelihood of message acceptance. Message acceptance is an important element in subsequent health behavior change. As both self-efficacy and response efficacy are required, the two have been combined into one construct in the model.

H3: Efficacy has a positive effect on perceived health behavior change.

Perceived health behavior change (PHBC). The interest in subsequent health behavior in the present study focuses on short-term (immediate) response to the health message, measuring the perceived health behavior change after the experiment. This single variable construct is made up of open-ended responses by the participants, categorized and then constructed into a scale from no perceived change to perceived change in behavior. Instead of using another food diary that measures one day very close to the experiment (when people may have already planned their food earlier on), the selected approach offered the participants a broader freedom to reflect on how they made their food choices after the experiment. The scale development for this construct is described in further detail in the section Measurement instruments.

Pre-test fruit and vegetable intake (PRVI). A single-measure construct PRVI offers an indication of the participants' fruit and vegetable consumption habits before the experiment. The participants' existing healthy eating habit may dictate the impact on perceived health behavior change in the sense that if participants are already eating plenty of fruit and vegetables before the experiment they are not likely to stop doing so after the experiment. However, receiving confirmation for the correct behavior that one is already engaging in could well increase one's sense of efficacy and encourage continuing or even further improving the target behavior. It should be noted that the experiment design did not try to measure if existing attitudes or habits were reinforced by the exercise.

H4: Existing health behavior has a positive effect on efficacy appraisal.

H5: Existing health behavior has a positive effect on perceived health behavior change.

Category variable: Need for Cognition. Using a need for cognition scale [11], experiment participants are assessed for their tendency for central or peripheral information processing. This tendency is then used as a lens for observing elaboration activity in the test conditions (active contributor vs. non-contributor).

H6: Higher need for cognition participants will produce more relevant thoughts in the experiment, thus affecting their efficacy appraisal.

Category variable: Active contributor and non-contributor. Two different activity types in online interactions have been identifiable from early on in the Web context: some people are active in sharing and contributing while others are happier with silent observation. In the experiment one group of participants were given the task of contributing (sharing) information, knowledge and experiences over Twitter with "others", thus forming the contributor group. Meanwhile, another group were instructed to simply observe the communication that takes place on Twitter, thereby forming the non-contributor group. Thus while both groups were subjected to the exact same content, participants in one group generated some of that content themselves. The two groups are a category variable in the present experiment and used as the basis for subgroup analysis.

Cognitive Dissonance Theory [16] posits that individuals strive towards consistency. If actions and cognition are not in line with each other, an individual will experience dissonance and will resort to a dissonance reduction process. In the case of endorsing healthy eating the test participants may not be experiencing a strong conflict in terms of their beliefs; they may well already be in agreement with the health message in question. However, by endorsing the message they will need some internal

justification for their behavior. By justifying their behavior ("I am endorsing this message because I believe in it") the actively contributing group are more susceptible to being persuaded by the health message. On the same grounds we expected the response efficacy appraisal to benefit from the act of endorsing the message.

H7: Active contribution style has a positive effect on efficacy.

4 Measurement instruments

The present study employs a combination of previously developed and validated instruments as well as ones that have been adapted from their original form to better match the research and problem domain. Previously validated instruments are efficient, but do not necessarily produce the best match in another context [6]. The indicator loadings for the constructs are presented in Appendix 1.

Health behavior: fruit and vegetable consumption and perceived behavior change. A simple open-ended questionnaire was provided both before and after the test. The participants were asked to list everything they had eaten the day before and to try and estimate specifically the consumption of fruit and vegetables as portions. Estimating portion sizes was an element of the health message provided in the test situation. The open-ended form approach was adapted from Epton and Harris [14], with the difference that the present experiment took the form of a group session and relied on participant independent self-reporting rather than on the experimenter recording the amounts of fruit and veg by means of picture prompts. The test session included a presentation that gave guidance in estimating portions of fruit and vegetables. On the whole, Cox [13] has found that, after guidance, the portion-based estimations of fruit and vegetable consumption are realistic and reliable. In the present experiment the interest was largely focused on immediate compliance with the health message, and so for the post-test consumption measure the same open-ended one-day record was selected. The purpose of the post-test listing of food was to support participants' reflection on their behavior and thoughts.

The post-test questionnaire concluded with an open-ended question: "Have you noticed any difference in your food choices after taking part in the experiment? Please describe." A verbal, direct, question was selected for this item in order to probe the participants' cognition: how they observed their own behavior and thoughts after the experiment. The responses were then analyzed and broken down into single statements. The statements were categorized and the categories were assessed for any patterns. The analysis and observation resulted in four distinct categories of responses: no effect,

increased awareness or thinking about food, intention to improve eating behavior, and finally a change in eating behavior (towards the target behavior of increased fruit and vegetable consumption). The categories were placed onto a scale from 1 to 4, where 1 signified no effect and 4 indicated a change in behavior.

The selected measure for post-test health behavior is one that indicates perceived effect of the participation in the interaction and test. In such an experimental setting it is not possible to extract the experiment situation (specific event, questionnaires, health message, etc.). By forming the scale from open-ended questions the scale then included items that participants actually observed instead. Alternative approaches could have been ones using more than one item in a scale querying intention, perceived change and participants' awareness of increased reflection (three items). However, these items would have had to be pre-set and thus imposed upon the participants, whereas through open-ended questions the items revealed themselves from the written answers.

