EXAMINING THE EFFECTS OF DIFFERENT TYPES OF INTERACTIVITY AND USER ENGAGEMENT ON SKIN CANCER INFORMATION PROCESSING

By

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To the Faculty of Washington State University:

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EXAMINING THE EFFECTS OF DIFFERENT TYPES OF INTERACTIVITY AND USER ENGAGEMENT ON SKIN CANCER INFORMATION PROCESSING

Abstract

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The advent of computer and mobile devices revolutionarily changes the way of communication. Technologies on mobile devices, websites and applications provide users the ability of more engagement and interactions with the content. Communication on the internet is distinguishable from communication on traditional media, such as print media and television. Traditional media allow users to have a linear way of processing information while digital media provide a curvilinear way for users to perform actions and process information based on their own choices and preferences. Is this form of communication and information processing more effective and efficient for users to absorb information online, especially health information?

Websites for health topics, such as skin cancer prevention and awareness, have a variety of ways in which they can present health information to audience members. The present study used skin cancer and sun protection as a health topic to explore how different types of interactivity on the health websites influenced user engagement, information processing, attitudes, and behavioral intentions. This study (N=287) employed a 2 (modality interactivity: high vs. low) x 2 (message interactivity: high vs. low) between-subjects online experiment to evaluate effects of two types of interactivity, modality interactivity and message interactivity, on interface assessment of a
skin cancer website, perceived credibility, knowledge, affective trust, cognitive trust, heuristic and systematic processing, attitudes toward skin cancer information and attitude toward the health website, and behavioral intention to use sunscreen in the future, intention to recommend the website to others, and intention to visit health websites in the future. Findings suggested that modality interactivity influenced behavioral intentions via its prior effects on perceived knowledge, affective trust, and attitudes toward the skin cancer information. Message interactivity affected behavioral intentions through its prior effects on perceived knowledge. Message interactivity led to more systematic processing while modality interactivity had a positive influence on attitudes toward the website and skin cancer information. Implications for designing health websites and health intervention content are discussed.
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CHAPTER ONE

INTRODUCTION

The use of technology in communication is ubiquitous in today’s society. As a result, the way that human communicate has shifted from the more traditional one-way communication to a two-way and reciprocal approach (Liu & Shrum, 2002; Rice & Williams, 1994). Media users become active information seekers instead of passive information receivers. The integration of advanced elements of interpersonal communication and mass communication into Internet-based communication results in immediate, back and forth, and customized responses (Cassell, Jackson, & Cheuvront, 1998; Kim & Stout, 2010). Moreover, users can generate content and share experiences with other users and users themselves may become a source as well a receiver of information (Kalyanaraman & Sundar, 2006; Sundar, 2008). This two-way flow of communication has been found useful for health promotion efforts (Chou, Hunt, Beckjord, Moser & Hesse, 2009; Harvey-Berino et al., 2002; Homer et al., 2000; Levine, 2011; Marshall, Leslie, Bauman, Marcus & Owen, 2003; Oenema, Brug & Lechner, 2001; Ritterband et al., 2003).

The rapid proliferation of the Internet has influenced the dissemination of health information, health interventions, health education, and advanced health applications. In 2004, a meta-analysis evaluated the effectiveness of Internet-based interventions and non-Internet-based interventions on health related behavioral outcomes (Wantland, Portillo, Holzemer, Slaughter & McGhee, 2004). The scholars reviewed 22 articles from 1999 to 2003 and found that Internet-based interventions worked better than non-Internet-based interventions for improving a variety of health related attitudes and behavioral outcomes including increased work out time, increased nutrition knowledge, increased participation in healthcare and more.
In 2012, 59 percent of adults in the United States searched for health information online and 77 percent of the online health information seekers started their search at a search engine such as Google, Yahoo, or Bing (Pew Research Center, 2013). According to the Pew Internet & American Life Project (Pew Research Center, 2013), one in three Americans have used the Internet to solve a medical problem and eight in ten online health information seekers start with a search engine. There are several reasons why the Internet has become a widely accepted source for health information. One reason may include the increasing availability of computers and laptops, fast modems, high-speed processors, and other digital technologies (Fotheringham and Owen, 2000). Additionally, the public’s increasing willingness to be more responsible for their own health status has also contributed to the expanded use of technologies in health communication (Baker, 2001; Eng et al., 1999). With easy access to health information online and increasingly expensive health care, people’s ability to communicate with medical professionals, individuals who share the same symptoms, and other patients online have been strengthened. In 2012, 35 percent of adults in the United States reported having used the internet to seek information to find out about their own medical condition and diagnose themselves (Pew Research Center, 2013).

The numerous advantages of applying interactive digital media technologies to health communication have been explored and examined by many researchers (e.g., Atkinson & Gold, 2002; Lu, Kim, Dou & Kumar, 2014; Lustria, 2007; Jaffé, 1997; Neuhauser & Kreps, 2003, Oh & Sundar, 2015). Characteristics of the media being used for health information may impact health-related outcomes. For example, interactivity, which is how responsive a system is to a user (Rafaeli, 1988), can positively influence the individuals’ perceptions of the health information, comprehension level, attitudes toward the health messages, user engagement,
behavioral intentions, and other health related outcomes (e.g., Lu, Kim, Dou & Kumar, 2014; Lustria, 2007; Oh & Sundar, 2016). For example, in one study about skin cancer (Lustria, 2007), interactivity was found to significantly influence attitudes toward the health websites as well as the comprehension level of the health content.

In spite of some promising results of using interactive media technologies in health communication, there has been a long existing argument that more interactivity in media may not always be better. While some studies have found that higher levels of interactivity can improve participants’ comprehension of health information (Lustria, 2007), knowledge (Lu, Kim, Dou & Kumar, 2014), intentions to use a health information resource (Willoughby & L’Engle, 2015) and attitude toward health websites (Lustria, 2007; Oh & Sundar, 2015), some studies have found that higher levels of interactivity did not have positive effects on knowledge (Camerini & Schulz, 2012; Jaffe, 1997) or self-efficacy (Jaffe, 1997). While not in a health context specifically, Sundar and Kim (2005) found that banner ads that used a medium level of interactivity led to increased product involvement when compared to both high and low level interactive banner ads. Carr (2010) has argued that interactivity may lead to superficial information processing and shallow assessment with the media content on the Internet. One phenomenon called the “interactivity paradox” refers to the circumstance that more fancy and interactive technological features require more cognitive effort and cognitive resources of the individual thus leading to a more negative evaluation of the information (Bucy, 2004). Instead of a panacea in persuasive communication, interactive affordances are seen as having more complicated results than linear effects and more interactivity does not always result in desirable outcomes (Sundar, 2010). Even though the features on digital media can produce positive effects on information processing, too much of the interactive features may jeopardize the processing of
the information, which leads to the curvilinear results. As a matter of fact, overloading of technological features on the media interfaces that exceed the cognitive processing boundary may lead to a distraction and reactance toward the persuasive messages (Bucy, 2004; Sundar et al., 2010). Moreover, for those individuals who are not familiar with new technology features, new and strange technological features can potentially reduce their intentions to engage with the system or the media channel. For individuals who are interested in exploring technology and use technological gadgets to finish their work efficiently, they are more likely to receive positive effects from the use of technology. Those people who are naturally good at technology or have a high level of interest in technology are called power users (Sundar & Marathe, 2010). Since there are both arguments for using interactive technological affordances and against it in terms of information processing and assessment, it is important to further examine the role of interactive features in an online environment.

Although there are various types of health information online and styles for presenting health messages to the audiences, some concerns regarding online health information seeking behavior and eHealth and mHealth literacy still exist. EHealth and mHealth are two relatively new concepts compared to the traditional concept of health. EHealth is “the use of emerging information and communications technology to improve or enable health and health care,” (Eng, 2001, p. 16). MHealth refers to “emerging mobile communications and network technologies for health care,” (Istepanian, Laxminarayan, & Pattichis, 2007, p.3). Both eHealth and mHealth literacy include key elements of health literacy, the component of skills needed for using the internet for health information, and component of skills needed for traditional health care. EHealth literacy can be defined as “the ability to seek, find, understand and appraise health information from electronic sources and apply knowledge gained to addressing or solving a
health problem,” (Norman & Skinner, 2006, p.2). EHealth literacy can “empower individuals and enable them to fully participate in health decisions informed by eHealth resources” (Norman & Skinner, 2006, p.2). This will result in a curvilinear information processing for individuals. However, since eHealth and mHealth involves the use of digital technologies, the concerns of a digital divide, such as availability, affordability, and credibility judgments, also may be problematic for eHealth literacy. How health information online can be effectively and efficiently delivered to the health information seekers is a significant issue in the digital era regarding health communication. There are numerous features online that present health messages in different ways, such as interactive functions and customization, which could influence information processing and interpretation.

As the results of interactive features on health outcomes tend to differ depending on the definitions and operationalizations of interactivity (Willoughby & Niu, 2016), researchers need to assess how different levels of interactivity and different types of interactivity may impact health communication. By doing so, scholars and health practitioners can gain practical knowledge about how to design interfaces when delivering various health messages. With this information, messages can be presented in clearer and easier to interpret formats, hopefully aiding in ease of understanding and interest in accessing and applying such information.

The present study aims to explore the effects of two different types of interactivity and examine whether there is an interaction effect of the different types of interactivity on perceptions related to the health information related to skin cancer and sun protection. Specifically, the goals of this study are to examine (1) how different types of interactivity influence outcome variables related to health information, (2) whether there are interaction effects among these two types of interactivity on attitudes and behavioral intentions related to
health information, and (3) when these interactivity cues are presented together, which one or
ones exert the most salient effect(s) on attitudes and behavioral intentions related to health
information.

CHAPTER TWO
LITERATURE REVIEW

Skin cancer and sun protection

Skin cancer is the most common cancer by far in the United States (Guy, Machlin, Ekwueme & Yabroff, 2015). There are approximately five million cases of skin cancer treated every year in the United States (USDHHS, 2014). One in five Americans will develop skin cancer in their lifetime (Stern, 2010). Each year, more than 3.5 million new cases of skin cancer are diagnosed in the United States, which is more than the combination of the new cases of all other types of cancers that are diagnosed every year (Armstrong et al., 2009; Siegel, Miller & Jemal, 2016). Most skin cancers are non-melanoma cancer and the survival rate of non-melanoma skin cancer is high. Melanoma cancer causes the most deaths among skin cancers (Siegel, Miller & Jemal, 2017). In 2017, there will be about 87,110 new melanomas diagnosed and 9,730 of people with melanoma are expected to die (Siegel, Miller & Jemal, 2017). The survival rate of melanoma is 18% if it has spread to the body, which makes it the deadliest skin cancer (Siegel, Miller & Jemal, 2017), and also highlights why early detection is key. Although the elderly are at high risk of getting melanoma, melanoma is one of the most common cancers in young adults, especially young women (Siegel, Miller & Jemal, 2017). However, skin cancer is the most preventable cancer compared to other forms of cancer (American Cancer Society, 1999). Additionally, early detection can aid in treatment options, improving health outcomes. Therefore, prevention of skin cancer has tremendous potential to save lives.
There are many risk factors that may cause skin cancer, which include sun exposure, family history of skin cancer, sensitive skin, skin color, preference of burn, and/or indoor tanning (Goldenberg et al., 2007; Green, Whiteman, Frost & Battistutta, 1999). The most preventable risk factor of all types of skin cancer is exposure to the ultraviolet (UV) light (Cokkinides, Albano, Samuels, Ward & Thum, 2005). Therefore, most of the skin cancer interventions aim to promote sun protection techniques, such as using protective clothes or shades and increasing sunscreen use for the general public or the people at high risk of skin cancer or decreasing their exposure to UV light, such as through artificial tanning beds.

Researchers have been working on skin cancer interventions for a long time. Skin cancer prevention programs have been conducted in the United States, Australia, and Europe over the past 20 years (Youl et al., 2015). The platforms used for skin cancer interventions developed from traditional media such as workbooks, pamphlets, videos, one-session teaching programs, and one-on-one instruction (Hughes, Altman & Newton, 1993; Kamin, O'Neill & Ahearn, 1993; Mermelstein & Riesenberg, 1992) to innovative media technologies such as short messaging service (SMS), or text messaging, (e.g., Armstrong et al., 2009; Hingle et al., 2014; Janda, Youl, Marshall, Soyer & Baade, 2013; Youl et al., 2015) and web-based mediums (e.g., Bernhardt, 2001; Lustria, 2007; Heckman, 2015). Research has found that SMS interventions for skin cancer prevention were effective in increasing adherence to sunscreen use, increasing the use of wearing hats and sunglasses and knowledge, and skin self-examination behaviors. There is one study about examining the effects of interactivity on health related outcomes by using skin cancer as a health context (Lustria, 2007). Lustria (2007) found that interactivity level of a website had a significant effect on comprehension of the health content and attitudes toward health websites. However, no previous study has employed skin cancer as a health context to
examine different types of interactivity on different types of attitudinal and behavioral outcomes. It is a particularly relevant area, however, as research has found interactive interventions may be beneficial in skin cancer prevention, and that interactivity or perceptions of interactivity may be associated with more positive attitudes toward health interventions and repeat use of health information resources (e.g., Lustria, 2007; Willoughby & L’Engle, 2015).

**Interactivity and communication**

Scholars have defined interactivity as a theoretical concept with different emphases in the literature (McMillan & Hwang, 2002) and there is no single definition agreed upon by all communication researchers. Researchers have defined interactivity by focusing on users’ influences on the medium (Stetuer, 1992), users’ customization (Kalyanaraman & Sundar, 2006), reciprocity and synchronicity of the communication (Liu & Shrum, 2009; Rafaeli, 1988), and interface affordances of the medium or the system (Sundar, 2008). From the computer-mediated communication perspective, interactivity is defined with a focus on human-to-human interaction and the interpersonal and social aspects (Rafaeli, 1988; Rice & Williams, 1994, Stromer-Galley, 2000). From the human-computer interaction perspective, interactivity is defined by focusing on the technological affordances that allow users to interact with the system and content, which is also considered functional interactivity (Sundar, Kalyanaraman & Brown, 2003; Sundar, 2008). In the present study, interactivity was conceptualized as a system that allows users to alter source, medium, and message, a view that Sundar and colleagues (2010) have previously used to design and assess interactivity from a communication perspective. The current study adopted this perspective because it is the first definition to ever distinguish different types of interactivity within the big concept of interactive functions on digital media. Other studies have used interactivity as a mixed concept within which there were no detailed classification or distinction.
between different interactive functions (e.g., Lustria, 2007). Based on Sundar’s conceptualization of interactivity, each type of interactivity can be examined individually, which can provide a better view for future implications.

Communication involves transmitting content from one entity to another entity. During the communication process, there are three fundamental elements, which are the source, the message and the medium (Sundar et al., 2010). Source refers to the message sender and content creator; message refers to the content itself that has been communicated; medium means the channel through which the message is spread (Sundar et al., 2010).

