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What is This?
Introduction

Health information is one of the most frequently searched topics on the Internet, according to the Pew Research Center (Fox and Jones, 2009). Over 80% of all adults in the United States and over 70% of European Internet users are estimated to have looked for health information in the internet, whereas this number increased steadily in the past few years (Andreassen et al., 2007; Atkinson et al., 2009, McMullan, 2006; Sillence, Briggs, Harris and Fishwick, 2007). The number of people looking for alternative or complementary therapies in medicine has also steadily increased worldwide and the press and media are reporting more frequently about alternative and complementary therapies as well (Barnes et al., 2002; Brauer

Pre-existing beliefs and expectations influence judgments of novel health information

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Abstract

The present study examined whether health information is judged differently depending on pre-existing beliefs and expectations. People’s initial beliefs and expectations were assessed by a questionnaire about acupuncture and a trustworthiness and preference rating task of doctors’ faces. Then, newspaper headlines about novel acupuncture treatment were shown and rated for their feasibility in a normal and framed condition. The judged feasibility of the newspaper headlines correlated strongly with initial beliefs about acupuncture in the normal condition, and with initial expectations towards a doctor’s face in the framed condition. Thus, as suggested by Bayes Theorem, pre-existing beliefs and expectations influence judgments of novel health information.

Keywords

Acupuncture, Bayes Theorem, Expectation, Health information, Trustworthiness

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However, alternative and complementary therapies are often criticized for their efficacy and validity, and people have diverse attitudes and judgments towards these novel therapies.

What information is preferred by people? When people have to choose from multiple sources of information, people have to judge which information appears more valid and trustworthy to them. The preference of certain information over another is dependent on many factors (DeFleur & Ball-Rokeach, 1989). The explicit content of the information influences our decisions as well as the implicit frame set around the information (Kahneman & Tversky, 2000; Tversky & Kahneman, 1981). The source of the information is important, as well as the context and the environment in which the information was delivered to us and last but not least, pre-existing attitudes and beliefs of the receiver of the information are playing a crucial role (Chaiken & Maheswaran, 1994; Petty, Cacioppo & Goldman, 1981; Petty & Wegener, 1999). In the field of communication, sociology and social psychology, these factors have been studied and discussed for many years.

Framing, in particular, has been an important tool to inform people about medical diseases and possible interventions in the field of health care communication and health education practice (Hodgetts & Chamberlain, 2006; Werrij et al., 2011). According to the theory of decision making called prospect theory, people will differ in their decisions depending on how a message is framed (Tversky & Kahneman, 1981), which also has a great impact for informing and persuading people towards healthy behaviour, e.g. performing diabetes screening, obtain a pap test, or using sunscreen (Hevey et al., 2010; Park et al., 2010; Rivers et al., 2005; Rothman & Salovey, 1997; Rothman et al., 2006). Moreover, framing is becoming increasingly important in dealing with the role of media in social issues such as power or injustice, which affect wider determinants of health (Barnes, 2007; Estacio, 2009; Marks, 1996, 2002, 2008).

In dealing with the question of which novel information to trust, the process of making a probability judgment about the truth of a proposition in the light of novel information can also be explained by Bayes Theorem. Bayes Theorem is concerned with the relationship between the subjective probability of a proposition after new information, the prior odds of the proposition and the likelihood ratio of the new evidence (Rutten, 2008; Spiegelhalter et al., 1999). According to Bayes Theorem, the initial or prior odds are as influential in determining the current or ‘posterior’ odds as the exposure to novel information (Koehler, 1993; Rutten, 2008).

Our study was designed to test how people judge new health information depending on pre-existing beliefs and expectations according to the Bayesian idea. Acupuncture is one of the most common alternative treatments in the world (Han & Ho, 2011). Because opinions about the efficacy and validity of acupuncture treatment are strongly divided (Langevin et al., 2006), it seemed to be a good domain with which to assess people’s tendency to approve or dismiss new health information. Some researchers deny the efficacy of acupuncture treatment, reducing its effects to mere ‘placebo effects’ (Bausell & O’Connell, 2009; Ernst, 2008). On the other hand, there have been studies showing how acupuncture treatment improves clinical symptoms both in humans and animals, even shedding light on the possible neurobiological mechanisms of acupuncture (Chae et al., 2009; Jeon et al., 2008; Zhao, 2008). Furthermore, Korea is an excellent location for testing those divided attitudes, because both kinds of medical systems—western and oriental—co-exist as part of the nationally provided regular health care system (Chang et al., 2011).