Efficacy measures. Self-efficacy was measured using four items adapted by Epton and Harris [14] for the purpose of fruit and vegetable consumption from Fuchs, Leppin, Schwarzer, and Wegner [22]. The scale items included both positive and negative statements such as "I can usually resist temptation of delicious, but unhealthy food" and "I doubt if I can manage to eat at least 5 portions of fruit and vegetables each day". Responses to the statements were collected on a four-point scale ranging from 1= "not at all true" to 4="exactly true".

Response efficacy was also measured using a set of items devised by Epton and Harris [14]. The scale included six items that were based on the health message in the experiment. The items were both promoting and preventative in style, for example: "My chances of experiencing heart disease and some cancers in the future, if I do not eat at least 5 portions of fruit and vegetables are…" and "Eating at least 5 portions of fruit and vegetables each day will improve my health by boosting my immune system". The responses were collected on a seven-point scale where 1 indicated a negative response (disagree/not at all likely) and 7 indicated a positive response (strongly agree / very likely). The same efficacy measures have also been used by Fielden, Sillance, Little and Harris [18] in studying fruit and vegetable intake in an online self-affirmation context.

Both self-efficacy and response efficacy are required for potential behavior change, and we combined these measures into a single efficacy construct in the present model and study. The combination was made as part of the parsimonious approach to model construction that was applied in

this experiment. In order to maintain internal consistency of each construct in the model, special attention was paid to the efficacy construct, and our explorative analysis revealed that the preventative response efficacy items differed from the promoting ones and the self-efficacy items in terms of internal consistency. As a result, the indicators for the efficacy construct were selected on the basis of their contribution to internal consistency (selected items are listed, with their loadings, in Appendix 1).

Social influence. Social influence was measured using instruments adapted from earlier studies on socially influencing systems [38,50,51]. These instruments were adapted to match the problem domain and system relevant to the present study. The instrument used 1 to 5 scales with statements about social comparison, social facilitation and recognition, with 1 indicating 'disagree' and 5 'agree'.

Need for cognition. Need for cognition scale, developed first as a 34 item scale by Cacioppo and Petty [9] and further developed into the shorter 19 item scale used in the present experiment by Cacioppo, Petty and Kao [11] was used to measure participants' message elaboration tendency (peripheral vs. central). The scale consists of 19 items, rated between -4 and 4. Thus the lowest possible score is -72 and highest possible score is 72. The scale is described in [11].

Relevant vs. irrelevant thoughts. Thought listing procedure is a way of measuring elaboration activity. At the end of the experiment the participants were asked to think back to their own thoughts during the tweeting period of the experiment, then write down whatever thoughts they could remember. The instruction included guidance to try and write just one thought per text box provided. The form was on paper, but the pages had 24 empty boxes printed on them to provide a visual cue for entering the thoughts. The participants were also instructed that they were allowed to write more thoughts and extra paper was available for this by asking the moderator. The thought listing technique was based on Cacioppo and Petty [9], Hepner, Wampold, and Kivlighan, [27], and Cacioppo, von Hippel and Ernst [10].

The purpose of thought listing (also known as verbal protocol analyses) is to provide insight into the cognitive assessments that take place during an activity, as opposed to measuring behavioral outcomes or using other structured assessments [10]. The dimensions of analysis were reduced to relevant vs. irrelevant in the present experiment. This was, for the most part, because of the desirability aspect of any healthier lifestyle concept: it would be difficult for many people to indicate a negative thought toward a relatively well-known health message and measuring the valence (positive vs. negative thoughts regarding the topic) would likely result in a ceiling effect. The analysis assumptions

of thought listing are that a) people with a high need for cognition will produce a larger number of relevant thoughts than irrelevant thoughts, b) people with a low need for cognition do not show such a clear pattern of relevant over irrelevant thoughts. The collected thoughts were checked and unitized where necessary (if a statement box on the response form contained more than one recognizable thought), and the statements were then coded as per a priori categories of 'relevant to topic' vs. 'irrelevant to topic'. A crude division, its purpose and aim was to rake over the thought processes of the participants in the experiment to see how they handled the health message during the experiment. Two researchers, one who was not directly involved with the design or analysis in the present experiment, coded the statements independently without seeing the details of the experiment conditions. On any assessment where the coding differed, the researchers discussed and compared basic criteria of the statements in order to find a unanimous decision. Where it was difficult to justify coding for 'relevant', 'irrelevant' was chosen. Less than 10% of the total of 249 statements came under discussion in the process. Relevant category included such statements as "*it's not that difficult to eat 5 portions if you try a little*" and "*I liked the suggestion of trying new fruits every week. There are so many different kinds…"* Irrelevant category included such statements as "*I wonder how many vegetables Chuck Norris eats (probably doesn't need them, they need him :))*" and "*carrot clarinet video is very interesting, it is not about healthy eating but I re-tweeted*".

5 Materials

Health message. The health message in the experiment focused on the role of fruit and vegetables as part of a healthy, balanced diet. Specifically, the message promoted the National Nutrition Council recommendation of eating at least 500g of fruit and vegetables per day. The guidance and recommendation also suggests achieving the target by trying to divide the amount into 5-6 portions of 80-100g, also giving examples of what constitutes such a portion, and how much of the total 500g should be fruit and berries and how much should be vegetables. The material also provided information about a healthier diet being a factor in the avoidance of various illnesses and health risks. A focused health message in a form of a short presentation and leaflet was created on the basis of the 2014 guidance material [44].