The MAIN model

According to Sundar’s Modality, Agency, Interactivity and Navigability (MAIN) model (2008), interactivity should be a system of technological affordances that can allow users to make changes to source, message, and medium while interacting with the interfaces. The MAIN model provides a theoretical explanation of how these technological cues on the interface influence the information judgment, especially the credibility judgment, through the cognitive heuristic processing. Heuristic-systematic processing literature focuses on different motivation and involvement levels that lead to different types of processing (Chaiken, 1980; Chen & Chaiken, 1999; Eagly & Chaiken, 1993). The types of processing are discussed later in this chapter. The MAIN model claims that the sheer presence of heuristic cues can bias information processing toward heuristic processing, thus individuals who are viewing technological cues tend to engage in heuristic processing.

The MAIN model also identifies four technological affordances that contain a large amount of innovative and influential cues: Modality, Agency, Interactivity, and Navigability. The following section briefly explains the theoretical framework with examples. Modality cues
are the features or functions on the interface such as the zoom in/out, slide or click, 3D carousel, and so on. The MAIM model posits that the rich modality cues can result in “realism heuristic” or “being-there heuristic” to trigger heuristic processing, therefore, leading to positive assessment of the interface or the message. Agency refers to the source. For example, if the individuals are viewing health information on a webpage with a medical doctor as the source, the authority cue will be triggered and the information will be judged as credible. Interactivity refers to that the interface cues that allow interaction between the user and the system. “Activity heuristic” or “interaction heuristic” are examples of interactivity cues that can be triggered to lead to high levels of user engagement. Navigability involves the navigation on the interface, such as the hyperlinks. Some heuristic processing like the “browsing heuristic” and “elaboration heuristic” can be triggered to make a credibility judgment. Hyperlinks have been found to have positive effects on credibility in political communication (Borah, 2014).

**Model of interactivity effects**

The interactivity effects model was introduced by Sundar, Xu & Bellur (2010) to demonstrate how different types of interactivity can influence user engagement then sequentially affect cognition, attitude, and behavior. Sundar (2008) defined three types of interactivity, which are modality interactivity, message interactivity, and source interactivity. According to Sundar et al. (2010), modality interactivity, message interactivity, and source interactivity affect user engagement through different mechanisms and consequently influence attitude and behaviors differently. The following section will explain each type of modality in details.

Modality interactivity refers to the interfaces allowance for users to have greater interaction to perform more activities and result in “greater depth and breadth of mentally representing and experiencing mediated content,” (Sundar et al., 2010, p. 2248). Traditional
media usually just have one modality on the channel (print: text); the new communication technologies have the capacity to contain many modality cues together, which is described as “multimedia.” Moreover, there are a great number of innovative modalities on the interactive media system, such as drag, click, slide, mouse-overs, 3D view, and so on. Each modality provides a new means to access the information and gain a new communication experience. Modality interactivity affects user engagement through the perceptual bandwidth (Reeves & Nass, 2000), which employs the sensory channels’ type and amount that are involved on the users’ mind during an interaction. Greater perceptual bandwidth will lead to more mental representations during the communication. If a website contains various types of the modality cues, such as picture, animation, and text, the perceptual ability related to sight and motion will be activated. Thus, more mental representations emerge on the users’ mind.

Some studies have shown that different modality may lead to different effects. For example, pictures can grasp more attention and lead to more favorable attitudes than text (Lang, 1995). It’s worth noticing that not only the types of modality and the distinct combinations of the modality but also the different amount of modality presented will affect the information process (Sundar, Xu & Bellur, 2010). Information processing is significant on shaping individuals’ perceptions and behaviors (Migone & Liotti, 1998). More and more modality interactivity does not mean the better the results will be (Sundar, 2001), however. The “Interactivity paradox” (Bucy, 2004) posits that more modality cues may lead to more cognitive effort, which may result in negative evaluations (Sundar, 2001).

When interactivity locates in the source, users not only can choose what information to process on what medium and in which format, but also can gatekeep the information. Source interactivity is defined as the extent to which the interfaces allow the users to customize the
system or create their own content. Customization means the degree to which the user feels he or she can be the source (sense of agency) or the gatekeeper. For example, a WordPress Blog can provide opportunity for users to change the interfaces and create content themselves. On an online support community about cancer, patients can share their stories as the source (Chou et al., 2009).

Some scholars have examined the effects of different sources. Sundar & Nass (2002) conducted an experiment by using the same news in four conditions: participants in different conditions were told that they were reading news that was selected by editors, system, other users, and themselves. Those who thought users had selected the news felt the news had higher quality, was more comprehensive, and was more appealing. Customization has been used in health interventions for a long time as the concept of tailoring (Latimer et al., 2005). The tailored messages in health promotion (e.g., messages designed for an individual) exert persuasive effects by meeting the needs of the individuals. By adding the sense of significance or personal relevance, source interactivity can also activate the systematic process. Kalyanaraman and Sundar (2006) found that if the website content matches the individuals’ personal preferences, their attitudes toward the portal would be more positive. The ability to be the source also was the determinant of the attitudes toward the message of power users, while the message content determined the attitudes of the users who were lowly involved with the topic (Sundar & Marathe, 2006).

Interactivity can also locate in the message itself. Message interactivity is the extent to which the interfaces allow back-and-forth interactive message exchange between users and between the system (Sundar, Xu & Bellur, 2010). The message is gained as a function of the user’s previous action. Two typical features of message interactivity are hyperlinks and the
buttons on the webpage. Message interactivity is accomplished through perceived contingency, which refers to the message being dependent upon the processing of the previous message and the message preceding that.

According to Sundar (2010), these three types of interactivity (e.g., modality interactivity, message interactivity, and source interactivity) can affect the levels of user engagement through different theoretical mechanism accordingly. Furthermore, the desired user engagement can effectively influence the psychological outcomes, such as cognition, attitude and even behavior. Sundar and his colleagues provide empirical evidence on each of the different types of interactivity. Sundar et al. (2014) did an experiment to examine the effects of different interaction techniques, such as dragging, clicking, sliding, and so on. They wanted to figure out whether modality interactivity affects the preliminary assessment, thus affecting the engagement between the users and the media. The results showed that different interaction combinations exerted different preliminary assessments and positive initial assessment of the website can lead to positive attitudes. Furthermore, when the participants felt that the website was intuitive, natural, and easy to use, they were more likely to engage with the website.

Bellur and Sundar (2013) designed a study to explore how different levels of message interactivity influenced college students’ attitudes toward health related websites. The results showed that those students in the high message interactivity conditions resulted in having higher levels of perceived contingency. The students who had higher perceived contingency were more immersive and lost track of time and felt the information more appealing, attractive, useful, and of high quality. They also felt it was a human agent not a computer agent they were exposed to and were more likely to recommend the website to others and to want to know more about the website in the future.
As the new communication technologies implemented on the Internet have integrated the characteristics of both mass communication and interpersonal communication (Cassell et al., 1998), they may provide unique opportunities related to health. Internet-based communication can disseminate a large amount of information to various audiences and it can also provide immediate, two-way, and customized feedback between the users and between the users and the systems. There is evidence that shows that interactivity can exert influences on improving user engagement, self-efficacy, attitude, behavior intention and other outcomes related to health context (Liu & Shrum, 2002; Rice, 2001).

Interactivity is identified as a unique feature in both mHealth (Free et al., 2009) and eHealth (Lustria, 2007). More than two-thirds of the world’s population had a mobile phone (Union IT, 2010). Among those Americans who owned mobile phones, 61 percent of them had smart phones (Smith, 2013). So mHealth interventions can reach out to a large number of audiences at a relatively low cost (Free et al., 2013). People carry their phones everywhere. Therefore, the persuasive messages can be delivered any time at its most relevant time. The techniques of mHealth such as text message, multimedia messages, and applications are all features that involve elements of interactivity, which provide the immediate feedback that traditional one-way communication does not. For example, smokers who signed up for a smoking cessation text message service can acquire extra help from the sender when they feel they are about to use cigarettes. The motivation, monitoring and other skills often used in face-to-face communication can be modified for mobile devices. Thus, tailored messages can be delivered through mHealth interventions feasibly. These advantages of interactivity in mHealth highlight that the concept of interactivity is a valuable theoretical concept to be applied in health communication.
One big issue in using interactivity in not only health communication but also other fields is that there is a dearth of literature of empirical research guided by theory and exploring the role of interactivity (Lustria, 2007). Another challenge lies in the difficulty in defining and operationalizing the concept of interactivity appropriately. Some scholars operationalized interactivity in their own research (Kim & Stout, 2010), while others who have studied it may not give a specific definition (Camerini & Schulz, 2012). This dissertation focused on two types of interactivity including modality interactivity and message interactivity. In addition, the present study used skin health and sun protection as a health topic to examine the effects of these two types of interactivity.

**Modality interactivity**

When interactivity is assessed as functional modalities on the medium interfaces, it is labeled as modality interactivity. Modality interactivity refers to “interface tools that afford users greater activity, resulting in greater depth and breadth of mentally representing and experiencing mediated content” (Sundar et al., 2010, p. 2248). Traditional mediums usually contain one single modality. Print media, for example, may just have text, and radio may just have an audio function. Digital media have multiple modalities and sometimes affect individuals’ senses together as multimedia content (Sundar, 2000). Modality cues not only include video, image, text, and audio but also include new interactive affordances such as hyperlinks, clicking, zooming, dragging, scrolling, mouse-overs, and so on. Each of the modality features may have different influences on user engagement and information processing (Sundar et al., 2010).

Some previous studies provided evidence to support the preposition that modality interactivity has influences on attitudes and behavioral intentions. A study about online shopping (Daugherty, Li, & Biocca, 2008) found that modality interactivity on a website including the
zooming in and out function or the presence of animation had positive influences on attitudes toward the brand and purchase intentions of the products. Another study (Schlosser, 2003) found that clicking or rolling the mouse over a product image generated higher purchase intention than viewing still pictures on the website. However, no specific theories about interactivity have been built to explain this kind of communication phenomena about why interactive actions between the users and the website can exert attitudinal and/or behavioral outcomes.

According to the interactivity effects model, which posits that different types of interactivity including message interactivity, source interactivity, and modality interactivity can affect individuals’ cognition, attitudes, and behavioral intentions through prior effects on user engagement, modality interactivity affects user engagement by changing the perceptual bandwidth. Perceptual bandwidth refers to “the type and number of sensory channels involved during an interaction between media and its users,” (Sundar et al., 2010, p. 2249). If a webpage has multiple modality functions such as clicking, zooming, and animation, users will need a high level of perceptual bandwidth to reach a more elaborate mental representation. According to Oh and Sundar (2015), good modality interactivity should provide a natural, intuitive, and easy-to-use interface, leading to enhanced perceptual bandwidth for users to mobilize their perceptual, motor, and cognitive abilities toward interacting with the content delivered by the interface.

There are some theoretical models that highlight the importance of user engagement in studying interactivity, such as dual-process models (Chaiken & Maheswaran, 1994; Petty & Cacioppo, 1986) and the mediated moderation model of interactivity (Bucy & Tao, 2007). The systematic-heuristic model (Chaiken, 1980, 1987) and elaboration likelihood model (Petty & Cacioppo, 1986) differentiate the type of information processing as systematic processing (or central route) and heuristic processing (peripheral route). The dual-process models have been
applied to explain the effects of interactivity on credibility (Sundar, 2008) and how user engagement could affect attitudes and behaviors (Oh & Sundar, 2016). The mediated moderation model (Bucy & Tao, 2007) demonstrated the relationships among interactivity attributes, perceived interactivity, media effects, and self-efficacy and how user engagement affected perceived interactivity and information exchange.

Although the definition of user engagement may vary with different emphasis of the interaction, it is noticeable that the effects of user engagement on cognition, attitude, and behavioral outcomes are confirmed. Generally speaking, modality interactivity can influence the initial assessment of the health website, and then influence user engagement. Individuals’ psychological and behavioral outcomes toward the website and the persuasive messages will be affected by the level of their user engagement with the websites.

Studies in human-computer interaction have found evidence to support the notion that people are influenced by the modalities of interactive systems (Oviatt, MacEachern & Levow, 1998; Sundar, Xu, Bellur, Oh & Jia, 2011). Certain modality features have been found to work better than others. Visual aids can draw immediate attention and require little cognitive effort (Lang, 1995) and can help with information encoding (Nelson, Reed & Walling, 1976), and many empirical studies have shown the successful use of modality interactivity in health communication (Lu et al., 2014; Oh & Sundar, 2015). Oh and Sundar (2015) found that modality interactivity could increase positive interface assessment and positive attitudes toward the health websites as well as attitudes toward the health topic. Modality interactivity has been found to positively affect attitudes toward health websites (Lustria, 2007) as well as attitudes toward persuasive health messages (Oh & Sundar, 2015). Behavioral intentions to recommend a fitness center (Lu et al., 2014) and actual exercises (Hurling, Fairley & Dias, 2006) were also
positively associated with high levels of modality interactivity. Therefore, I proposed:

H1: Modality interactivity will be positively associated with interface assessment.

H2: Modality interactivity will be positively associated with (H2a) attitude toward the health website and (H2b) attitude toward the skin cancer messages.

H3: Modality interactivity will be positively associated with (H3a) intentions to use sunscreen, (H3b) intentions to recommend the health website to others, and (H3c) intentions to visit health websites in the future.

**Theory of Planned Behavior**

Some theories have been constructed to demonstrate the relationship between attitude and behavioral intention (e.g., Theory of Reasoned Action, Theory of Planned Behavior, Theory of Trying). Attitudes have been found to have effects on behavioral intention. The Theory of Reasoned Action (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980; Fishbein, 1980) posits that an individual’s behavioral intention is determined by the individual’s attitude toward the behavior and subjective norms, which are the social pressure on individuals about doing something or not.

Theory of Planned Behavior, which was introduced by Ajzen (1985, 1991), attempted to explore the relationship between beliefs and behaviors. As an extended model of the Theory of Reasoned Action, TPB employed an additional concept called perceived behavioral control as an antecedent of behavioral intention. Perceived behavioral control refers to the perceived ability of an individual to perform a specific behavior. It is considered to have influences on behavioral intention and then affect actual behavior. According to TPB, there are three key factors that affect behavioral intention, which are posited to lead to the occurrence of the behavior. The factors are: attitudes which include positive or negative evaluation toward the behavior,
subjective norms, which is the perceived social pressure from others to conduct the behavior, and perceived behavior control, which refers to an individual’s perceived ability of perform a behavior (Ajzen, 1988, 1991).

Being a theoretical model for predicting behavioral intention, the TBP has been successfully applied to the field of health behaviors. A number of health related behavioral intentions have been explained or predicted by the TBP (e.g., weigh loss, Corner & Armitage, 1998; cancer support, Kam et al., 2012; condom use, Albarracin, Johnson, Fishbein & Muellerleile, 2001; alcohol consumption, Cooke, Dahdah, Norman & French, 2016). The TPB has also been applied to predict skin cancer related health behaviors such as sunscreen use, indoor tanning, and self-monitoring (Hillhouse, Adler, Drinnon & Turrisi, 1997; Hillhouse, Turrisi & Kastner, 2000; Martin, Jacobsen, Lucas, Branch & Ferron, 1999).