We tested people’s pre-existing beliefs and expectations in two separate experiments. First, using a self-rated questionnaire, the acupuncture belief scale (ABS), and secondly, an alternative forced choice (2AFC) task in which the participants had to choose which of two medical doctors they preferred, using a set of faces of medical doctors which previously
had been rated for their perceived trustworthiness. The judgment of participants about new health information was assessed by letting them rate the feasibility of a newspaper headline regarding new findings in acupuncture research. Based on previous findings in the field of social psychology and communication, and in line with Bayes Theorem, we hypothesized that the feasibility ratings of the newspaper headlines will show a correlation with the ABS ratings, indicating an influence of pre-existing beliefs. Similarly, we hypothesized that the assessed expectation about a doctor’s trustworthiness, perceived from briefly shown doctors’ faces, should also affect the judgments about the newspaper headlines.

Experiment 1: Correlation between the acupuncture belief scale and feasibility ratings of newspaper headlines about acupuncture in normal people

Participants

Ninety Two healthy participants (mean age = 20.2, SD = 1.6) participated in Experiment 1. They were recruited through advertisements posted on several places around the college. All participants were college students, and had no previous knowledge of the purpose of the experiments. All participants received a detailed explanation of the study and written, informed consent was obtained. This investigation was conducted in accordance with the guidelines of the human subjects committee of Kyung Hee University and ethics approval was obtained for this study from the ethics committee of the Acupuncture and Meridian Science Research Center of Kyung Hee University, Seoul, Republic of Korea.

Procedure

Participants were asked to fill out the ‘Acupuncture Belief Scale’ (ABS) questionnaire to determine their belief in the efficacy of acupuncture for treating physical and psychiatric symptoms. The acupuncture belief scale (ABS), a self-reported 36-item scale, was used to assess the belief in the efficacy of acupuncture for treating physical and psychiatric symptoms (Dennehy, Webb & Suppes, 2002). The participants were instructed to complete the Korean version of the ABS using a five-point Likert scale.

Then, the participants were divided into two groups—positive and negative—reading 15 different newspaper headlines with either positive or negative content about new findings in acupuncture treatment. The newspaper headlines were collected from Korean national and local newspapers. The newspaper headlines were searched through two Korean search engines; Naver (www.naver.com) and Daum (www.daum.net). All searched articles were published between the 1st of January 2005 and the 31st August 2008. Fifteen different headlines were selected containing either a positive or negative statement about new research findings regarding acupuncture treatment.

Finally, the participants were asked about how feasible they judged those news contents—meaning how probable they judged the described content of the newspaper headline was to happen in reality. The newspaper headlines had to be rated by the participants on a scale ranging from 1 (absolutely not feasible) to 9 (absolutely feasible). The participants had as much time as they wanted to answer the questions.

Data analysis

The baseline characteristics of the participants age, height, weight, and the ABS were compared between the groups using an independent sample t-test. The relation between the ABS results and the feasibility rating of the newspaper headlines was explored to confirm our hypothesis about prior beliefs and health information judgments. Cronbach’s α computed for all items is 0.736 for the positive group and 0.717 for the negative group. All values were expressed as the mean ± standard error (SEM).
The level of significance was set at 0.05 for all analyses. All data processing was done using the software MATLAB (Mathworks Inc., Natick, MA, USA) and MS Excel (Microsoft Inc., Redmond, WA, USA). Statistical analysis was performed using the Statistical Package for Social Sciences for Windows 17.0 (SPSS; Chicago, IL, USA).