Sample selection. The sample in the experiment was one of opportunity made up of volunteers recruited from all parts of the research institution (approximately 17,000 students and 3000 staff). The

recruitment was undertaken via a blanket e-mail and also by handing out flyers. As a result a total of 37 people approached the researchers and volunteered for the experiment, choosing a time most suitable for themselves from a selection of test sessions provided by the researchers. In the end 30 people participated in the test sessions. The recruitment message provided a selection of session times for potential participants to choose from, explained that the experiment used Twitter and was related to health behavior, and also noted that Twitter experience or a personal Twitter account were not necessary: the participants simply had to have a device that they could use for Twitter.

Procedure. The experiment was conducted in six sessions. The participants were divided into two groups at the start of each session. Where possible the researchers aimed at an equal gender division between groups. The two groups went to two separate classrooms. Since it was not possible to know ahead of time exactly how many participants were going to attend each session, the division into groups had to be undertaken at the start of the sessions as the session participants arrived in the lobby outside the two classrooms. In this way the researchers could achieve a close-to-equal number of participants in both groups. One of the session moderators directed participants to the rooms applying an 'A-B-A-B' division: one person to room A, the next person to room B. The division was done in order of arrival or, where more people were present at once, in the order based on where the participants were standing in the lobby (going around the lobby, assigning everyone in turn). Gender division was achieved by applying the A-B division separately for males and for females. No other participant profile was applied pre-test apart from this gender division.

Once separated into two groups (group A and group B), the participants were informed of the overall outline of the experiment session and of what they were expected to do. To begin with, the participants were handed the experiment response booklets and Twitter account details were given to those who did not have an account already or who did not want to use their own account for this experiment. The booklet included experiment information (as explained also at the start of the session) and a consent form as the first items to be filled in.

Before filling in the pre-test part of the booklet, participants were provided with the health message (a short presentation) and handed printed material that repeated the presentation content. Group A was assigned the active participation role, where they were given the task of promoting the "half a kilo a day" message on Twitter. To set a context, group A was asked to think of a situation where they had decided that they could help their peers with a healthier lifestyle either out of general

interest or because perhaps they knew someone who could benefit from such support. In this scenario they had learned about a Twitter discussion topic and they were now to take part in the discussion.

Group A participants were asked to use any Twitter features they wanted to and were encouraged to use other Web resources as well as to draw upon their own experiences and the distributed written material as the basis of the messages they would send via Twitter. The participants were instructed to follow the set topic (#puolikgoulu in the Finnish sessions, #halfkgoulu in the English sessions) and to tweet using that same topic. Twitter instruction was left projected on the wall, and then a tweeting period of 15-20 minutes started. The variance in the tweeting time depended largely on the group dynamic and the pace of messaging. To ensure a comfortable flow and to see that the participants did not have to feel as if they were the first to start, research assistants were planted discreetly into the group of participants and they tweeted a number of messages simply to get the ball rolling. These messages were on a par with the participant contributions in terms of expertise: they focused on simple, every-day tips and did not include any specialist knowledge about the topic. Meanwhile, group B was assigned to the passive condition in the experiment. It was explained to them that their task was to learn about beneficial health behavior simply by following a Twitter feed under the instructed topic. As a scenario, the participants were asked to imagine themselves in a situation where they had come to think that they could benefit from healthier eating, and that they had come across a discussion topic on Twitter that they thought might be helpful to them.

After the Twitter period, the moderator in both groups thanked everyone and asked them to turn to the post-test pages of the response booklet and to complete all remaining sections. Participants were also reminded that the experiment included one more short online questionnaire to be filled in at the end of the following day, after which time they would be entered in a small prize draw (two prizes with a value of 50€ each). As participants completed their questionnaires and were about to leave, the moderator also discreetly pointed to a plate of fruit near the room exit, inviting participants to help themselves to a snack.

In the early evening of the following day all the participants were e-mailed a link to an online questionnaire on their food intake in the last 24 hours. The question was open-ended and like its pre-test counterpart it asked the participants to try and report their fruit and vegetables intake as portions. As the last item of this questionnaire the participants were asked (open-ended again) if they thought taking part in the experiment had affected their food choices.

6 Data analysis and results

For the Partial Least Squares Equation Modeling (PLS-SEM) analysis of the research model (Figure 1) we used SmartPLS v.3.2.1 [45]. In terms of sample size, the present study satisfies a generic rule of thumb of ten times the largest number of paths directed at a particular construct [25]. In addition to PLS-SEM analysis, we conducted analyses of variance (ANOVAs) and t-tests as a means of observing inter-group differences in variance.

6.1 Sample characteristics

Total sample size in the study was 30 (14 female, 16 male), with ages distributed from 21 to 48 years (31 years of age on average). The participants were recruited predominantly from a university-wide mailing list. Table 1 lists the key characteristics of the sample in the present study. The NfC assessment was done by finding the point in the scores that allowed half the participants in an upper (higher) segment and the other half in the lower segment (median split). The lowest NfC score in the whole sample was -10 and the highest was 35. The technical minimum and maximum on the scale was -72 and 72, and in those terms the sample here presents rather a central tendency.