Previous studies also have found the positive effects of modality interactivity on attitudes toward the content or the health message (Lu et al., 2014; Oh & Sundar, 2016). Particularly, Lu et al. (2014) found that attitudes toward the fitness center mediated the effects of interactivity on different types of behavioral intentions including intention to recommend the fitness center and intention to visit the fitness center. It is expected that a similar pattern will appear for the current study about interactivity and a skin health website. Thus, I proposed:

H4: Attitude toward the skin cancer message mediates the effect of modality interactivity on (H4a) intentions to use sunscreen, (H4b) intentions to recommend the health website to others, and (H4c) intentions to visit health websites in the future.

H5: Attitude toward the website mediates the effect of modality interactivity on (H5a) intentions to use sunscreen, (H5b) intentions to recommend the health website to others, and (H5c) intentions to visit health websites in the future.
Message interactivity

Message interactivity has been demonstrated by many researchers through the concept of “message exchange” (Rafaeli, 1988) or “two-way communication” (Liu & Shrum, 2009). Message interactivity refers to the extent to which the system allows users to exchange messages in a back and forth interaction. The action of message interactivity is performed through the principle of contingency, which means that “the idea that a given message is contingent upon user reception of the previous message and the ones preceding that,” (Sundar et al., 2010, p. 2253). If a system or a media channel allows users to have back and forth interaction in a highly logical flow, the system or the channel is seen as having high message interactivity. Therefore, if the system or the channel acts more like a human and responds with more human like cues, it will be considered more interactive. Similarly, Rafaeli (1988) argues that there should be three types of interactivity: non-interactive, reactive, and responsive. If two individuals post messages individually without interacting with each other in a chat room, the situation is called non-interactive. If one individual posts a message and the other person responds to this message, it is called reactive. If one individual posts a message not only responding to the message posted by the other individual but also responding to the messages preceding it, the scenario is called responsive or fully interactive. This definition illustrates different levels of message interactivity, and high level of message interactivity will lead to high levels of message contingency.

Sundar et al. (2003) examined the effect of how hypertext, when operationalized as message interactivity, allowed users to access information through non-linear communication means while exploring a website. In this way, users’ actions on the hypertext exemplify the contingent back and forth. The website responds upon users’ different input on the website. The communication between user and the website become curvilinear rather than linear.
Hyperlinks and buttons embedded in websites are a typical format of manipulating message interactivity. Users can access the information by clicking to explore different layers of the content. The action of clicking will result in an access to some new content and the media content is obtained by the direct action of the user. Therefore, the back and forth interaction is performed through message interactivity. Some previous studies proved that hyperlinks on a website can increase message elaboration and lead to more content related thoughts and understanding (Tremayne & Dunwoody, 2001; Sicilia, Ruiz & Munuera, 2005). Oh and Sundar (2015) found that message interactivity positively related to message elaboration and was associated with positive attitudes among participants who were not highly involved with the anti-smoking topic. Previous studies also found that participants in this curvilinear condition liked a fictitious political candidate more than participants in a linear condition. (Sundar et al., 2003) and the format of contingent back and forth had a significantly effect on attitudes toward the ad and product involvement level (Sundar and Kim, 2005). Hence, message interactivity in this study should have a similar effect on information processing.

H6: Message interactivity will be positively associated with message elaboration.

**Combinatory effects of different types of interactivity**

Previous researches mainly focus on the effectiveness of interactivity and compares the effects of different levels of interactivity; little research has been conducted to examine the interaction effects of different types of interactivity and whether there is an interaction effect of two or more types of interactivity. However, in real life situations, different types of interactivity usually are presented together on the interfaces and individuals interact with multiple technological affordances back and forth in a curvilinear way. For example, a webpage can contain hyperlinks and buttons as well as mouse-overs and dragging features. Although modality
interactivity and message interactivity are interactivity cues and are supposed to evoke heuristic processing according to MAIN model, modality interactivity provides playful features and allows uses to interact with the content through multiple new techniques while message interactivity is more about using the sense of message contingency and allows interaction in a human-like dialogue. Therefore, modality interactivity influences individuals more through the peripheral route while message interactivity draw individuals’ attention and leads to mental representations and message elaboration (Oh & Sundar, 2015). According to Chaiken and Maheswaran’s (1994) additivity hypothesis, heuristic cues can enhance the persuasive effects when the cues are consistent with the direction of the persuasive content. For example, if the persuasive content is smoking cessation, heuristic cues that trigger positive attitude toward the website or the health content can reinforce the persuasive effects of smoking cessation content (Oh & Sundar, 2015). However, while the information carried by heuristic cues has contradictory direction of the systematic processing, the influences of heuristic cues can be neglected. There is a dearth of empirical studies about the combinatory effects of message interactivity and modality interactivity, leading to the following research question:

**RQ1:** Is there an interaction effect among modality interactivity and message interactivity on attitudes and intentions?

**Heuristic and systematic model**

The heuristic-systematic model (HSM) was proposed by Chaiken (1980) and is used to examine information processing through two different routes (Chaiken, 1980; Chen & Chaiken, 1999; Eagly & Chaiken, 1993). The HSM depicts a dual-process approach to information processing and assumes that people engage in two types of processing: systematic and heuristic. Heuristic processing is a “more limited type of information processing that requires less
cognitive effort and fewer cognitive resources than systematic processing,” (Eagly & Chaiken, 1993, p. 327). Systematic processing, in the other hand, refers to “comprehensive, analytic orientation to information processing in which perceivers access and scrutinize a great deal of information for its relevance to their judgment task,” (Eagly & Chaiken, 1993, p. 326). Therefore, according to human nature, people tend to engage in easy heuristic processing first and avoid effortful systematic processing (Chaiken, 1980, 1987; Chen & Chaiken, 1999). Heuristic processing is triggered by cues that need less cognitive effort including knowledge, attention or mental short cuts to process, while systematic processing is triggered by actual message content, which requires more cognitive resources.

The HSM has been used to explore the information processing of technological affordances by researchers (Koh & Sundar, 2010; Sundar & Kim, 2005). Based on the assumptions of the MAIN model, modality cues will trigger heuristic processing first and lead to initial assessment of the website or interface. Message interactivity, on the other hand, focuses on grabbing users’ attention to the message content rather than interacting with the technological cues. According to Oh and Sundar (2015), lower message interactivity will lead to systematic processing of the information. Therefore, message interactivity needs more cognitive effort and resources to process.

H7: Higher level of modality interactivity will lead to more heuristic processing.

H8: Lower level of message interactivity will lead to more systematic processing.

Trust and Behavioral Intention

The literature about trust suggests that there are different dimensions of trust, which include cognitive trust, affective trust, and behavioral trust (Johnson & Grayson, 2005; Koh and Sundar, 2010; Lewis & Weigert, 1985). Cognitive trust and affective trust are commonly
investigated as mediators to predict behavioral outcomes (Kim & Sundar, 2015). As stated above, systematic processing involves more cognitive effort, which means that the trust constructed by systematic processing requires more cognitive ability. Thus, systematic processing will lead to cognitive trust. Respectively, trust established through heuristic processing demand less cognitive capacity including knowledge and attention. Therefore, heuristic processing will further result in affective trust. Combining this reasoning with previous assumptions based on the effects of two types of interactivity on heuristic and systematic processing (see H7 & H8), it is proposed:

H9: Higher modality interactivity will lead to greater affective trust.

H10: Higher message interactivity will lead to greater cognitive trust.

H11: Heuristic processing will mediate the effects of modality interactivity on affective trust.

H12: Systematic processing will mediate the effects of message interactivity on cognitive trust.

There has been evidence supporting the positive relationship between interactivity and trust. Some studies regarding message credibility show that hyperlinks have positive effects on online news credibility judgment (Borah, 2014; Johnson & Wiedenback, 2009). Sundar’s MAIN model (2008) also posits that interactivity has an influence on credibility judgment. However, an empirical question remained: can interactivity influence behavioral intentions. Lu et al. (2014) provided evidence to support that interactivity could influence trustworthiness and further influence the behavioral intention toward fitness. The effects of message interactivity on individuals’ perceived credibility of persuasive message in health commutation need more empirical data and further examination. The relationship between perceived credibility and
behavioral intention also needs further exploration. Thus, I present two research questions:

RQ2: Will affective trust mediate the effects of modality on (a) intention to use sunscreen, (b) intention to recommend the health websites, and (c) intention to visit health websites?

RQ3: Will cognitive trust mediate the effects of message interactivity on (a) intention to use sunscreen, (b) intention to recommend the health websites, and (c) intention to visit health websites?

Knowledge and Learning

Knowledge gain has been measured in many health related studies as a standard to evaluate health messages or the effects of health interventions. According to Schulz and Nakamoto (2005), health knowledge can be operationalized as basic learning skills, declarative knowledge, and judgmental skills that can be applied to different health contexts. There are three types of knowledge tests that have been used in previous studies. The first one is the recall of information in the original health messages (Jaffè, 1997). It is pure memory recall without any additional information processing of the message. The second one is not focusing on the exact same health information. The evaluation focuses on applying the information people have read to different health contexts (Camerini & Schulz, 2012). This situation requires the ability of information processing, integration, and further application. The third one is measuring people’s perception of knowledge gain (Lu et al., 2014). The questions often focus on how knowledgeable the individuals feel after receiving the health information. This kind of measure puts the emphasize more on subjective knowledge gain rather than objective knowledge gain.

Different types of media can exert different influences on learning (Kozma, 1991). Traditional media like books or newspapers can present stable information for individuals to read the information slowly and engage in deep and thorough information processing. Television has
richer content like pictures, audio, and motion elements, but it does not allow users to have two-way interactions with the content. Therefore, TV usually presents some simplistic information and messages. Computers or mobile devices, on the other hand, allow users to access information through their own actions via a variety of ways, such as clicking, sliding, and, shaking etc. Richer media usually receive a more positive evaluation on the interface or the messages than non-rich media (Sundar, 2000; Coyle & Thorson, 2001). However, the dynamic affordances on the websites may trigger heuristic processing, which may lead to superficial information processing and missing of constructs in the mental models (Jaffe, 1997).

There have been some studies investigating how interactivity affects knowledge and learning in the health communication field. However, the results are inconsistent. One study found that interactivity did not have direct effects on fibromyalgia syndrome patients’ knowledge (Camerini & Schulz, 2012); one study exploring hypermedia’s effects on knowledge gain and self-efficacy gain did not find direct effects of media interactivity on knowledge gain about first aid (Jaffe, 1997); another study investigating college students’ physical activity found that interactivity on the gym website had positive influences on college students’ perception of knowledge about the topic. Moreover, perceived knowledge mediated the effects of interactivity on intentions to recommend the websites about the gym to others (Lu et al., 2014). Since previous research yielded different results about the effects of interactivity on knowledge, the following research questions are posited:

RQ4: What is the effect of (a) modality interactivity and (b) message interactivity on perceived knowledge of skin cancer and sun protection?

RQ5: What is the effect of (a) modality interactivity and (b) message interactivity on actual knowledge gain about skin cancer and sun protection?
RQ6: Will perceived knowledge mediate effects of modality interactivity on behavioral intentions?

RQ7: Will perceived knowledge mediate effects of message interactivity on behavioral intentions?

RQ8: Will heuristic processing mediate effects of modality interactivity on perceived knowledge?

RQ9: Will systematic processing mediate the effects of message interactivity on perceived knowledge?

**Cognitive Engagement and Interface**

User engagement has attracted a large amount of attention in many fields, such as advertising, marketing, media studies, and public health. Consumers could have emotional engagement with the ad or emotionally attached to a brand (Mollen & Willson, 2010; Wang, 2006). Stories in television show can generate narrative engagement which can “direct a reader’s thought toward the story and its themes” (Strange & Leung, 1999, p. 437). Narrative engagement can also be explained as “transportation”, which usually refers to when the audience watch or read a narrative, he or she would transport himself or herself into the environment or scenes and become lost in the stories (Busselle & Bilandzic, 2008). Narrative engagement often creates feelings close to the character and creates a sense of immersion, which can lead to positive outcomes about certain messages. Therefore, it is often used in entertainment education, which are efforts to embed informative and educational content in entertaining mediums (Moyer-Gusé, 2008; Slater & Rouner, 2002), for health interventions targeting teenagers and young adults (e.g., Willoughby, Niu & Liu, 2016). Digital media like social media also have their own form of user engagement. User generated content websites such as YouTube and Facebook often engage users
by letting them create and share content on their own pages with their accounts. For one topic, users who are more engaged with the content with more sharing or generating behaviors may have different information processing, attitudes, and relevant behavioral intentions toward the topic. In addition to the content, users sometimes spontaneously or intentionally interact with the medium or the interface. For example, if an individual is playing virtual reality games, he or she will intentionally engage with the controllers or the menu in the VR world. If an individual is exploring a website for news or product information, he or she may spontaneously be engaged with the interface functions such as 3D rotation, zoom-in and zoom-out, slider bar, scrolling, and dragging for more information about the news story or the product. Webster and Ho (1997) defined audience engagement with multimedia as “a state of playfulness which includes attention focus, curiosity, and intrinsic interest” with the multimedia system (p. 65). The key elements are attraction and interest in the system, which can result in a positive evaluation and experience in exploring the multimedia system. In the present study, the engagement examined includes both cognitive engagement and interface assessment because they have both been found to be influenced by modality interactivity in previous studies (Oh & Sundar, 2015; Oh & Sundar, 2016).

User engagement can sometimes exert certain positive outcomes. But there is a dearth of literature about how user engagement should be defined. According to Oh and Sundar (2016), at least three basic factors need to be present when defining user engagement under the media environment: “(a) strong cognitive and emotional focus on media content; (b) attraction, curiosity, and interest toward the medium or interface; and (c) voluntary participation influenced by media content” (p. 179). In their study about persuasive effects of anti-smoking messages, they found that modality can influence interface assessment and then influence cognitive
engagement though its prior effects on interface assessment. Furthermore, cognitive engagement mediated the relationship between modality interactivity and attitudes toward health messages (Oh and Sundar, 2016). Thus, this study tries to replicate their results in current contexts. Based on their findings, I proposed:

H13: Interface assessment will mediate the effects of modality interactivity on cognitive engagement.

H14: Cognitive engagement will mediate the effects of modality interactivity on attitude toward skin cancer information.
CHAPTER THREE

METHOD

Design overview

The present study used a 2 (modality interactivity: high vs. low) x 2 (message interactivity: high vs. low) online experiment to evaluate effects of modality interactivity and message interactivity on interface assessment, perceived credibility, knowledge, affective trust, cognitive trust, heuristic and systematic processing, attitudes, and behavioral intentions.

Participants and sample

Participants were recruited from March to April, 2017 through Amazon’s Mechanical Turk (M-Turk), which is an online marketplace for people to work on the tasks posted on the platform. M-Turk can provide a more diverse and valid sample according to previous studies (Buhrmester, Kwang & Gosling, 2011; Casler, Bickel & Hackett, 2013). The sample of M-Turk is more socio-economically and demographically diverse than college samples and traditional Internet samples, which suggests a better generalizability than other traditional samples (Buhrmester et al., 2011). M-Turk data can be collected fast and inexpensively; the data quality wouldn’t be affected by the realistic compensation rate; the reliability of M-Turk data is as reliable as other traditional data and this has been supported by several studies (Buhrmester, Kwang & Gosling, 2011; Holden, Dennie, and Hicks, 2013; Johnson & Borden, 2012).