Results

There were no significant differences in any of the baseline characteristics between the positive and the negative groups (data not shown). An exploratory correlation analysis was performed between the ABS and the feasibility rating of newspaper headlines. Because the newspaper headlines were either of positive or negative content about acupuncture treatment, the feasibility ratings for each group were analyzed separately. Participants who gave generally higher ratings in the ABS questionnaire rated the feasibility of positive articles higher. In the positive group, there was a significant positive correlation between the ABS and the feasibility rating ($r = 0.418, p < 0.01$; see Figure 1A). Participants who gave generally higher ratings in the ABS questionnaire also rated the feasibility of negative articles lower. In the negative group, there was a significant negative correlation between the ABS and the feasibility rating in the negative group ($r = -0.338, p < 0.05$; see Figure 1B).

Experiment 2: Influence of framing with doctors’ faces on feasibility ratings of newspaper headlines about acupuncture in patients

Participants

Forty-eight adult outpatients (mean age = 30.4, SD = 12.6; Male = 15, Female = 33) were recruited at an Oriental Medical Clinic located in Seoul, Republic of Korea. All participants were adult outpatients visiting an oriental medical clinic in order to receive treatment. All participants had no previous knowledge of the purpose of the experiments. They were asked whether they wanted to participate in this study on the evaluation of novel health information about acupuncture presented in newspapers.
Chang et al.

while they were waiting for the clinical consultation with the doctor. Patients who agreed participated in this study, whereas exclusion criteria were if the participants were left-handed, or if they had poor vision or cognitive or motor problems. This investigation was conducted in accordance with the guidelines of the human subjects committee of Kyung Hee University and ethics approval was obtained for this study from the ethics committee of the Acupuncture and Meridian Science Research Center of Kyung Hee University, Seoul, Republic of Korea.

**Procedure**

In Experiment 2, all participants were engaged in a ‘framed’ condition, meaning that health information was presented in a specially chosen contextual manner. After the patients agreed to participate, they were placed on a chair in front of a video monitor and were instructed about the experiment’s procedure. After a short instruction, all of them were able to use the Keypad in the appropriate way to be able to participate in the experiment. Experiment 2 consisted of the following three separate tasks.

In the first task, patients were asked to rate the perceived trustworthiness of 40 different Asian male doctors’ faces which were each presented individually for 1 second (see Figure 2A). The age of the doctors ranged between 25–50 years old and all of them were wearing a shirt with tie and a doctor’s white coat over it. All pictures were taken from the front, and were presented in black and white.

In the second task, they had to watch 20 different pairs of doctors’ faces and choose their preferred face as fast as possible by pressing either the left (= 1) or the right (= 2) button (Figure 2B). The doctors’ face pictures were shown paired and without a time limit, but the participants were told to decide as fast as possible which face they preferred. The
interval time between the presentations of pictures was 100–500 ms.

In the third task, participants had to read 20 randomly selected different newspaper headlines and rate the feasibility of them just as in Experiment 1. The interval between the presentations of newspaper headlines was 100–500 ms. This time, the newspaper headlines were framed with a random doctor’s face presented in the previous tasks (Figure 2C) and shown right next together. The same newspaper headlines were shown twice, such that each of the newspaper headlines were shown once with a preferred doctor’s face and then again with a non-preferred face. The order of presentation of the newspaper headlines was pseudo-randomized so that the same headlines were not shown subsequently. Again, the newspaper headlines had to be rated about their feasibility on a scale ranging from 1 (absolutely not feasible) to 9 (absolutely feasible).

Data analysis

In the first task, the values for the inferred trustworthiness by patients were collected for each picture of doctors’ faces. The inferred trustworthiness values were calculated as (participants judging the doctor on the right to be more trustworthy) – (participants judging the doctor on the left to be more trustworthy) representing the difference of inferred trustworthiness between the two presented doctors’ face pictures. In the second task, the simulated preference values, asking to choose one doctor’s face in the 2AFC task, were calculated as [(preference for the right picture) – (preference for the left picture)]/(sum of total). An exploratory correlation analysis was also performed between the inferred trustworthiness and the simulated preference values of a doctor’s face was found ($r = 0.742, p < 0.001$).