Sample characteristics (N=30)	**Value**	**Frequency**	**%**
Group	A	16	53
	B	14	47
	Higher NfC	15	50
	Lower NfC	15	50
Gender	Female	14	47
	Male	16	53
Occupation	Student	21	70
	Other (employed, unemployed, home-maker, self-employed)	9	30
Twitter	Previous Twitter experience	21	70
	No Twitter experience	9	30
Length of Twitter experience (for those who had used)	Less than a month	5	17
	A year or more	16	53

Table 1 Experiment sample characteristics

While dichotomizing the scores is known to reduce the statistical power of the results and also lead to loss of detail as regards the descriptiveness of the observations, in the present study we opted for this method instead of using a continuous predictor for three reasons: a) to complement the PLS-SEM with analysis of variance (ANOVA), b) to explore the difference at a level that would be reasonably applicable to practical system design (i.e. aiming at a system for higher or lower types) and c) the limited sample size would have been a hindrance to a truly superior regression. As a concession the present analysis takes great care not to present the NfC appraisals as “high” or “low” per se, but

only as “higher” or “lower” in relation to each other. Such a definition was deemed to be adequate in a situation where the study’s explorative objective was to see if a difference in this characteristic had any potential to show an effect. Also, as regards designing persuasive systems, tailoring to a group characteristic is somewhat simpler than personalizing at individual level, and therefore our interest is in exploring the potential of NfC tailoring. Dichotomized handling of the scores does not increase the risk of type II error and any detected effect would therefore work as an indication that the NfC characteristic would be something to study in the present context.

6.2 Measurement model

PLS-SEM analysis examines the relationships of latent variables, demonstrating explained variance (R^2 values) in these latent variables (also called constructs), and indicating the strength (β -values) of the relationships in the model as well as the statistical significance of these relationships [24,26]. The analysis takes place in two phases: the measurement model is evaluated first, after which the structural model is assessed.

The measurement model was assessed by observing the internal consistency, the reliability of the indicators and convergent validity and the discriminant validity. Table 2 illustrates the descriptive statistics for the study (internal consistency, indicator reliability, and discriminant validity). The collected data had only one missing value in one of the multi-item instruments, the need for cognition scale. With that being only one value in one scale, we omitted the item and formed the final score for that factor without it so that for one participant the NfC appraisal is made of 17 items rather than 18. Both Cronbach’s alpha and composite reliability were used for assessing internal consistency of the model. For indicator reliability we looked at average variance extracted (AVE). When indicator loadings and internal consistency are above .708, they are generally considered acceptable, though for explorative studies values over .6 are acceptable [25,35]. In the present study composite reliability is .848 and .890 for efficacy (EFFI) and social influence (SOCI) respectively, Cronbach’s alpha is above .7 for both of these items, and the AVE values are above the recommended .5 [21] for both items as well.

	CA	**CR**	**AVE**	**1**	**2**	**3**	**4**	**5**
1. EFFI	.769	.853	.593	**.770**				
2. PHBC	1.000	1.000	1.000	.348	**1.000**			
3. PRVI	1.000	1.000	1.000	.235	-0.249	**1.000**		
4. RELT	1.000	1.000	1.000	.280	.157	-0.239	**1.000**	
5. SOCI	.859	.891	.544	.606	.334	.036	.186	**.738**

Table 2 Internal consistency and indicator reliability assessment. CA= Cronbach's Alpha, CR= Composite Reliability. Convergent reliability is indicated using Average Variance Extracted (AVE) value and Fornerll-Larcker analysis. Square root of AVE and inter-construct correlations are given as a bolded value. PHBC, PRVI and RELT constructs were loaded with a single indicator

The indicators for the multi-indicator constructs of social influence (SOCI) and efficacy (EFFI) came from existing scales used in health behavior and persuasive systems research. Where necessary, these scales were adapted for the context where necessary. Despite originating from validated instruments, the indicators for SOCI and EFFI contained some items that were found to cause problems with the internal consistency of the constructs. Such items were therefore removed from the constructs [25]. The remaining constructs of pre-test fruit and vegetable intake, relevant thoughts (RELT), and perceived health behavior change (PHBC) were single-indicator constructs. The section Measurement Instruments describes the selection and development of the instruments in closer detail.

6.3 Structural model

As seen in the research model (Figure 1), we hypothesized that the amount of relevant thoughts on the experiment topic (healthy eating, eating more fruit and vegetable) would have a positive effect on an individual's efficacy appraisal, leading to a positive effect on perceived health behavior change post-test. We also hypothesized that the style of interaction (active vs. passive) would have a bearing on the overall outcome of the experiment (namely, perceived health behavior change). In order to see what role pre-experiment eating habits had on the other constructs, we included the pre-test fruit and vegetable intake measure. Figure 2 illustrates the results of the PLS analysis of our research model.

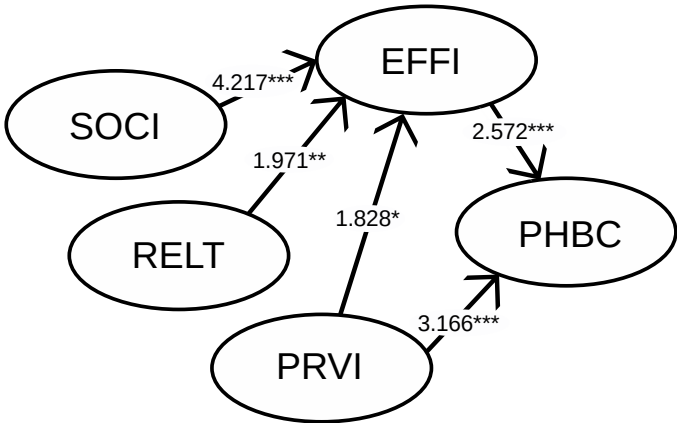

Fig 2 Structural model. ***p<.01, **p<.05, *p<.10.