A total of 303 participants who have an account on M-Turk took part in the present study. I added two attention manipulation checks in the survey. One is the commonly used instructional manipulation checks presented by Oppenheimer, Meyvis, & Davidenko (2009), which can increase statistical power and reliability of a dataset (Figure 1). In this attention check, participants must not click on anything and directly go to the next page. The other check I used
in my survey was adding a statement at the end of a set of questions asking the participants to choose one specific number to make sure they were actually reading the questions (Figure 2). Individuals who did not pass these two checks were dropped from the data set. I also had manipulation checks for each type of interactivity. For the modality interactivity, participants were asked if they dragged the slider bar to view the change of the pictures. If the respondents answered “no” to the question, they were dropped from the data. For the message interactivity, participants were asked if they clicked on the plus icon to view more information about sun protection. The respondents who answered “no” were dropped as well. I also used perceived interactivity to evaluate the interactivity level in each condition, which will be discussed in the manipulation check section. After data cleaning, attention check, and the manipulation checks, I had a final sample size of 287.

Figure 1

Attention check 1

Most modern theories of decision-making recognize the fact that decisions do not take place in a vacuum. Individual preferences and knowledge, along with situational variables can greatly impact the decision process. In order to facilitate our research on decision-making we are interested in knowing certain factors about you, the decision maker. Specifically, we are interested in whether you actually take the time to read the directions; if not, then some of our manipulations that rely on changes in the instructions will be ineffective. So, in order to demonstrate that you have read the instructions, please ignore the sports items below. Instead, simply continue reading after the options. Thank you very much.

Which of these activities do you engage in regularly? (write down all that apply)

- Basketball
- Soccer
- Running
- Football
- Swimming
- Tennis
- Volleyball
More than half of the sample was female (N=157) and 55% of the sample was male (N=130). The age of the respondents ranged from 20 to 85 years old ($M=36$, $SD=12.02$). More than 40% of the respondents (N=120) reported obtaining a college degree and 30% (N=87) reported attending some college. Table 1 contains demographic information for the sample. There were 75% of the participants who agreed that most time of the year they live in a place with abundant sunshine.
**Table 1**

*Demographics of sample*

<table>
<thead>
<tr>
<th>Variable</th>
<th>M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>35.97 (12.02)</td>
</tr>
<tr>
<td>Gender</td>
<td>n (%)</td>
</tr>
<tr>
<td>Male</td>
<td>130 (45%)</td>
</tr>
<tr>
<td>Female</td>
<td>157 (55%)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>Caucasian/White</td>
<td>213 (74.6%)</td>
</tr>
<tr>
<td>African American/Black</td>
<td>26 (9.4%)</td>
</tr>
<tr>
<td>Hispanic or Latino/a</td>
<td>15 (5.2%)</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>28 (9.7%)</td>
</tr>
<tr>
<td>Native American or American Indian</td>
<td>5 (1.7%)</td>
</tr>
<tr>
<td>Family income in last year</td>
<td></td>
</tr>
<tr>
<td>0-$20000</td>
<td>34 (11.8%)</td>
</tr>
<tr>
<td>$20001-$50000</td>
<td>109 (37.9%)</td>
</tr>
<tr>
<td>$50001-$70000</td>
<td>51 (17.8%)</td>
</tr>
<tr>
<td>$70001-$100000</td>
<td>60 (20.9%)</td>
</tr>
<tr>
<td>$100001-$150000</td>
<td>22 (7.8%)</td>
</tr>
<tr>
<td>More than $150000</td>
<td>11 (3.8%)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>Some high school or less</td>
<td>2 (0.7%)</td>
</tr>
<tr>
<td>High school degree</td>
<td>22 (7.7%)</td>
</tr>
<tr>
<td>Education Level</td>
<td>Count (Percentage)</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Some college</td>
<td>84 (29.3%)</td>
</tr>
<tr>
<td>College degree</td>
<td>117 (40.8%)</td>
</tr>
<tr>
<td>Some graduate school</td>
<td>17 (5.9%)</td>
</tr>
<tr>
<td>Maters or law degree</td>
<td>38 (13.2%)</td>
</tr>
<tr>
<td>MD, PhD or other advanced degree</td>
<td>7 (2.4%)</td>
</tr>
</tbody>
</table>
Procedure

An online questionnaire launched in Qualtrics was used to collect data from the respondents who participated in this online experiment. All the independent variables are between-subjects factors. At first, participants gave consent to participate in this study and then they answered questions on pre-existing attitude toward sunscreen use and past behavior about using sunscreen. After that, the participants were randomly assigned into one of four different experimental conditions. The participants were provided with a link and asked to click on the link and explore the websites as much as they can. They were instructed to read all the information on the website and click on the links and buttons as much as possible. After browsing the website, participants completed a questionnaire via Qualtrics regarding the independent variables, the dependent variables, and demographics information. At the beginning of the survey, they viewed a reminder asking them if they browsed the website. Such reminders have been found to be one way to increase viewing of content. The incentive for each participant was $.50 USD.

Experimental Treatment Conditions

Four websites (2 (modality interactivity: high vs. low) x 2 (message interactivity: high vs. low)) were built for this research project. All four websites had the same webpage layout and health content. They only differed in the interactive features. The websites’ title was “Sun and Skin” with sections on the webpage including one about skin cancer and the other one about sunburn and aging (Figure 3).
Message interactivity was manipulated on the section of “Skin Cancer.” High message interactivity condition had a clicking function through which the participants needed to click on the bars to get further information (Figure 4). Low message interactivity did not have the clicking function and participants could read the information by scrolling down the page (Figure 5). This is consistent with previous manipulations of message interactivity (Oh & Sundar, 2015).
Figure 4

High message interactivity

Skin Cancer

On average, one person dies of skin cancer every hour in the United States (American Cancer Society [ACS], 2013). Over 3.5 million cases of skin cancer are diagnosed each year in the United States, more than all other types of cancer combined (ACS, 2013). Over 12,850 deaths because of skin cancer occurred in 2013, 75% of which are caused by melanoma, the most lethal form of skin cancer (ACS, 2013). The greatest risk factor for skin cancer is well known to be ultraviolet (UV) light exposure from the sun resulting in skin damage (American Academy of Dermatology, 2013). Damage to skin occurs over time with chronic, intermittent, and intense sun exposure. Research has shown that use of broad-spectrum sunscreen prevents all forms of skin cancer and decreases the incidence of melanoma by up to 50% (Green, Williams, Logan, & Strutton, 2011).

The ABCDEs of Detecting Melanoma

<table>
<thead>
<tr>
<th>A: Asymmetry</th>
<th>B: Border</th>
<th>C: Color</th>
<th>D: Diameter</th>
<th>E: Evolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symmetrical</td>
<td>Borders Are Even</td>
<td>One Color</td>
<td>Smaller Than 1/4 Inch</td>
<td>Ordinary Moles</td>
</tr>
<tr>
<td>Asymmetrical</td>
<td>Borders Are Uneven</td>
<td>Multiple Colors</td>
<td>Larger Than 1/4 Inch</td>
<td>Changing in Shape, Size, and Color</td>
</tr>
</tbody>
</table>

Keep Your Skin Healthy

Some sun can be good for you, but to keep your skin healthy, be careful:
(please click on the plus sign on right corner for more information)

Limit time in the sun.

It’s okay to go out during the day, but try to avoid being in the sun during peak times when the sun’s rays are strongest. For example, during the summer try to stay out of the sun between 10 a.m. and 4 p.m. Don’t be fooled by cloudy skies. The sun’s rays can go through clouds. You can also get sunburned if you are in water, so be careful when you are in a pool, lake, or the ocean.

Use sunscreen.

Wear protective clothing.

Avoid tanning.

Your skin may change with age. But remember, there are
Modality interactivity was manipulated through the section of “Sunburn and Aging.”

The high modality interactivity condition had a slider bar feature through which the participants can slide the button from left to right to view the process of aging (Figure 6). In the low modality interactivity condition, two pictures of aging were directly placed on the webpage (Figure 7).

This manipulation is similar to other modality interactivity manipulations used in previous research (Oh & Sundar, 2015).
Figure 6

High modality interactivity

Too much exposure to UVB rays can lead to sunburn. UVA rays can travel more deeply into the skin than UVB rays, but both can affect your skin’s health. When UV rays enter skin cells, they upset delicate processes that affect the skin’s growth and appearance.

Over time, exposure to these rays can make the skin less elastic. Skin may even become thickened and leathery, wrinkled, or thinned like tissue paper. “The more sun exposure you have, the earlier your skin ages,” says Dr. Barnett L. Kramer, a cancer prevention expert at NIH.
Photoaging describes the clinical and histologic skin changes induced by sun exposure. Affected skin loses elasticity and appears dry, wrinkled, and patchily pigmented and often has dilated superficial blood vessels and actinic keratoses.

Ultraviolet (UV) A and B components of solar radiation are implicated in photoaging of the skin. Apart from unwanted cosmetic effects, photoaging is a strong risk factor for skin cancer. Ultraviolet radiation damages nucleic acids and proteins in epidermal cells directly and through reactive oxygen species, resulting in impaired collagen and elastin homeostasis, local immune suppression, altered differentiation of keratinocytes, and ultimately tumor development.

A long-term clinical trial that took more than 2 years in Australia proved that regular sunscreen use by young and middle-aged adults younger than 65 years can retard skin aging.

An estimated 90 percent of skin aging is caused by the sun. People who use sunscreen with an SPF of 15 or higher daily show 24 percent less skin aging than those who do not use sunscreen daily.

It's as easy to get sunburned in winter as in summer. Snow reflects the sun's rays,
Figure 7

Low modality interactivity

Photoaging describes the clinical and histologic skin changes induced by sun exposure. Affected skin loses elasticity and appears dry, wrinkled, and patchily pigmented and often has dilated superficial blood vessels and actinic keratoses.

Ultraviolet (UV) A and B components of solar radiation are implicated in photoaging of the skin. Apart from unwanted cosmetic effects, photoaging is a strong risk factor for skin cancer. Ultraviolet radiation damages nucleic acids and proteins in epidermal cells directly and through reactive oxygen species, resulting in impaired collagen and elastin homeostasis, local immune suppression, altered differentiation of keratinocytes, and ultimately tumor development.

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It’s as easy to get sunburned in winter as in summer. Snow reflects the sun’s rays.

Measures

Manipulation checks.

*Perceived interactivity* was measured by three items adapted from Kalyanaraman and Sundar (2006) asking participants to indicate how interactive the website was, if the website allowed them to perform a lot of actions, and if the website allowed them to access information in a variety of ways. Additionally, a manipulation check item was asked for each of the interactivity manipulation types to assess exposure to the stimuli. To assess message interactivity, participants were asked the yes/no question of “did you click on the link to view more information” and “how interactive did you feel the site was when using the drop down
“button/menu” on a scale of 1-7, where 1 is not at all and 7 is extremely. Modality interactivity was assessed the yes/no question of “did you drag the slider bar to view more information” and “How interactive did you feel the site was while dragging the slider to view the picture” on a scale of 1-7, where 1 is not at all and 7 is extremely.

Before beginning analysis of the data, all manipulation check items were assessed. If participants in the high interactivity conditions did not answer “yes” to the dichotomous manipulation check questions, they were dropped from the data as failing to pass the manipulation check. A total of 16 participants were dropped due to failing the manipulation check, resulting in a final analysis sample of 287. Independent sample t-tests were used to check if the high interactivity conditions have higher scores on the second set of manipulation check questions. According to the results of two independent sample t-tests, participants in the high modality condition ($M=4.67, SD=1.55$) scored higher on perceived interactivity than participants in the low modality condition ($M=4.22, SD=1.50$), $t(291)=2.58, p<.05$; participants in the high message condition ($M=4.60, SD=1.48$) scored higher on perceived interactivity than participants in low modality condition ($M=4.30, SD=1.60$), $t(291)=1.18, p<.05$.

**Dependent variables.**

Table 2 provides descriptive statistics for all variables under study. *Behavioral intention* was measured from three aspects: intention to use sunscreen, intention to share the website, and intention to visit the website in the future. Hu and Sundar’s (2010) adapted multidimensional scale was used to measure the intention to share. The respondents were asked to indicate their degree of agreement regarding the statements on their behavioral intention to act upon the advice in the message and to recommend the information to others. Two seven-point Likert type items included “I will recommend the advice I read on the webpage to another person,” and “I will
forward the website to my online acquaintances” (Cronbach’s $\alpha= .88$). Intention to visit the website again in the future was measured by three seven-point Likert type items including “I would like to visit this website again in the future,” “I would like to visit other websites similar to the one that I just browsed,” and “I would like to save this web page for future browsing” (Cronbach’s $\alpha= .93$). Intention to use sunscreen was measured by three items including “I plan to use sunscreen in the future” “I will try to use sunscreen in the future”, and “I intend to use sunscreen in the near future.” Items will be averaged to create a scale (Cronbach’s $\alpha= .93$).
<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Range</th>
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<td>Previous behaviors</td>
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<td>1-7</td>
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<td>1.17</td>
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<tr>
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<td>1-10</td>
<td>1.57</td>
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<td>Intention to use sunscreen</td>
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<td>1-7</td>
<td>1.44</td>
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<tr>
<td>Cognitive engagement</td>
<td>4.40</td>
<td>1-7</td>
<td>1.41</td>
</tr>
</tbody>
</table>
**Attitude.** Seven 7-point scale statements were used to measure the respondents’ attitude toward health information and the health website. To measure attitude toward the website, questions asked whether the respondents agreed or disagreed that the website was “exciting”, “high quality”, “fun”, “cool”, “imaginative”, and “entertaining” (Cronbach’s α= .87). Attitude toward skin cancer was measured by six statements asking whether the respondents felt skin cancer information was “not believable” or “believable”, “not informative” or “informative”, “not insightful” or “insightful”, “not objective” or “objective”, “not interesting” or “interesting”, “not clear” or “clear” (Cronbach’s α= .93).

**Cognitive trust** was measured by 4 items ranging from 1 (extremely not) to 10 (extremely). The respondents were asked whether they felt the website was “believable”, “credible,” “reliable,” and “accurate” (Cronbach’s α= .95). **Affective trust** was measured by 5 items ranging from 1 (extremely not) to 10 (extremely) adapted from Lewis & Weigert (1985). The respondents were asked whether they felt the website was “personal”, “interested in my well-being”, “likeable,” “enjoyable,” and “positive” (Cronbach’s α= .86).