Results

In the first task, ratings of all participants were averaged. The doctor’s face with the minimum value of inferred trustworthiness rating was 3.98 and the doctor’s face with the maximum value was 6.63 on a nine-point scale. The average of inferred trustworthiness ratings in all doctor’s face pictures was 4.89 (SE = 0.12).

In the second task, the inferred trustworthiness ratings of the preferred and non-preferred pictures were compared. The more preferred, and thus more frequently chosen doctor’s face pictures in the 2AFC task had inferred trustworthiness values of 5.14 ± 0.15. The non-preferred, and thus less frequently chosen doctor’s face pictures had inferred trustworthiness values of 4.64 ± 0.16. When a paired-sample t-test was performed, the difference between
both was significant \( (t = 7.324, df = 47, p < 0.001) \). An exploratory correlation analysis was also performed between the inferred trustworthiness values and the simulated preferences of the pictures. The inferred trustworthiness values and the simulated preferences for each of the 40 pictures are shown on a graph (Figure 3). The X-axis is showing the inferred trustworthiness value which is calculated by subtracting the inferred trustworthiness value of the left picture from the right picture during the 2AFC task where paired pictures were shown. The Y-axis is showing the simulated preference value which is calculated by subtracting the preference value of the left picture from the right picture during the same task. There is a strongly significant correlation between the inferred trustworthiness and the simulated preference values of a picture \( (r = 0.742, p < 0.001) \).

In the third task, the influence of framing was sought by looking at the feasibility ratings of the same newspaper headlines depending on whether it was shown together with a preferred doctor’s face or not. There was a significant difference in the feasibility ratings when the same newspaper headlines were compared with each other. When the same newspaper headline was framed with a preferred doctor’s face, the feasibility ratings were higher \( (5.43 \pm 0.11) \), compared to the same newspaper headline framed with a non-preferred doctor’s face \( (5.28 \pm 0.12) \) (Figure 4). When a paired-sample t-test was performed, the difference between both was significant \( (t = 2.143, df = 47, p < 0.05) \).

**Discussion**

In our study, we wanted to explore in particular how pre-existing beliefs and expectations influence judgments made about new health information, using newspaper headlines about new findings in acupuncture research.

In the first experiment, the belief in the efficacy of acupuncture for treating physical and psychiatric symptoms, measured by the ABS, correlated directly with judgments made about the feasibility of newspaper headlines (see Figure 1). The feasibility of positive news content about acupuncture treatment was rated higher by participants with a stronger initial belief in acupuncture and lower by participants with a weaker initial belief in acupuncture (see Figure 1A), and vice versa for the feasibility of negative news content ratings (see Figure 1B). This result shows that in both groups—exposed to positive and negative news content—answers about the belief in the efficacy of acupuncture based on pre-existing views of the participants synchronized with the judgments about new findings in acupuncture research. In this experiment, participants were normal people (not patients) and had sufficient time to think and consider about their answers.

In the second experiment, the influence of framing on the judgment of novel health information was assessed by evaluating newspaper headlines framed with either a preferred or a non-preferred doctor’s face in outpatients. The general attitude towards a treating physician was evaluated by fast and unreflective face judgments about inferred trustworthiness and preferences. Here, we wanted to assess the rapid
and automated face judgments as a measure of the pre-existing, subliminal attitudes and beliefs about a physician. Recent models of social cognition and face perception suggest a distinction between fast, unreflective, effortless ‘system 1’ processes and slow, deliberate, effortful ‘system 2’ processes (Chaiken & Trope, 1999). Many inferences made from facial appearance of people can be characterized as automated ‘system 1’ processes (Todorov, Mandisodza, Goren & Hall, 2005; Winston, Strange, O’Doherty & Dolan, 2002). Also, various trait judgments from facial appearance—such as attractiveness, competence, confidence, intelligence and trustworthiness—are highly correlated with each other and judgments of trustworthiness are known to be the best approximate for face evaluation (Todorov, 2008). In our study, we focused on the inferred trustworthiness of doctors’ faces, as a measure of pre-existing expectations, which strongly and significantly correlated with the preferences for the doctors’ faces.