In testing the research model we obtained the path coefficients and explained variances using parametric Bootstrapping (5000 samples, parallel processing, no sign changes). The constructs in the

model were reflective. The complete model shows that 47% of the variance in EFFI was explained by SOCI, RELT, and PRVI. 28% of the variance in PHBC was explained by EFFI and PRVI.

6.4 Total effects and effect sizes

By assessing the total effects and effect sizes (f^2), we determined the practical relevance of the model. Using values of .02 (small), .15 (medium), and .315 (large) to guide the assessment [12], a latent construct's contribution to another one [25] can be evaluated. In the presented model there were four medium and one large f^2, and all the effects were valid (see Table 3). On the basis of the effect sizes it is reasonable to conclude that the model does have some practical relevance.

	EFFI	**PHBC**	**PRVI**	**RELT**	**SOCI**
EFFI		.307 (med)			
PHBC					
PRVI	.131 (small)	.172 (med)			
RELT	.100 (small)				
SOCI	.544 (large)				

Table 3 Total effects and effect sizes (f^2)

6.5 Predictive validity of the model

In order to observe the predictive validity of the model we used the blindfolding procedure. The Stone-Geisser cross-validated redundancy value (Q^2) is considered to suggest predictive validity of endogenous constructs when the value is above 0. Both efficacy and perceived health behavior change demonstrate $Q^2>0$, thus indicating predictive relevance (table 4).

Construct	**Q^2**
Efficacy	0.220
Perceived health behavior change	0.190

Table 4 Predictive validity of the model: Q^2 values for endogenous constructs.

6.6 Sub-group analysis

The experiment involved two test conditions (tweeting vs. non-tweeting, group A and group B respectively) and the participants were also assessed for their NfC tendency (higher vs. lower). We observed the differences in the coefficients and explained variances between these groups by running the PLS analysis with bootstrapping (5000 samples) for all groups. The coefficients and variances are illustrated in tables 5, 6, 7 and 8. The NfC differences were observed regardless of contribution style test condition (group A or B).

	B Subgroup A (N=16)	B Subgroup B (=14)	β Full (N=30)
EFFI →PHBC	.674 n.s.	2.479**	2.572***
PRVI→EFFI	1.1212 n.s.	1.408 n.s.	1.828*
PRVI→PHBC	2.829***	1.111 n.s.	3.166***

RELT→EFFI	.329 n.s.	.990 n.s.	1.971**
SOCI→EFFI	7.622***	1.681*	4.217***

n.s. non-significant, *p<.1, **p<.05, ***p<.01

	B Subgroup HNfC (N=15)	**B** Subgroup LNfC (=15)	**β** Full (N=30)
EFFI →PHBC	.780 n.s.	2.821***	2.572***
PRVI→EFFI	2.335**	.007 n.s.	1.828*
PRVI→PHBC	1.387 n.s.	1.533 n.s.	3.166***
RELT→EFFI	1.769*	.790 n.s.	1.971**
SOCI→EFFI	1.195 n.s.	3.346***	4.217***

n.s. non-significant, *p<.1, **p<.05, ***p<.01

Table 5 Path coefficients for the tweeter and non-tweeter (A and B) sub-groups and full sample

Table 6 Path coefficients (β) for the NfC groupings (higher and lower NfC) and full sample

Examination of the path coefficients showed that for group A (tweeters) the paths from PRVI to PHBC and from SOCI to EFFI are significant. For group B (non-tweeters) EFFI to PHBC and from SOCI to EFFI relationships are significant. Table 7 illustrates the path coefficients and the significances. In other words, for the tweeting group existing eating habits (indicated by PRVI) feature in PHBC, and SOCI boosts the efficacy appraisal; for the non-tweeting group PHBC is closely linked to their efficacy appraisal and EFFI is somewhat linked to SOCI. For tweeters (groups A) SOCI, RELT and PRVI explained 79% of the variance in EFFI, and EFFI and PRVI explained 25% of the variance in PHBC. For group B SOCI, RELT and PRVI explained 57% of the variance in EFFI and EFFI and PRVI explained 41% of variance in PHBC – in other words, a more leveled contribution between the studied constructs compared to group A.

Examining the paths between the two NfC levels (higher and lower), we can see that for participants in the higher half the paths from PRVI to EFFI and from PRVI to PHBC are significant. For the lower NfC group paths from EFFI to PHBC and from SOCI to EFFI are significant (Table 8). In the higher NfC group 71% of the variance in EFFI was explained by SOCI, RELT and PRVI, and just 19% of the variance in PHBC was explained by EFFI and PRVI. In the lower NfC group 59% of the variance in EFFI was explained by SOCI, RELT and PRVI, and as much as 39% of the variance in PHBC was explained by EFFI and PRVI.

	R^2 Subgroup A (N=16)	R^2 Subgroup B (N=14)	R^2 Full (N=30)
EFFI	.788 (79%)	.573 (57%)	.466 (47%)
PHBC	.248 (25%)	.474 (47%)	.282 (28%)

Table 7 Variances explained (R^2) for tweeting and non-tweeting sub-groups (A and B) and full sample

	R^2 Subgroup HNfC	R^2 Subgroup LNfC	R^2 Full (N=30)

	(N=15)	(N=15)	
EFFI	.710 (71%)	.588 (59%)	.466 (47%)
PHBC	.185 (19%)	.385 (39%)	.282 (28%)

Table 8 Variances explained for higher and lower NfC sub-groups and full sample (HNfC for higher NfC and LNfC for lower NfC)

6.7 Need for Cognition, elaboration activity and thought relevance

We wanted to observe the possible interactions and differences between our independent variables of contribution style (tweeter and non-tweeter, A and B respectively) and NfC appraisals ('higher' vs 'lower') from a slightly different angle, using analyses of variance. The reason for examining the relationships between NfC appraisals, group divisions and thought listing results was to gain a better insight into how these variables influence each other, and to see if there is a tendency or a pattern to be detected at this level of observation.