**Knowledge** was measured from two aspects, the objective memory recall and the perception of knowledge gain. **Perceived knowledge** was measured by four 7-point Likert-scale items ranging from 1 (strongly disagree) to 7 (strongly agree) asking how knowledgeable the respondents felt after exploring the websites. This measure was adapted from Lu et al. (2014), which was modified from Smith and Park (1992). The statements including “I feel very knowledgeable about skin cancer”, “If a friend asked me about skin cancer, I could give them advice”, “If I had to get some help on sun protection, I would need to gather very little information in order to make a wise decision”, and “I feel very confident about my ability to tell the disadvantages of sun exposure” (Cronbach’s α= .89). Memory recall was measured by three
questions asking whether they thought the following statements were correct based on what they had read. The statements were retrieved from the information on the website and included “People don't need to use sunscreen in winter,” “Tanning pills can help protect skin when you use tanning beds,” and “Sunscreen with an SPF of 10 is enough for people doing outdoors activities.” Correct answers were coded as 1 and incorrect answers were coded as 0. The number of correct answers was integrated as the final scores for the objective knowledge gain.

**Mediating variables**

Seven 7-point Likert-type items adapted from Griffin, Neuwirth, Giese and Dunwoody’s (2002) questionnaire were used to measure the *heuristic processing of the participants*, such as: “When I encounter information about this topic, I focus on only a few key points,” “If I have to act on this matter, the advice of one expert is good enough for me,” “When I was reading information about skin health, I rarely spent much time thinking about it,” “I skimmed through the content,” “I didn't spent much time thinking about the information after I read it” “There is far more information about skin health than I personally need” (Cronbach’s α=.84).

In addition, five 7-point Liker-type items adapted from the same questionnaire were used to measure the *systematic processing*. For example, “After I encounter information about this topic, I am likely to stop and think about it,” “If I need to act on this matter, the more viewpoints I get the better,” “It is important for me to interpret information about skin health in a way that applies directly to my life,” “After thinking about skin health, I have a broader understanding,” “When I encounter information about skin health, I read or listen to most of it, even though I may not agree with its perspective” (Cronbach’s α=.82).
Covariates

Pre-existing attitudes toward using sunscreen were measured by six questions adapted from Myers & Horwill’s (2006) sunscreen use scale. Participants were asked if they feel that using sunscreen is “unpleasant” or “pleasant”, “enjoyable” or “unenjoyable”, “beneficial” or “harmful”, “satisfactory” or “unsatisfactory”, “bad” or “good”, “positive” or “negative” on a scale of 1-7 (Cronbach’s $\alpha = .91$).

Previous behaviors regarding sunscreen use were also measured. Four 7-point Likert-type items were adapted from Weinstein (2007). The questions aimed to ask whether the participants have used sunscreen in the past year. The items included “I have used sunscreen protection whenever I was outdoor,” “I tended to use sunscreen protection as much as I can”, “I tried to use sunscreen protection in both winter and summer,” and “I simultaneously use sunscreen to protect my skin from the sun” (Cronbach’s $\alpha = .95$).

Power usage were measured by six 7-point Likert-type items ranging from 1 (strongly disagree) to 7 (strongly agree) adapted from power usage scale of Marathe, Sundar, Bijvank, van Vugt, & Veldhuis (2007). Examples include “I make good use of most of the features available in any technological device,” “I have to have the latest available technology or the latest available upgrades,” and “I like to challenge myself in figuring out how to use any new technology” (Cronbach’s $\alpha = .82$).

Data analysis

General linear model (GLM) analyses were used to test the effects of the two independent variables (modality interactivity and message interactivity) on dependent variables proposed in hypotheses. Two-way ANCOVA was used because I was trying to explore the interaction effect of modality interactivity and message interactivity. The conditions were coded as high and low.
Pre-existing attitudes toward using sunscreen were controlled in analyses that used the attitudes toward using sunscreen as the dependent variable. Previous behaviors about using sunscreen in the past year were controlled for in the analyses that used behavioral intentions as the outcome variables. M-Turk workers have a broader range of age and were 10 years old than the age of a typical college student sample (Johnson & Borden, 2012) and people at different ages have different perceptions about skin cancer. Moreover, compared to men, women have a higher risk of getting skin cancer (Muzic et al., 2017). Therefore, age and gender were controlled as covariates in all ANCOVA analyses. To test the mediating variables, I also ran a set of regression-based process macro models by Hayes (see Preacher, Rucker, and Hayes, 2007).

To test that the population was normally distributed, a test of normality was conducted (Explore-histograms). To test for homogeneity of variances, Levene’s test was conducted. The results suggested that the assumptions were met for the data set.
CHAPTER FOUR

RESULTS

Attitude

According to the ANOVA analyses, modality interactivity did not have a significant influence on interface assessment. Thus H1 was not supported.

There was a significant effect of modality interactivity on attitudes toward the health information about skin cancer after controlling for gender, age, and pre-existing attitude toward sunscreen. Participants in the high modality interactivity condition \( (M=6.03, \ SE=.08) \) did score high on attitudes toward the health information about skin cancer than participants in the low modality interactivity condition \( (M=5.79, \ SE=.08) \), \( F (6, 281) =6.416, p< .05, \ \eta_p^2 = .016 \). Moreover, there was a significant effect of modality interactivity on attitudes toward the health website after controlling for gender, age, and pre-existing attitude toward sunscreen. Participants who explored the high modality websites \( (M=4.69, \ SE=.11) \) scored higher than participants who explored the low modality websites \( (M=4.26, \ SE=.11) \), \( F (6, 281) =9.50, p < .01, \ \eta_p^2 = .026 \). Therefore, H2a and H2b were supported.

Behavioral Intention

Modality interactivity was also found to have a positive effect on intentions to use sunscreen after controlling for gender, age, and previous behaviors of using sunscreen. Participants who explored the high modality websites \( (M=5.70, \ SE=.12) \) scored higher on intention to use sunscreen in the future than participants who explored the low modality websites \( (M=5.18, \ SE=.12) \), \( F (5, 282) =6.12, p < .001, \ \eta_p^2 = .053 \). Thus, H3a was supported. I also found a significant effect of message interactivity on intentions to use sunscreen. The effect of message interactivity was negative, indicating that people who viewed the low message
interactivity websites ($M=5.78$, $SE=.12$) had a higher intention to use sunscreen than people who viewed the high message interactivity websites ($M=5.10$, $SE=.12$) in the future, $F(6, 281) =9.50$, $p < .001$, $\eta^2_p = .078$.

In addition, I found a significant effect of modality interactivity on intentions to recommend the health websites to others. Participants in the high modality interactivity condition ($M=5.04$, $SE=.13$) reported higher intention to recommend the website to others than participants in the low modality interactivity condition ($M=4.65$, $SE=.13$), $F(7, 280) =4.29$, $p < .05$, $\eta^2_p = .017$. Thus, H3b was supported. However, I did not find a significant effect of modality interactivity on intention to visit the website in the future. Therefore, H3c was not supported.

To test the mediating role of attitude toward skin cancer and the health website, PROCESS Model 4 was used to run the analysis with intention to use sunscreen/intention to recommend/intention to visit health websites as the outcome variable (Y), modality interactivity as the independent variable (X) and attitude toward skin cancer/attitude toward the health website as the mediator (M). The number of bootstrapping iterations was set at 1,000 (CI at 95% level). According to the results of process model 4, attitude toward skin cancer information was mediating the effects of modality interactivity on intention to use sunscreen in the future (Figure 8). There was a significant indirect effect of modality interactivity on intention to use sunscreen via its prior effect on attitude toward skin cancer information ($B_{indirect} = .08$, $SE=.04$, 95%CI: .01 to .19). In addition, there was a direct effect of modality interactivity on intention to use sunscreen ($B= .48$, $SE=.16$, $p<0.01$).

Attitude toward skin cancer information was also mediating the effects of modality interactivity on intention to recommend the website to others (Figure 9). There was a significant
indirect effect of modality interactivity on intention to recommend via its prior effect on attitude toward skin cancer information ($B_{\text{indirect}} = .11$, SE = .06, 95%CI: .01 to .26).

**Figure 8**

**Mediation Model: Effect of modality interactivity on intention to use sunscreen as a function of attitude toward skin cancer information levels**

![Mediation Model](image)

*Note:* The model includes effects of control variables (gender, age, and pre-existing attitude), which are not displayed. Pre-existing attitude is a significant predictor, $p < .001$; age is a significant predictor, $p < .01$.

* $p < .05$. ** $p < .01$. *** $p < .001$.

**Figure 9**

**Mediation Model: Effect of modality interactivity on intention to recommend as a function of attitude toward skin cancer information levels**

![Mediation Model](image)

*Note:* The model includes effects of control variables (gender, age, and pre-existing attitude), which are not displayed. Pre-existing attitude is a significant predictor, $p < .001$.

* $p < .05$. ** $p < .01$. *** $p < .001$. 

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Note: The model includes effects of control variables (gender, age, and pre-existing attitude), which are not displayed. Pre-existing attitude is a significant predictor, $p<.001$.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Additionally, attitude toward skin cancer information was a mediator that mediated the effects of modality interactivity on intention to visit health websites in the future (Figure 10). There was a significant indirect effect of modality interactivity on intention to visit via its prior effect on attitude toward skin cancer information ($B_{\text{indirect}} = .08$, SE = .05, 95%CI: .00 to .21). Therefore, H4a, H4b, and H4c were supported.

Attitude toward health website was mediating the effects of modality interactivity on intention to recommend (Figure 11). There was a significant indirect effect of modality interactivity on intention to recommend via its prior effect on attitude toward health website ($B_{\text{indirect}} = .26$, SE = .10, 95%CI: .06 to .47). Attitude toward health website was also as a mediator that mediated effects of modality interactivity on intention to visit (Figure 12). There was a significant indirect effect of modality interactivity on intention to visit via its prior effect on attitude toward health website ($B_{\text{indirect}} = .24$, SE = .10, 95%CI: .06 to .46). Therefore, H5a was not supported while H5b and H5c were supported.
Figure 11

Mediation Model: Effect of modality interactivity on intention to recommend as a function of attitude toward health website levels

Note: The model includes effects of control variables (gender, age, and previous behavior), which are not displayed.
*p < .05. **p < .01. ***p < .001.

Figure 12

Mediation Model: Effect of modality interactivity on intention to visit as a function of attitude toward health website levels

Note: The model includes effects of control variables (gender, age, and previous behavior), which are not displayed. Previous behavior is a significant predictor, p< .001.
*p < .05. **p < .01. ***p < .001.
According to the results of two-way ANOVA, no interaction effect was found of modality interactivity and message interactivity on either attitudes or intentions. Therefore, RQ1 was answered.

**Message elaboration**

I did not find a significant effect of message interactivity on elaboration. Thus, H6 was not supported.

**Heuristic and systematic processing**

There was a significant effect of message interactivity on systematic processing, whereas there was no significant effect of modality interactivity on heuristic processing. Participants who viewed the low message interactivity websites ($M=5.45$, $SE=.09$) had a higher level of systematic processing than those who viewed the high message interactivity websites ($M=5.20$, $SE=.08$), $F(5, 282)=1.58$, $p<.05$, $\eta_p^2=.011$. Therefore, H7 was not supported while H8 was supported.

**Trust**

There were two types of trust that focused on two different dimensions. Cognitive trust focuses on the rational aspect while affective trust focuses on the emotional judgment. There was a significant effect of modality interactivity on affective trust. Participants who explored the high modality interactivity websites ($M=7.89$, $SE=.32$) had a higher level of cognitive trust than those who viewed the low modality interactivity websites ($M=6.65$, $SE=.33$), $F(6, 281)=2.94$, $p<.01$, $\eta_p^2<.001$. Therefore, H9 was supported. I did not detect a significant effect of message interactivity on cognitive trust. Thus, H10 was not supported.

To test the mediating role of systematic and heuristic processing, PROCESS Model 4 was used to run the analysis with affective trust/ cognitive trust as the outcome variable (Y), modality
interactivity/message interactivity as the independent variable (X) and heuristic processing/
systematic processing as the mediator (M). The number of bootstrapping iterations was set at
1,000 (CI at 95% level). According to the results of process model 4, heuristic processing was
not mediating the effects of modality interactivity on affective trust, whereas systematic
processing was mediating the effects of message interactivity on cognitive trust (Figure 13).
There was a significant indirect effect of message interactivity on cognitive trust via its prior
effect on systematic processing ($B_{indirect} = -.14, SE = .07, 95\% CI: -.20$ to $.48$). Therefore, H11 was
not supported while H12 was supported.

The same analyses were used to detect the mediating roles of affective trust and cognitive
trust on behavioral intentions. PROCESS Model 4 was used with intention to use
sunscreen/intention to recommend/intention to visit health websites as the outcome variable (Y),
modality interactivity/message interactivity as the independent variable (X) and affective
trust/cognitive trust as the mediator (M). According to the results of process model 4, affective
trust was mediating the effects of modality interactivity on intention to recommend (Figure 14).
There was a significant indirect effect of modality interactivity on intention to recommend via its
prior effect on affective trust ($B_{indirect} = .11, SE = .11, 95\% CI: .06$ to $.41$). affective trust was also
a mediator of modality interactivity on intention to visit health websites in the future (Figure 15).
There was a significant indirect effect of modality interactivity on intention to visit via its prior
effect on affective trust ($B_{indirect} = .10, SE = .09, 95\% CI: .05$ to $.34$). I did not find affective trust
as a mediator of modality interactivity on intention to use sunscreen. In addition, I cognitive trust
was not mediating effects of message interactivity on behavioral intentions. Therefore, RQ2 and
RQ3 were answered.
Figure 13

Mediation Model: Effect of message interactivity on cognitive trust as a function of systematic processing levels

Note: The model includes effects of control variables (gender, age, and pre-existing attitude), which are not displayed. Age is a significant predictor, $p < .05$; pre-existing attitude is a significant predictor, $p < .05$.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Figure 14

Mediation Model: Effect of modality interactivity on intention to recommend as a function of affective trust levels

Note: The model includes effects of control variables (gender, age, and previous behavior), which are not displayed. Previous behavior is a significant predictor, $p < .001$.
* $p < .05$. ** $p < .01$. *** $p < .001$. 
Figure 15

Mediation Model: Effect of modality interactivity on intention to visit as a function of affective trust levels

Note: The model includes effects of control variables (gender, age, and previous behavior), which are not displayed. Previous behavior is a significant predictor, $p < .001$.

Knowledge

Two types of knowledge were examined in the present study, the perceived knowledge and actual knowledge (memory recall). I found a significant main effect of modality interactivity on perceived knowledge. Participants who were in the low modality interactivity conditions ($M=4.98$, $SE=.10$) scored higher on perceived knowledge than participants who were in the high modality interactivity conditions ($M=4.43$, $SE=.10$), $F(6, 284) =12.56$, $p < .001$, $\eta_p^2 = .046$. I also found a significant main effect of message interactivity on perceived knowledge. Participants who were in the high message interactivity conditions ($M=4.42$, $SE=.10$) scored higher on perceived knowledge than participants who were in the low message interactivity conditions ($M=4.99$, $SE=.10$), $F(6, 281) =12.56$, $p < .001$, $\eta_p^2 = .043$. Therefore, RQ4 was answered.