We also used the methodology of ‘framing’ to assess the influence of pre-existing expectations towards a doctor on the judgments about new health information. In the field of psychology and decision-making, the term ‘framing’ refers to the contextual manner in which a problem of choice is represented (Tversky & Kahneman, 1981). For instance, the judgment of whether a certain newspaper headline is regarded as valid information or not is dependent on the credibility of the magazine in which the headline is presented (Deppe et al., 2005). We presented various newspaper headlines framed with the faces of doctors, the preference ratings of a doctor’s face seemed to have a significant influence on the judgments made about the feasibility of newspaper headlines (see Figure 4).

In general, our study confirms previous findings in the field of social psychology and communication theories; that people are inclined to judge and rate information in ways that verify existing attitudes and beliefs (Brehm & Cassin, 2002). When presented with new information, they show the tendency to interpret information in ways that can be most compatible with their pre-existing attitudes and beliefs (Snyder & Haugen, 1994). This so called ‘confirmation bias’ does not only occur with ambiguous information but is even persistent after it has been shown that the initial belief was false (‘Belief perseverance’, Anderson, Lepper & Ross, 1980).

What kind of implications could this have on interpreting the results of our study? In both experiments in our study, the pre-existing beliefs and expectations significantly influenced the final judgment of the feasibility of new acupuncture-related health information. This was the case both when participants had enough time to think about their answers (Experiment 1; ‘system 2’ processes), and when they had to judge quickly and be unreflective about their preferences (Experiment 2; ‘system 2’ processes). In other words, when facing new information, people seem to be biased by their pre-existing beliefs and expectations and therefore don’t judge the new information objectively, which is consistent with previous findings in political science, social psychology, decision science and communication (Brehm & Kassin, 2002). Our results can also be explained by the Bayesian approach, because once the prior (initial belief or expectation) is set, posterior decisions (judgments of information) are difficult to be modified by a single exposure to new evidence (novel health information), which explains why updating of pre-existing beliefs or expectations are difficult and works only with repeated exposure to reliable new information (Koehler, 1993; Rutten, 2008).

This is no different in the field of clinical or health information. The importance of initial beliefs and expectations and their significant contribution towards treatment and impact on clinical outcomes has been well known, especially in the treatment of psychiatric disorders (Awad, 2004). Previous research and clinical experience also shows that there are a certain percentage of people preferring novel therapies, whereas another percentage of people just stick to traditional ways of treatments, refusing to try out any new treatments (Cacioppo, Gardner & Bernston, 1997; Sollner, Zingg-Schir, Rumpold...
& Fritsch, 1997). Considering previous findings in the field of communication research and social psychology, it is to be assumed that when people face new health information, it is not only the objective information content which plays a role in deciding for a novel treatment. A systematic review in the field of complementary and alternative medicine has also shown how beliefs influence the inclination of people to decide for alternative treatments (Bishop, Yardley & Lewith, 2007).

There are a few limitations to this study as well. First of all, it is unclear how much actually people do rely on briefly presented information such as newspaper headlines. There might be differences in how they deal with information, if they were actively searching for detailed information, or if the information source was different (Brehm & Kassin, 2002). Secondly, it is hard to judge how much of the initial attitude and belief about acupuncture was really captured by the ABS questionnaire, used in Experiment 1 (Chae et al., 2008). Third, the order of presented newspaper headlines, as well as the gap between completing the previous tasks before rating the headlines might have been a factor in the judgment of information (Morrison et al., 2010). And last, but not at least, a sampling bias due to the relatively small number of participants and the geological location of the experiment, cannot be completely excluded.

In summary, our results show that there is a significant interrelationship between pre-existing beliefs and expectations and judgments of new health information. This indicates that the decisions people make about novel treatments are dependent on pre-existing beliefs and expectations rather than based on objective interpretations of health information. Especially, when educating people on novel health information, the source and affiliation of information—who is presenting this information, and how trustworthy that person appears to the audience—could be an important factor influencing the judgments of people regarding the novel information. As suggested by Bayes Theorem, our findings also indicate that people judge new health information depending on pre-existing beliefs and expectations. We suggest that this has to be considered in both decisions for novel treatments and promotion of new health information.

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