On the whole, higher NfC participants in group A (tweeting) listed fewer *relevant* thoughts (M 4,0) than the lower NfC participants (M=6,4). In group B, the higher NfC participants still produced fewer relevant thoughts (M=6.9) than Low NfC participants (M=7.6), but in this group the difference is not so marked. The same analysis for the number of *irrelevant* thoughts shows that the higher NfC participants in group A listed more irrelevant thoughts (M=3,4) than the lower NfC participants in that group (M=1,6). In group B lower NfC participants listed some more relevant thoughts (M=1,7) than higher NfC participants (M=1,6), but in this group this difference in the average is negligible. Figure 3 illustrates the differences for both NfC appraisals as regards relevant and irrelevant thoughts (average) per contribution style group (A and B), and overall. The interesting observation from Figure 3 is that overall, both cognitive styles (NfC) listed more relevant thoughts than irrelevant thoughts, but for lower NfC participants the gap between relevant and irrelevant is a little wider than the gap for higher NfC participants. At first glance this might suggest that the lower NfC participants have focused their elaboration activity more on the topic of the session. The difference between the A and B groups by NfC categories is not marked in most of the other comparisons either: lower NfC participants are quite close together in terms of relevant and irrelevant thoughts, and higher NfC participants are not very far apart in the relevant thought comparison. However, the patterns become more interesting when observing the groupwise differences of relevant thoughts with the higher NfC participants: these participants have clearly listed fewer relevant thoughts in group A than in group B. Figures 4 and 5 further illustrate these patterns.

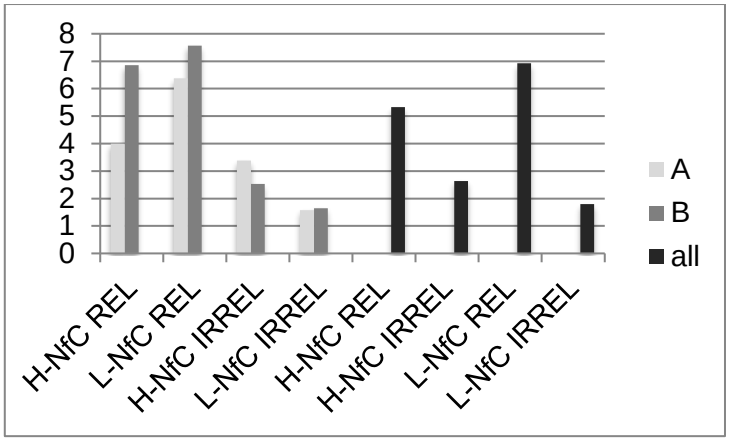

Fig 3 Average number of relevant and irrelevant statements per group and NfC category