As for the actual knowledge gain, modality interactivity did not have a significant main effect on the memory recall or actual knowledge gain. Message interactivity had an approaching
significant main effect on the knowledge gain, \( p = .054 \). However, there was an interaction effect of modality interactivity and message interactivity on the memory recall, \( F(6, 281) = 8.95, p < .001, \eta_p^2 = .043 \). Participants who were in the high modality interactivity and high message interactivity condition had the highest score on the memory recall. Thus, RQ5 was answered.

PROCESS Model 4 was used to run the analysis with intention to recommend/intention to visit health websites/ intention to use sunscreen as the outcome variable (Y), modality interactivity/message interactivity as the independent variable (X) and perceived knowledge as the mediator (M). The number of bootstrapping iterations was set at 1,000 (CI at 95\% level).

According to the results of process model 4, perceived knowledge was mediating the effects of modality interactivity on intention to recommend (Figure 16). There was a significant indirect effect of modality interactivity on intention to recommend via its prior effect on perceived knowledge (\( B_{\text{indirect}} = -.13, \text{SE} = .05, 95\% \text{CI: } -.26 \text{ to } -.05 \)). In addition, modality interactivity had a direct effect on intention to recommend (\( B = .47, \text{SE} = .18, p < .01 \)). Perceived knowledge was also mediating the effects of modality interactivity on intention to visit health websites (Figure 17). There was a significant indirect effect of modality interactivity on intention to visit via its prior effect on perceived knowledge (\( B_{\text{indirect}} = .12, \text{SE} = .05, 95\% \text{CI: } .04 \text{ to } .26 \)). I did not find the mediating role of perceived knowledge of modality interactivity on intention to use sunscreen. Thus, RQ6 was answered.
Figure 16

Mediation Model: Effect of modality interactivity on intention to recommend as a function of perceived knowledge levels

![Diagram](image)

Note: The model includes effects of control variables (gender, age, and previous behavior), which are not displayed. Previous behavior is a significant predictor, \( p < .01 \); age is a significant predictor, \( p < .05 \)

\* \( p < .05 \) \** \( p < .01 \) \*** \( p < .001 \).

Figure 17

Mediation Model: Effect of modality interactivity on intention to visit as a function of perceived knowledge levels

![Diagram](image)

Note: The model includes effects of control variables (gender, age, and previous behavior), which are not displayed. Previous behavior is a significant predictor, \( p < .001 \); age is a significant predictor, \( p < .05 \)

\* \( p < .05 \) \** \( p < .01 \) \*** \( p < .001 \).
Additionally, perceived knowledge was a mediator which mediated the effects of message interactivity on intention to recommend (Figure 18). There was a significant indirect effect of message interactivity on intention to recommend via its prior effect on perceived knowledge ($B_{\text{indirect}} = .12$, SE = .05, 95%CI: .04 to .26). Perceived knowledge was also mediating the effects of message interactivity on intention to visit (Figure 19). There was a significant indirect effect of message interactivity on intention to visit the health website via its prior effect on perceived knowledge ($B_{\text{indirect}} = .09$, SE = .05, 95%CI: .02 to .23). Therefore, RQ7 was answered.

**Figure 18**

**Mediation Model: Effect of message interactivity on intention to recommend as a function of perceived knowledge levels**

Note: The model includes effects of control variables (gender, age, and previous behavior), which are not displayed. Previous behavior is a significant predictor, $p < .01$; age is a significant predictor, $p < .05$; *$p < .05$. **$p < .01$. ***$p < .001$.

According to the results of process model 4, heuristic processing did not mediate the effects of modality interactivity on perceived knowledge; thus RQ8 was answered. However, systematic processing mediated the effects of message interactivity on perceived knowledge (Figure 20). There was a significant indirect effect of message interactivity on perceived knowledge via its prior effect on systematic processing ($B_{\text{indirect}} = -.06$, SE = .03, 95% CI: -.16 to -.0001).
Therefore, RQ9 was answered. Besides, there was a direct effect of message interactivity on perceived knowledge (B=.52, SE=.14, p<0.001).

**Figure 19**

**Mediation Model: Effect of message interactivity on intention to visit as a function of perceived knowledge levels**

![Diagram](image)

*Note:* The model includes effects of control variables (gender, age, and previous behavior), which are not displayed. Previous behavior is a significant predictor, p<.001.

*p < .05. **p < .01. ***p < .001.

**Figure 20**

**Mediation Model: Effect of message interactivity on perceived knowledge as a function of systematic processing levels**

![Diagram](image)

*Note:* The model includes effects of control variables (gender, age, and pre-existing attitude), which are not displayed. Pre-existing attitude is a significant predictor, p<.001.

*p < .05. **p < .01. ***p < .001.
Cognitive engagement

According to the results of process model 4, interface assessment was not a significant mediator that mediated effects of modality interactivity on cognitive engagement. Thus, H13 was not supported. However, cognitive engagement was found to mediate the relationship between modality interactivity and attitude toward skin cancer information (Figure 21). There was a significant indirect effect of modality interactivity on attitude toward skin cancer information via its prior effect on cognitive engagement \( B_{\text{indirect}} = .07, \ SE = .04, \ 95\% \ CI: .01 \text{ to } .15 \). Therefore, H14 was supported. Table 3 contains all hypotheses and results while table 4 contains all research questions and results.

Figure 21

Mediation Model: Effect of modality interactivity on attitude toward skin cancer information as a function of cognitive engagement levels

Note: The model includes effects of control variables (gender, age, and pre-existing attitude), which are not displayed. Pre-existing attitude is a significant predictor, \( p < .01 \); age is a significant predictor, \( p < .05 \).

\* \( p < .05 \), \* \( p < .01 \), \* \( p < .001 \).
### Table 3

**Results of hypotheses**

<table>
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<tr>
<th>Hypothesis</th>
<th>Results</th>
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<td>H1: Modality interactivity will be positively associated with interface assessment.</td>
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<tr>
<td>H2a: Modality interactivity will be positively associated with attitude toward the health website.</td>
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<tr>
<td>H2b: Modality interactivity will be positively associated with attitude toward the skin cancer messages.</td>
<td>Supported</td>
</tr>
<tr>
<td>H3a: Modality interactivity will be positively associated with intentions to use sunscreen.</td>
<td>Supported</td>
</tr>
<tr>
<td>H3b: Modality interactivity will be positively associated with intentions to recommend the health website to others.</td>
<td>Supported</td>
</tr>
<tr>
<td>H3c: Modality interactivity will be positively associated with intentions to visit health websites.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H4a: Attitude toward the skin cancer message mediates the effect of modality interactivity on behavioral intentions to use sunscreen.</td>
<td>Supported</td>
</tr>
<tr>
<td>H4b: Attitude toward the skin cancer message mediates the effect of modality interactivity on behavioral intentions to recommend the health website to others.</td>
<td>Supported</td>
</tr>
<tr>
<td>H4c: Attitude toward the skin cancer message mediates the effect of modality interactivity on behavioral intentions to visit health websites.</td>
<td>Supported</td>
</tr>
<tr>
<td>H5a: Attitude toward the website mediates the effect of modality interactivity on behavioral intentions to use sunscreen.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H5b: Attitude toward the website mediates the effect of modality interactivity on behavioral intentions to recommend the health website to others.</td>
<td>Supported</td>
</tr>
<tr>
<td>H5c: Attitude toward the website mediates the effect of modality interactivity on behavioral intentions to visit health websites.</td>
<td>Supported</td>
</tr>
<tr>
<td>H6: Message interactivity will be positively associated with message elaboration.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H7: Higher level of modality interactivity will lead to more heuristic processing.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H8: Lower level of message interactivity will lead to more systematic processing.</td>
<td>Supported</td>
</tr>
<tr>
<td>H9: Higher modality interactivity will lead to greater affective trust.</td>
<td>Supported</td>
</tr>
<tr>
<td>H10: Higher message interactivity will lead to greater cognitive trust.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H11: Heuristic processing will mediate the effects of modality interactivity on affective trust.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H12: Systematic processing will mediate the effects of message interactivity on cognitive trust.</td>
<td>Supported</td>
</tr>
<tr>
<td>Hypothesis</td>
<td>Support</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>H13: Interface assessment will mediate the effects of modality interactivity on cognitive engagement.</td>
<td>Not supported</td>
</tr>
<tr>
<td>H14: Cognitive engagement will mediate the effects of modality interactivity on attitude toward skin cancer information.</td>
<td>Supported</td>
</tr>
</tbody>
</table>
### Table 4

**Results of research questions**

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1: Is there an interaction effect among modality interactivity and message interactivity on attitudes and intentions?</td>
<td>No interaction effects on attitudes or behavioral intentions.</td>
</tr>
<tr>
<td>RQ2: Will affective trust mediate the effects of modality on (a) intention to use sunscreen, (b) intention to recommend the health websites, and (c) intention to visit health websites?</td>
<td>Modality interactivity → Affective trust → Intention to recommend Modality interactivity → Affective trust → Intention to visit Cognitive trust was not a mediator of message interactivity on behavioral intentions.</td>
</tr>
<tr>
<td>RQ3: Will cognitive trust mediate the effects of message interactivity on (a) intention to use sunscreen, (b) intention to recommend the health websites, and (c) intention to visit health websites?</td>
<td>Modality interactivity had a negative impact on perceived knowledge. Message interactivity had a positive impact on perceived knowledge. There was a interaction effect on actual knowledge gain.</td>
</tr>
<tr>
<td>RQ4: What is the effect of (a) modality interactivity and (b) message interactivity on perceived knowledge of skin cancer and sun protection?</td>
<td>Modality interactivity → Perceived knowledge → Intention to recommend</td>
</tr>
<tr>
<td>RQ5: What is the effect of (a) modality interactivity and (b) message interactivity on actual knowledge gain about skin cancer and sun protection?</td>
<td>Modality interactivity → Perceived knowledge → Intention to visit Message interactivity → Perceived knowledge → Intention to recommend</td>
</tr>
<tr>
<td>RQ6: Will perceived knowledge mediate effects of modality interactivity on behavioral intentions?</td>
<td>Message interactivity → Perceived knowledge → Intention to visit No</td>
</tr>
<tr>
<td>RQ7: Will perceived knowledge mediate effects of message interactivity on behavioral intentions?</td>
<td>Message interactivity → Perceived knowledge → Intention to visit</td>
</tr>
<tr>
<td>RQ8: Will heuristic processing mediate effects of modality interactivity on perceived knowledge?</td>
<td>Message interactivity → Systematic processing → Perceived knowledge</td>
</tr>
<tr>
<td>RQ9: Will systematic processing mediate the effects of message interactivity on perceived knowledge?</td>
<td>Message interactivity → Systematic processing → Perceived knowledge</td>
</tr>
</tbody>
</table>
CHAPTER FIVE

DISSCUSION

The aim of this study was to examine both the main effect and interaction effect of two different types of interactivity presented on the health websites’ interface. Although some previous studies investigated the effects of interactivity on attitudinal and behavioral variables, there is still a dearth of using differently conceptualized types of interactivity to detect how different types of interactivity influence attitudinal and behavioral outcomes. Research that examines the possible interplay of multiple types of interactivity is also lacking. This study attempts to overcome these barriers by using two different types of interactivity, modality interactivity and message interactivity, to predict how different interactive features on the health website influence attitudinal and behavioral intentions of both the health content about skin cancer and the health website.

Scholars tend to use their own definition or dimensions of interactivity in their study so that there is not a unified definition of interactivity in communication field. The current study tries to illustrate the distinct effect of different types of interactivity in an empirical study. In addition, employing interactivity in health interventions still requires more empirical studies. There are not many studies explicitly assessing interactivity and the influence of interactivity in health interventions (Willoughby & Niu, 2016). Data of the present study lends support to most of the theoretically constructed hypotheses and demonstrates that different types of interactivity, which focus on different trust, user engagement, and information processing type, have different influences on health-related outcome variables through different mediators. The technological affordances on the media system need to be carefully defined and applied into eHealth and mHealth interventions. Another contribution of the present study is that I not only examined
different types of interactivity, but also classified attitudinal and behavioral outcomes into more specific categories, such as intention to use sunscreen, intention to recommend, and intention to visit. Moreover, both actual knowledge gain and perceived knowledge were measured to explore their direct and mediated relationship with other variables. The following sections will discuss these findings in details.

**Manipulation of interactivity in health interventions**

The present study used the MAIN model (Sundar, 2008) as a theoretical background to conceptualize different types of interactivity and used the model of interactivity effects as a guiding theory to map the relationships between interactivity, mediators (such as perceived knowledge), and attitudinal and behavioral outcome variables. Previous studies have examined some interactivity models in the advertising field (e.g., a dual-process model of interactivity effects, Liu & Shrum, 2009) or purely focusing on building a moderation model of technological attributes (e.g., mediated moderation model of interactivity, Bucy & Tao, 2007). Not many theories or models of interactivity have been examined or applied to eHealth or mHealth interventions. This study distinguished two types of interactivity, message interactivity and modality interactivity, to examine the different effects of each type of interactivity on health related outcomes. Previous studies in the communication field have used interactivity as a general concept and have not differentiated among various technological functions, such as hyperlinks and 3D rotation function (e.g., hyperlinks, Chung & Zhao, 2004; zoom-in and zoom-out, pan and rotate, Lu et al., 2014; navigation tools and hyperlinks, Lustria, 2007). Previous research has not investigated which interactive features on the interface should belong to which type of interactivity, which interactivity would lead to which kind of information processing and which would yield which kind of effects. The present study operationalized two types
interactivity with different technological features in an experimental study and explicitly examined the distinct effects of different types of interactivity on a health website, which has added to the previous literature gap in the interactivity research and has added methodological implications to empirical eHealth research.

**Heuristic and Systematic processing**

According to HSM, heuristic processing requires less cognitive effort and fewer cognitive resources, therefore, the decisions or judgments are made quickly based on the heuristics such as video, pictures, or other information that can be easily processed. I did not find a significant effect of modality interactivity on heuristic processing in the present study. It can be explained by the fact that the heuristics in the high modality interactivity condition and the low modality interactivity condition did not differ from each other. When individuals in the high modality interactivity condition dragged the bar to view the change of the pictures, they might use more cognitive effort for information processing than individuals who only viewed static pictures. A previous study (Kim & Sundar, 2016) investigating how presentation mode and screen size influenced information processing found that larger screen size and video mode led to more heuristic processing. This could be because large screen and video mode are clearly distinguished from small screen and text mode, while in the current study, pictures in the modality interactivity conditions were leading to similar heuristic processing level. Regarding message interactivity, I did find that message interactivity had a negative effect on systematic processing which is consistent with the study of Kim and Sundar (2016). People in the low message interactivity condition did not need to interact or perform any actions. They just read all the text and pictures on the website, which was more like communication on traditional media. Therefore, they needed more cognitive effort which led to a higher level of systematic processing.
Researchers, campaign designers, and health practitioners should be alerted by the content and goals they want to achieve. For websites of advertising, marketing or organizational communication, the goal may be getting more heuristics and help customers to make quick but not rational decisions. However, for health websites with serious health information, there will be a difference if the goal is to help people absorb credible and accurate information and the goal is to impress the participants with the website or make the viewers be more interested in the topic.