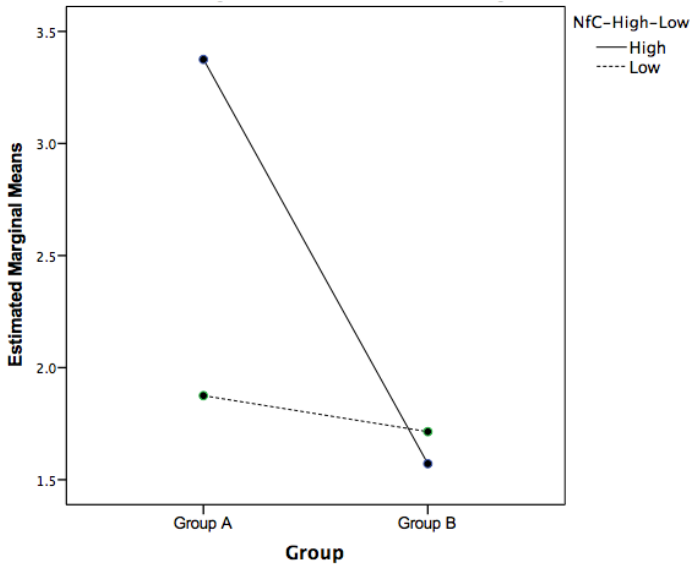

Fig 4 Estimated marginal means of irrelevant thoughts

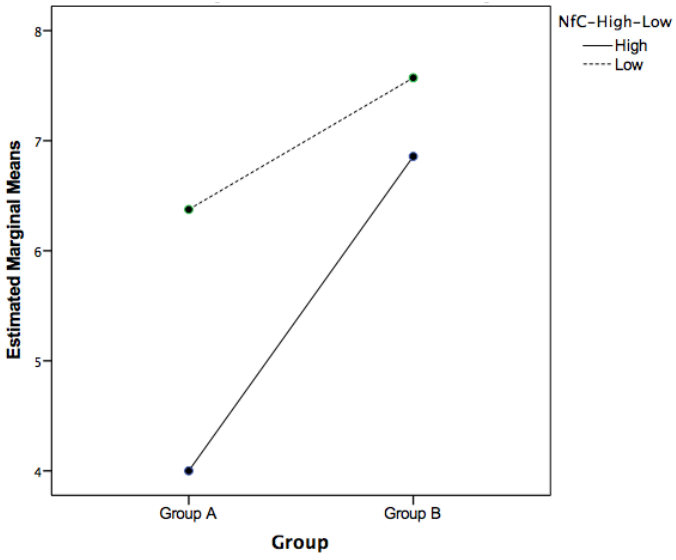

Fig 5 Estimated marginal means of relevant thoughts

Fig 6 Estimated marginal means of PHBC

Two-way analyses of variance (ANOVAs) for the variance of relevant thoughts, irrelevant thoughts and perceived health behavior change (PHBC) each were conducted comparing the contribution style (tweeting and non-tweeting, group A and group B respectively), and NfC level (higher and lower). At α-level of .05 no significant effect of NfC level or contribution style (tweeter / non-tweeter) on relevant or irrelevant thoughts was found. There was no significant effect of NfC level or contribution style to PHBC. However, in terms of trends, it was interesting to note that higher NfC participants in group A (tweeters) reported a higher PHBC than higher NfC level participants in the non-tweeting group B. The trend was the reverse of that with the lower NfC participants in both groups, where the tweeting group's PHBC was lower than non-tweeting group's. Figure 6 shows how higher NfC participants'' score on PHBC is higher in both contribution style groups (A and B) than lower NfC. The noteworthy development here is how the two NfC groups' PHBC score comes closer to each other in group B, and that (as said) the higher NfC participants' PHBC rating is lower in group B compared to group A. Tables 9 and 10 list the descriptive statistics for PHBC and relevant / irrelevant thoughts analyses of variance.

	Group	N	Mean	Std. Dev.
Group A	Higher NfC	8	3.13	.991
	Lower NfC	8	2.13	1.126
	Total	16	2.63	1.147
Group B	Higher NfC	7	2.57	1.397
	Lower NfC	7	2.43	1.512
	Total	14	2.50	1.401

Table 9 Descriptive statistics for PHBC analysis of variance

An independent samples t-test was run for relevant and irrelevant thoughts for 1) tweeters vs. non-tweeters (groups A and B) and 2) NfC categories (higher vs. lower NfC). The scores in all groups were normally distributed (Shapiro-Wilks test $p>.05$), they were of equal variance (Levine's test for homogeneity $p>.05$), and no significant outliers were identified using labeling method. At α-level of .05 no significant differences were found. The t-test descriptive statistics are presented in table 10.

Despite the lack of statistical significance, observing the trends in the results form the t-tests and ANOVAs we can see that as regards the frequency of irrelevant thoughts listed in the thought listing procedure, participants in the tweeting group (A) were clearly distracted and produced more thoughts outside the topic of the test session, and within that group we can see from the means that it was specifically the higher NfC participants who most displayed this tendency (Table 11). In other words,

it appears that the higher NfC tendency of elaboration is not restricted to a given topic, but is applied to the full context of the exercise. A qualitative analysis on the thought listing content is likely to shed more light on the themes of the straying thoughts, but such an analysis does not fall within the scope of the present paper. We can only conclude that the task of producing the content into the Twitter discussion provided a task-related distraction that reduced the amount of attention that higher NfC participants were able to give to the discussion topic itself.

	Group	N	Mean	Std. Dev.	Std. Error Mean
Relevant Thoughts	Group A	16	5.19	3.124	.781
	Group B	14	7.21	3.683	.984
Irrelevant Thoughts	Group A	16	2.63	2.062	.515
	Group B	14	1.64	2.023	.541

Table 10 Descriptive statistics for independent samples t-test on relevant and irrelevant thoughts between tweeting and non-tweeting groups (A and B, respectively)

	Group	N	Mean	Std. Dev.	Std. Error Mean
Relevant Thoughts	Higher NfC	15	5.33	3.244	.838
	Lower NfC	15	6.93	3.654	.943
Irrelevant Thoughts	Higher NfC	15	2.53	2.264	.584
	Lower NfC	15	1.8	1.859	.480

Table 11 Descriptive statistics for independent samples t-test on relevant an irrelevant thoughts between higher and lower NfC participants

7 Discussion and conclusions

Social networking platforms like Twitter attract high volumes of users. Twitter's active user accounts in the first quarter of 2016 was in the region or 310 million [49]. Peer support has been an established form in helping forming and maintaining behavior change for various health and lifestyle domains from weight loss to alcohol use cessation. Such peer support is already available online (for example on Facebook or as various forums), and it would seem only natural that the progression is towards more synchronous forms of social interaction that is characteristic of social networking platforms. The possibilities and opportunities provided by social networks as well as mobile and ubiquitous computing are also a recognized aspect of educational design and methods [1,15,33]. Given the goal oriented nature of providing and receiving help and support on a specific issue, healthier lifestyle, the interaction in the social networks as studied in the present paper also displays characteristics of e-coaching that is mediated over the Web.

In the present study we looked into how different information processing styles, namely need for cognition (NfC) appraisal, can affect health behavior change when the information is handled in the context of a social networking platform (Twitter). We were also interested in seeing how different NfC

levels (higher and lower) operate under the different experimental conditions. The experiment differentiated between two contribution styles (tweeting vs. non-tweeting) and between higher and lower need for cognition. Primarily, the experiment focused on perceived health behavior change as a result of an interaction exercise conducted on Twitter. In addition to behavior change, we propose that what was learnt from the present study can be taken into consideration also in the context of other persuasion-related problem domains (behavior change in other areas, such as sustainability or physical activity), in research on learning (such as mobile learning and use of social networks in learning) and in research and development e-coaching systems that use social interaction as part of the coaching strategy.

We constructed a theoretical model of factors that might influence health behavior change as a consequence of taking part in the healthy diet promotion. The results revealed significant relationships between constructs, and these significant relationships differed somewhat between the examined groups. Most importantly, we found that for participants in a tweeting group, existing dietary habits (pre-test fruit and vegetable intake measure) were connected to perceived health behavior change, and for this group social influence was connected to a sense of efficacy. For this group, however, efficacy did not contribute to perceived health behavior change in a statistically significant manner. Analysis of the model for the non-tweeting group revealed that only the relationship between efficacy to perceived health behavior change was statistically significant.

A visual comparison of the differences between the two levels of NfC (higher and lower) revealed that higher NfC participants group had a significant relationship between existing dietary habits and their efficacy appraisal. The lower NfC group had significant relationships between efficacy and perceived health behavior change and between social influence and efficacy. The differences between the NfC levels are interesting: where the higher NfC participants build up their efficacy appraisal on their existing behavior, the lower NfC group draw from social interaction in boosting the efficacy appraisal – and efficacy then has an impact on the perceived health behavior change.

We also examined these variables through analysis of variance and found that the NfC level had a significant effect on perceived health behavior change: the higher NfC group, overall, reported a higher perceived health behavior change than the lower NfC group, but a comparison of the two contribution styles (tweeting vs. non-tweeting) showed that the tweeting group's higher NfC participants assessed their perceived health behavior change higher than the corresponding respondents

in the non-tweeting group. At contribution style level, the higher NfC participants in the tweeting group reported a higher perceived health behavior change than the lower NfC group; this difference was smaller in the non-tweeting group, where lower NfC participants reported higher perceived health behavior change assessments than the corresponding respondents in the tweeting group. As regards the perceived health behavior change assessment, then, we can see a tendency that engaging in the sharing leads to higher perceived change for those with a higher NfC style compared to when these participants were not engaged in sharing.

From these results we suggest that the context of social interaction over the Web does affect behavior change outcome and information processing: being in a contributing role affected the higher NfC participants in such a way that they did *not* produce a higher number of relevant thoughts during the experiment than the lower NfC group as was expected, but instead the higher NfC group actually produced a higher number of *irrelevant* thoughts. The context, then, seemed to distract the higher NfC participants in a notable way in this regard. Such observation has implications on behavior change and possibly also on related issues such as mobile learning: if generating content in a social context like this disrupts information processing, then it would be very important to understand the mechanism more closely. In our case, regardless of the elaboration activity observations, the perceived health behavior change was higher with the active participants compared with the non-tweeters, much as predicted. In socially shared e-coaching in a peer-to-peer setting the implications of these findings are significant in the same way as in mobile learning. This implication applies to both practitioners and research. Having better insights into factors that affect acceptance of a behavior change message is of great importance when looking for maximum impact of an intervention.

The potential social networking platforms for reaching high volumes of people for the purpose of behavior change or learning and for offering a peer support environment for these objectives is tremendous. Encouraging that peer support in the social network environment requires understanding the mechanisms of social influence both 1) in general terms of identifying what type of activities can be socially influencing, and 2) in terms of what effects different interaction styles and behavioral roles can have on receiving and processing information.

The present paper describes an experiment into social influence and behavior change (effectively, e-coaching by peers) over the social networking platform Twitter. The orientation of the study was largely explorative. The main limitation of the study resides with its limited sample size

(N=30). While the researchers are confident that the present experiment set-up has produced noteworthy results and insights that offer new understanding and direction for both academia and practitioners in the fields of behavior change, e-coaching, and social networking, further experiments and research with a more substantial sample size would offer great benefits. A larger sample size would, among other things, allow for more refined models and analysis into the significance and relationships between the variables.

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Appendix 1

Table 12 lists the questionnaire items and their loadings.

#	Item	Loadings
Response efficacy		
Q4	Eating at least 5 portions of fruit and vegetables each day will improve my health by boosting my immune system. (1-strongly disagree, 7-strongly agree)	.833
Q6	My chances of experiencing a healthy immune system in the future, if I do eat at least 5 portions of fruit and vegetables, are…. (1-very low, 7-very high)	.697
Self-efficacy		
Q1	I know for sure that I could adhere to eating at least 5 portions of fruit and vegetables each day.	.720
Q4	If I intend to take up eating at least 5 portions of fruit and vegetables each day, I know that I can stick to it.	.822
Social influence		
Social comparison 1	I was able to compare my own knowledge on the topic with others.	.604
Social comparison 2	From the tweets I could see that there were other users who were similar to myself.	.694
Social facilitation 1	Seeing so much information about nutritional recommendations made me want to increase my own fruit and vegetable intake.	.575
Social facilitation 3	When more people are aware of what the nutritional recommendations are, I feel I am more aware of what choices I should make myself as regards food.	.827
Recognition 1	A: Getting a like/re-tweet in this topic indicates that what I shared/tweeted was valid for promoting better eating habits.	.753

	B: A message that gets a like/re-tweet shows that the person tweeting it has valid information to contribute to this topic.	
Recognition 2	A: Getting a like/re-tweet tells me that I know about the discussion topic. B: A message that gets a like/re-tweet shows that the person tweeting it knows about the topic.	.853
Recognition 3	A: Getting a like/re-tweet for this topic means that it is possible for me, too, to follow the nutritional advice. B: Tweets that get a like/re-tweet are more likely to help me follow the nutritional advice.	.807

Table 12 Questionnaire items and their loadings