**Trust**

The present study employed two dimensions of trust, cognitive trust and affective trust. Cognitive trust is logic-driven and it represents the rational judgment of the information. Cognitive trust can also be explained as perceived crediblility, which refers to the judgment of how credible the message is. Affective trust is another dimension of trust and is often emotion-driven. It is at the opposite location of cognitive trust in human perceptions (Picard, 2002) and represents more aspects of enjoyment and satisfaction (Kim & Sundar, 2016). Participants in the high modality interactivity condition had a higher level of affective trust than participants in the low modality interactivity condition, which means that people had a higher level of interactions with the modality cues on the health website enjoyed the information more regarding the trust perspective. They were more satisfied with the experience with interacting with the website emotionally. Message interactivity level did not have a direct effect on cognitive trust. However, I found that message interactivity had an indirect on cognitive trust via its prior effects on systematic processing and the relationship was fully mediated. Previous studies have found that hyperlinks as one form of the message interactivity could increase perceived credibility of online news (Borah, 2014; Johnson & Wiedenbeck, 2009), but no studies had results about how message interactivity may influence perceived credibility of health messages. The present study
provided a direction of how message interactivity can influence perceived credibility of health messages through potential mediators such as systematic processing.

The results about the relationship between heuristic processing and affective trust and systematic processing and cognitive trust are consistent with previous studies (Kim & Sundar, 2016). This finding demonstrated that if health practitioners aim to increase affective trust toward the health content, they need to work on increasing modality interactivity; if they want to make the information credible and let the individuals make rational judgments, they need to work on message interactivity. Future studies should examine whether affective trust and cognitive trust will exert different effects under different health contexts and whether message interactivity or different presences of interactivity on media systems influence perceived credibility through different mediators of other health context. Empirical data are needed to draw further conclusions.

**Perceived knowledge and actual knowledge gain**

Perceived knowledge and actual knowledge gain are two different concepts which may exert different influences on attitudes and behavioral intentions. The formation of human perceptions requires a large amount of different elements that may vary based on personal experiences, cultural background, values or other individual differences. Therefore, even presented with the same amount of information, people may generate dramatically different perceptions. One contribution of this study is that I measured both perceived knowledge and actual knowledge gain which can also be called memory recall to see if there was a difference between the effects of these two types of knowledge on behavioral intentions.

Both modality interactivity and message interactivity had a significant effect on perceived knowledge. Modality interactivity had a negative effect on perceived knowledge,
which means that participants in the low modality interactivity condition had greater perceived knowledge than participants in the high interactivity condition. This can be explained by attention paid to the content. Individuals in the high modality condition played with the slider bar on the website, which might result in paying less attention to the textual information or just focusing on the interactive features on the interface. Some of the individuals might feel this presence of health messages was more entertaining than pure informative. Message interactivity had a positive effect on the perceived knowledge. Participants in the high message interactivity condition reported higher perceived knowledge than participants in the low message interactivity condition. Individuals who clicked on the banner to open a new text box to read more text information about sun protection information felt that they gained more knowledge through the process. Giving input to get more valuable information lead to greater perceived knowledge. Higher level of systematic processing means the individuals used more cognitive effort and more cognitive resources to process the health messages, which sequentially resulted in greater perceived knowledge.

Although participants perceived that their knowledge about skin cancer increased, their actual knowledge gain was not significantly affected by these two types of interactivity. However, perceived knowledge was a significant predictor of behavioral intentions. There was also an interaction effect of modality interactivity and message activity on the actual knowledge gain. I found that participants in both the high modality and message interactivity condition had the highest score on the actual knowledge gain. This finding illustrated that, generally speaking, interactivity had positive effects on actual knowledge gain. However, the results of previous studies about interactivity on knowledge are inconsistent. For example, some studies find that interactivity did not have a direct effect on knowledge (e.g., Camerini et al., 2016; Jaffe, 1997;
Some studies indeed confirmed the effects of knowledge on skin cancer and sun protection related outcomes (Jones, Abraham, Harris, Schulz & Chrispin, 2001; Shadel, Fosko & Lickerman, 2011). But other studies showed that knowledge alone is not enough to predict skin cancer prevention (Mermelstein & Riesenberg, 1992). Health practitioners can explore what other factors may be influenced by interactivity and how they can work together with knowledge to affect health behaviors in skin cancer interventions. Future studies can take a look at how three different types of knowledge, perceived knowledge, actual knowledge gain, and applying knowledge to different contexts contribute to behavioral intention change. Further, psychological mechanism and information processing style can be examined under each type of knowledge.

**Attitudinal outcomes**

The present study examined two variations of attitudes. One was the participants’ attitude toward the skin cancer information, which refers to the health message itself along with the topic as the context. The other one was participants’ attitude toward the health website, which includes their evaluation about the website design, interaction with the features, and user experience with the whole website. Modality interactivity had a positive influence on both attitude toward health websites and attitude toward skin cancer information, which is consistent with a previous study about interactivity on an anti-smoking website (Oh & Sundar, 2015). Individuals who had the experience of a high level of modality features on the health websites tended to generate more favorable attitudes toward the health websites and also toward skin cancer information. In the present study, modality interactivity did not influence attitudes through heuristic processing which is inconsistent with the previous study (Oh & Sundar, 2015). It could be because the amount of heuristic cues in the high modality interactivity condition and the low modality interactivity condition are not saliently different from each other. Another possibility could be
the differences between health topics. In Oh and Sundar’s (2015) study about anti-smoking websites, undergraduate students were used as the sample. But smoking is not a daily event that will happen for most of the undergraduate students, which was the sample of their study about smoking cessation. Although skin cancer seems not to be an urgent health topic, however, sun protection and photo aging are health topics that need people to pay attention every day and are quite relevant to undergraduate students in their daily life. Individuals may pay more attention and be more serious about the topics that are highly relevant to themselves. Future studies can explore whether or not health context has significant influences on applying interactivity models in health interventions.

**Behavioral outcomes**

Another contribution of this study is that three types of behavioral intentions were examined. The clear classification of attitudes and behavioral intentions related to the health information and the health website can give clear directions for health website designers, health practitioners, and health interventions designers. Different types of interactivity influenced different types of behavioral intentions differently through different mediators. Message interactivity had a direct negative effect on intention to use sunscreen. Therefore, individuals who only focused on the skin cancer information without interaction with the website had a higher intention to use sunscreen in the future. Modality interactivity had a direct positive effect on both intention to use sunscreen and intention to recommend the health website about skin cancer and sun protection to others. Individuals who played with the modality features on the website tended to use sunscreen and recommend this website to others in the future. Therefore, health researchers and health campaign designers can decrease message interactivity and increase modality interactivity on the health website to achieve the goal of promoting certain
behavioral intentions.

Modality interactivity also influenced intention to recommend and intention to visit health websites in the future through attitude toward skin cancer information and attitude toward the website. However, modality interactivity only had effects on intention to use sunscreen through attitude toward skin cancer information. In other words, attitude toward the health website did not influence the intention to use sunscreen. This result provides a direction to other health topics as well. Attitude toward the website did not influence behavioral intentions to perform actions related to the health topic, which should grab attention from health practitioners about whether they should increase both favorable attitude to the website and the health topic. The health practitioners can focus on how to increase favorable attitude toward the health topic more in the future studies.

Limitations

Like many other studies in the communication field, the present study has some limitations. M-Turk data was used in this study. M-Turk data provides a more socio-economically and demographically diverse sample than college samples and traditional Internet samples (Buhrmester et al., 2011). However, as an online experiment, this experiment had less control from the researcher during the data collection process. M-Turk workers who are experienced and participate in the survey only for money can easily pass the manipulation check without paying attention to the stimuli. This is a downside of M-Turk data. Additionally, the lack of control could also influence participants use of the website. While participants were directed to use the features of the website, we do not have data related to length of time spent on page, or amount of interactivity features accessed. While only participants who passed the manipulation check remained in the study, there could also be differences based on the level of interaction
with which participants engaged with the website, which we are unable to examine in the present study. However, the use of an online experiment actually mimics the real situation of how people may view health websites at their home or other places in their daily life instead of a research lab. This may lend additional external validity to the study.

Another limitation of this study is that modality and interactivity are operationalized on two different pages about both skin cancer and sun protection and photoaging. Although the ultimate goals of these two pages are to promote sun protection techniques to viewers, people may have different understanding, information processing, and attitude toward different part of the topic. For example, some people may be more into the information about photoaging than skin cancer. However, the scales such as perceived knowledge and attitude did not differentiate these topics. Future studies can include specific scales for only one topic to make the effects of different types of interactivity clearer. Future study can also try to place two features on the same webpage to explore whether there will be a stronger interaction effect or not.

Since cancer is a sensitive topic, people who have relatives, friends or themselves experiencing cancer may have different perceptions or reactions toward cancer information. Future studies should include this aspect as a covariate to better assess individual differences.

Actual knowledge gain which can also be understood as memory recall was measured in this study. According to previous studies (Hartman & Spiro, 1989; Jacobson, 1990), people view traditional and linear media were better at memory recall test, while people who engaged in hypermedia learning had a better potential to “transfer practically useful knowledge” into different contexts (Jaffe, 1997, p. 240). Although the present study contained stimuli with hypermedia functions and measured knowledge as a learning outcome, applying knowledge was not measured in this study. Future studies should also measure the ability to apply new
knowledge in different context under the hypermedia condition. Moreover, memory test is for short term effects. Future studies should explore the effects of knowledge in a long term. A longitudinal study may work better to examine the long-term effect of modality and message interactivity on skin cancer prevention.

Outcome variables in this study were attitudes and behavioral intentions instead of actual behaviors. People may over-report their behavioral intentions to perform healthy activities for social desirability. Therefore, future studies can aim at measuring actual behavior change of skin cancer and sun protection behavior.

**Contributions and future study**

The present study has both theoretical and practical implications for studies in the field of health communication involved with interactivity. The present study found empirical evidence to support some of the relationships of the model of interactivity effects. However, some of the findings were not in line with the MAIN model, such as the relationship between modality interactivity and heuristic processing. Future studies should provide more empirical data to examine the theoretical frameworks of interactivity. Another significant contribution of the current study is that attitudinal and behavioral intention outcomes were classified into different types from different perspectives. This is important for health researchers and practitioners, because interactive features on the internet have different influences on different dimensions of attitudes and behavioral intentions. For example, in the current study, modality interactivity influenced attitude toward the health content and then affected behavioral intention to use sunscreen. If the aim of a health campaign is to increase the behavioral intention to use sunscreen, health researchers can focus on how to design health websites with attractive modality interactivity features to increase people’s favorable attitudes toward the health topic.
Message interactivity could affect perceived knowledge through systematic processing, which can influence participants’ elaboration of the message. If the goal of a health campaign is to generate some long-term or profound effects, message interactivity may be more important than the mental short cuts produced by the modality interactivity. Future studies should explore whether different health topics exert different effects when different types of interactivity are employed. The present study also provides a perspective for how to better design a health website. For example, high modality interactivity and message interactivity would be better to increase favorable attitudes toward the health content. However, low modality interactivity and message interactivity would be better to increase the perceived knowledge of users. Practitioners would need to decide what would be most beneficial, and future studies not only need to explore effects of the different types of interactivity but also need to examine different levels of each type of interactivity on the outcome variables.

**Conclusion**

In sum, the findings of the current study are generally consistent with previous studies about interactivity. For example, interactivity may influence behavioral intentions via its prior effects on knowledge and perceived trust (Lu et al., 2014) and modality interactivity can lead to favorable attitudes toward both the health website and the health content (Oh & Sundar, 2015). The current study, which uses a 2X2 experimental design to assess two different types of interactivity, has contributions related to designing effective health websites for health interventions. Different types of interactivity along with clearly classified attitudes and behavioral intentions were examined to map the relationships between independent and dependent variables. Modality interactivity had direct positive effects on behavioral intention to use sunscreen and intention to recommend the health website. Modality interactivity also had
indirect positive effect on behavioral intentions through affective trust, perceived knowledge, attitude toward the website, and attitude toward skin cancer information. Message interactivity only had a direct effect on behavioral intention to use sunscreen. However, as intention to use sunscreen may be a key outcome for a number of health interventions, it is important to note. Moreover, message interactivity influenced behavioral intentions through perceived knowledge, systematic processing and cognitive trust. To design a health intervention or campaign in the digital age, health researchers and practitioners need to figure out what their goal is and then employ interactive features in their design accordingly. The current study provides implications to health practitioners who have different goals when designing health websites for eHealth and mHealth interventions.
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Liu, Y., & Shrum, L. J. (2002). What is interactivity and is it always such a good thing? Implications of definition, person, and situation for the influence of interactivity on advertising effectiveness. *Journal of Advertising*, 31, 53–64.


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Communications of the ACM, 43, 65-70.


## APPENDIX

### Appendix A

**Measures assessed in the questionnaire following website exposure**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Items</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived interactivity</td>
<td>1. How interactive the website is&lt;br&gt;2. If the website allows you to perform a lot of actions&lt;br&gt;3. If the website allows you to access information in a variety of ways</td>
<td>Kalyanaraman and Sundar (2006)</td>
</tr>
<tr>
<td>Perceived credibility</td>
<td>“I think the information I just read is believable”&lt;br&gt;“I think the information I just read is accurate,”&lt;br&gt;“I think the information I just read is fair,” and “I think the information I just read is in-depth”.</td>
<td>Flanagin &amp; Metzger (2007); Johnson &amp; Kaye, (2002, 2004); Sundar &amp; Nass, (2001).</td>
</tr>
<tr>
<td>Systematic processing</td>
<td>1. After I encounter information about this topic, I am likely to stop and think about it.&lt;br&gt;If I need to act on this matter, the more viewpoints I get the better.&lt;br&gt;It is important for me to interpret information about this topic in a way that applies directly to my life.&lt;br&gt;After thinking about this topic, I have a broader understanding.&lt;br&gt;When I encounter information about this topic, I read or listen to most of it, even though I may not agree with its perspective.</td>
<td>Griffin, Neuwirth, Giese and Dunwoody’s (2002)</td>
</tr>
<tr>
<td>Heuristic processing</td>
<td>1. When I encounter information about this topic, I focus on only a few key points.&lt;br&gt;If I have to act on this matter, the advice of one expert is good enough for me.&lt;br&gt;When I see or hear information about this topic, I rarely spend much time thinking about it.&lt;br&gt;There is far more information on this topic than I personally need.</td>
<td>Griffin, Neuwirth, Giese and Dunwoody’s (2002)</td>
</tr>
<tr>
<td>Behavioral Intention</td>
<td>1-9</td>
<td>Hu and Sundar’s (2010)</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----</td>
<td>------------------------</td>
</tr>
<tr>
<td>“Recommend this website to others,”</td>
<td>“forward this website to my acquaintances,” “visit this website again in the future,” “visit other websites similar to the one that I just browsed,” and “save this web page for future browsing”.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attitude toward the website</th>
<th>1-7</th>
<th>Myers, L. B., &amp; Horswill, M. S. (2006)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“I intend to use high factor protection sunscreen when I sunbathe this summer,” “I plan to use high factor sunscreen protection this summer,” and “I want to use high factor sunscreen protection this summer.”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attitude toward skin cancer information</th>
<th>1-7</th>
<th>Sundar (2000) and Sundar et al. (2014); Sundar (2000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Exciting, high quality, fun, cool, imaginative, and entertaining.”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interface assessment</th>
<th>1-9</th>
<th>Oh &amp; Sundar (2016)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“My interaction with the website was intuitive,” “The ways that I used to control the changes on the website seemed natural,” and “The website was easy to use”.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cognitive trust</th>
<th>1-10</th>
<th>Soh, Reid, and King (2009)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The website I just viewed was believable”, “credible,” “reliable,” and “accurate.”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Affective trust</th>
<th>1-10</th>
<th>Lewis &amp; Weigert, (1985)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The website I just viewed was personal”, “interested in my well-being”, “likeable,” “enjoyable,” and “positive.”</td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cognitive engagement</th>
<th>1-7</th>
<th>Agarwal and Karahanna (2000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I had fun interacting with the site</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. The site’s features provided me a lot of enjoyment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I was bored (reverse-coded)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I felt as if my curiosity was excited</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I felt as if my imagination was aroused</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-existing attitudes about using sunscreen.</td>
<td>6. I felt that my interest was evoked using a high factor sunscreen protection this summer with 6 semantic differential scales (7-point scales): 1 unpleasant-pleasant; 2 enjoyable-unenjoyable; 3 beneficial-harmful; 4 satisfactory-unsatisfactory; 5 bad-good; and 6 positive-negative.</td>
<td>Myers &amp; Horswill (2006)</td>
</tr>
<tr>
<td>---</td>
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<td>---</td>
</tr>
</tbody>
</table>
| Power usage | 1-9  
“I make good use of most of the features available in any technological device,”  
“I have to have the latest available technology or the latest available upgrades,”  
“I like to challenge myself in figuring out how to use any new technology,”  
“A little bit of intuition is all that is needed to figure out how to use any new technology,”  
“Many of my friends come to me to get help related to technological gadgets,”  
“I find myself using macros and keyboard shortcuts on the computer.” | Marathe, Sundar, Bijvank, van Vugt, & Veldhuis (2007) |
| Knowledge | 1-7  
1. I feel very knowledgeable about skin health.  
2. If a friend asked me about skin health issues, I could give them advice about skin health.  
3. If I had to get some help on skin health, I would need to gather very little information in order to make a wise decision.  
4. I feel very confident about my ability to tell the difference of skin health products. | Smith and Park (1992) |
Appendix B

Questionnaire

Q75 Thank you for your interest in this study. In this study, you will view a website. We will then ask you to complete a survey about your opinions. The web page you view may contain information related to sun protection and skin cancer. Please make sure you read all information on the website. Random answers may not get rewarded. If you have any questions, please send an email to zhaomeng.niu@wsu.edu.

Q76 Do you agree to participate in this study?
☐ I am 18 or older and agree to participate in this study. (1)
☐ I am not 18 or older and/or I do not agree to participate in this study. (2)

Q40 Using a scale of 1-7, please indicate how pleasant you feel about using a high factor sunscreen protection in both winter and summer is.
☐ 1 unpleasant (1)
☐ 2 (2)
☐ 3 (3)
☐ 4 (4)
☐ 5 (5)
☐ 6 (6)
☐ 7 pleasant (7)

Q41 Using a scale of 1-7, please indicate how enjoyable you feel about using a high factor sunscreen protection in both winter and summer is.
☐ 1 unenjoyble (1)
☐ 2 (2)
☐ 3 (3)
☐ 4 (4)
☐ 5 (5)
☐ 6 (6)
☐ 7 enjoyable (7)
Q42 Using a scale of 1-7, please indicate how beneficial you feel about using a high factor sunscreen protection in both winter and summer is.
☐ 1 harmful (1)
☐ 2 (2)
☐ 3 (3)
☐ 4 (4)
☐ 5 (5)
☐ 6 (6)
☐ 7 beneficial (7)

Q43 Using a scale of 1-7, please indicate how satisfactory you feel about using a high factor sunscreen protection in both winter and summer is.
☐ 1 unsatisfactory (1)
☐ 2 (2)
☐ 3 (3)
☐ 4 (4)
☐ 5 (5)
☐ 6 (6)
☐ 7 satisfactory (7)

Q44 Using a scale of 1-7, please indicate how good you feel about using a high factor sunscreen protection in both winter and summer is.
☐ 1 bad (1)
☐ 2 (2)
☐ 3 (3)
☐ 4 (4)
☐ 5 (5)
☐ 6 (6)
☐ 7 good (7)

Q45 Using a scale of 1-7, please indicate how positive you feel about using a high factor sunscreen protection in both winter and summer is.
☐ 1 negative (1)
☐ 2 (2)
☐ 3 (3)
☐ 4 (4)
☐ 5 (5)
☐ 6 (6)
☐ 7 positive (7)
Q88 On a scale of 1-7, where 1=strongly disagree, 7=strongly agree, please indicate to what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>7 Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the past year, I have used high factor sunscreen protection whenever I was outdoor. (1)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>In the past year, I tended to use high factor sunscreen protection as much as I can. (2)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>In the past year, I tried to use high factor sunscreen protection in both winter and summer. (3)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>In the past year, I simultaneously use high factor sunscreen to protect my skin from the sun. (4)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Q73 Please click on the link below and explore the website as much as you can. You will need to click on buttons on the webpage to get information. You will be asked questions about the content of the two subpages, so please make sure you read all information on TWO subpages. After reading all the information on the website, please finish the survey. The forward button will appear after 90 seconds. Make sure to leave this window open as you explore the website. http://121.41.24.184/page.html (If the link does not work, please copy and paste it into a new tab.)

Q96 Please answer the following questions.

<table>
<thead>
<tr>
<th></th>
<th>Yes (1)</th>
<th>No (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did you click on some plus icon to link to view more information when you explore the website? (1)</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Did you drag the slider bar to view more information when exploring the website? (2)</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Q98 If yes to the above question, how interactive did you feel the site was when you click on the buttons for more information on the website?

○ 1 Not at all (1)
○ 2 (2)
○ 3 (3)
○ 4 (4)
○ 5 (5)
○ 6 (6)
○ 7 Extremely (7)

Q74 Please click on the link below and explore the website as much as you can. You will need to click on buttons on the webpage to get information. You will be asked questions about the content of the two subpages, so please make sure you read all information on TWO subpages. After reading all the information on the website, please finish the survey. The forward button will appear after 90 seconds. Make sure to leave this window open as you explore the website. http://121.41.24.184/page_2.html (If the link does not work, please copy and paste it into a new tab.)
Q100 Did you drag the slider bar to view more information when exploring the website?
☐ Yes. (1)
☐ No. (2)

Q102 If yes to the above question, how interactive did you feel the site was while dragging the slider bar to view the picture?
☐ 1 Not at all (1)
☐ 2 (2)
☐ 3 (3)
☐ 4 (4)
☐ 5 (5)
☐ 6 (6)
☐ 7 Extremely (7)

Q75 Please click on the link below and explore the website as much as you can. You will need to click on buttons on the webpage to get information. You will be asked questions about the content of the two subpages, so please make sure you read all information on TWO subpages. After reading all the information on the website, please finish the survey. The forward button will appear after 90 seconds. Make sure to leave this window open as you explore the website. http://121.41.24.184/page_3.html (If the link does not work, please copy and paste it into a new tab.)
Q104 Did you click on some plus icon to link to view more information when you explore the website?
☐ Yes. (1)
☐ No. (2)

Q106 If yes to the above question, how interactive did you feel the site was when you click on the buttons for more information on the website?
☐ 1 Not at all (1)
☐ 2 (2)
☐ 3 (3)
☐ 4 (4)
☐ 5 (5)
☐ 6 (6)
☐ 7 Extremely (7)

Q76 Please click on the link below and explore the website as much as you can. After reading all the information on the website, please finish the survey. You will be asked questions about the content of the website, so please make sure you scroll down and read all information on the page. The forward button will appear after 90 seconds. Make sure to leave this window open as you explore the website. http://121.41.24.184/page_4.html (If the link does not work, please copy and paste it into a new tab.)
Q108 Did you drag the slider bar to view more information when exploring the website?
  ○ Yes. (1)
  ○ No. (2)

Q90 Please close the link of the website and then complete the survey.

Q28 Using a scale of 1-7, please indicate that how strongly you believe the website was each of the following on a scale of 1 not at all to 7 extremely.

<table>
<thead>
<tr>
<th></th>
<th>1 Not at all (1)</th>
<th>2 (2)</th>
<th>3 (3)</th>
<th>4 (4)</th>
<th>5 (5)</th>
<th>6 (6)</th>
<th>7 Extremely (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>How interactive the website is (1)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>If the website allows you to perform a lot of actions (2)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>If the website allows you to access information in a variety of ways (3)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Q2 Using a scale of 1-7, please indicate how believable you feel the health information you just viewed was, with 1=not believable and 7=believable.
- 1 not believable (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 believable (7)

Q4 Using a scale of 1-7, please indicate how informative you feel the health information you just viewed was, with 1=not informative and 7=informative.
- 1 not informative (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 informative (7)

Q6 Using a scale of 1-7, please indicate how insightful you feel the health information you just viewed was, with 1=not insightful and 7=insightful.
- 1 not insightful (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 insightful (7)
Q8 Using a scale of 1-7, please indicate how objective you feel the health information you just viewed was, with 1=not objective and 7=objective.
- 1 not objective (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 objective (7)

Q10 Using a scale of 1-7, please indicate how interesting you feel the health information you just viewed was, with 1=not interesting and 7=interesting.
- 1 not interesting (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 interesting (7)

Q12 Using a scale of 1-7, please indicate how clear you feel the health information you just viewed was, with 1=not clear and 7=clear.
- 1 not clear (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 clear (7)
Q33 Using a scale of 1-7, please indicate how exciting you feel the website you just viewed was, with 1= not exciting and 7=exciting.
- 1 not exciting (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 exciting (7)

Q34 Using a scale of 1-7, please indicate how good you feel the quality of the website you just viewed was, with 1=low quality and 7= high quality.
- 1 low quality (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 high quality (7)

Q35 Using a scale of 1-7, please indicate how fun you feel the website you just viewed was, with 1=not fun and 7=fun.
- 1 not fun (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 fun (7)
Q36 Using a scale of 1-7, please indicate how cool you feel the website you just viewed was, with 1=not cool and 7=cool.

- 1 not cool (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 cool (7)

Q37 Using a scale of 1-7, please indicate how imaginative you feel the website you just viewed was, with 1=not imaginative and 7=imaginative.

- 1 not imaginative (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 imaginative (7)

Q38 Using a scale of 1-7, please indicate how entertaining you feel the website you just viewed was, with 1=not entertaining and 7=entertaining.

- 1 not entertaining (1)
- 2 (2)
- 3 (3)
- 4 (4)
- 5 (5)
- 6 (6)
- 7 entertaining (7)
Q60 On a scale of 1-7, where 1=strongly disagree, 7=strongly agree, please indicate to what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1 Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>7 Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>My interaction with the website was intuitive.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The ways that I used to control the changes on the website seemed natural.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The website was easy to use.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Q14 To what extent do you agree or disagree with the following statement, where 1=not at all, 10=extremely.

<table>
<thead>
<tr>
<th></th>
<th>1 Not at all (1)</th>
<th>2 (2)</th>
<th>3 (3)</th>
<th>4 (4)</th>
<th>5 (5)</th>
<th>6 (6)</th>
<th>7 (7)</th>
<th>8 (8)</th>
<th>9 (9)</th>
<th>10 Extremely (10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think the information I just viewed was accurate. (1)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I think the information I just viewed was believable. (2)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I think the information I just viewed was reliable. (3)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I think information I just viewed was credible. (4)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Q16 To what extent do you agree or disagree with the following statement, where 1=not at all, 10=extremely.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1 (Not at all)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10 (Extremely)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The health information I just viewed was likable.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The health information I just viewed was enjoyable.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The health information I just viewed was positive.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The health information I just viewed was personal.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The health information I just viewed was interested in my well-being.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Q93 On a scale of 0-10, where 0=very slowly, 7=very fast, how time seemed to progress for you during the exploring time?
☐ 0 Very slowly (1)
☐ 1 (2)
☐ 2 (3)
☐ 3 (4)
☐ 4 (5)
☐ 5 (6)
☐ 6 (7)
☐ 7 (8)
☐ 8 (9)
☐ 9 (10)
☐ 10 Very fast (11)
Q38 On a scale of 1-7, where 1=strongly disagree, 7=strongly agree, please indicate to what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly Disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>7 Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I had fun interacting with the site. (1)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The site’s features provided me a lot of enjoyment. (2)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I was bored. (3)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I felt as if my curiosity was excited. (4)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I felt as if my imagination was aroused. (5)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I felt that my interest was evoked. (6)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Q82 Please indicate your attitudes towards the following statements about the website on a scale of 1 = Strongly disagree and 7 = Strongly agree.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1 Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>7 Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The messages conveyed by the site are important to me. (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interacting with the site was meaningful for me. (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The site did not have anything to do with me or my needs. (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The site talked about something that concerns me, personally. (4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>While interacting with the site, I thought about how the topic might be useful to me. (5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
gave me information that is personally relevant to me. (6)
Q83 Please indicate your attitudes towards the following statements about the website on a scale of 1 = Strongly disagree and 7 = Strongly agree.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1 Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>7 Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I lost track of time when I was interacting with the site. (2)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>I spent more time in interacting with the site than I intended. (3)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>While I was interacting with the site, I was able to block out most other distractions. (4)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>While I was interacting with the site, I was absorbed in what I was doing. (5)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>While I was interacting with the site, I was immersed in what I was doing. (6)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>
While I was interacting with the site, my attention did not get diverted. (7)
I felt in control while I was browsing the site. (9)
I felt that I had no control over my interaction with the site. (10)
Q84 Please indicate your attitudes towards the following statements about the website on a scale of 1 = Strongly disagree and 7 = Strongly agree.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1 Strongly disagree (1)</th>
<th>2 Disagree (2)</th>
<th>3 Somewhat disagree (3)</th>
<th>4 Neither agree nor disagree (4)</th>
<th>5 Somewhat agree (5)</th>
<th>6 Agree (6)</th>
<th>7 Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am totally satisfied with my interaction with the site. (1)</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
</tr>
<tr>
<td>Some things about my interactions with the site could have been better. (2)</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
</tr>
<tr>
<td>I am not completely satisfied with my interactions with the site. (3)</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
</tr>
<tr>
<td>I thought the site took notice of me as a person. (4)</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
</tr>
<tr>
<td>The site was very careful in considering my health information needs. (5)</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
<td>🔘</td>
</tr>
</tbody>
</table>
Q22 On a scale of 1-7, where 1=strongly disagree, 7=strongly agree, please indicate to what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1 Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>7 Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am interested in the topic. (1)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I would like to know more about the topic. (2)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Q24 On a scale of 1-7, where 1=strongly disagree, 7=strongly agree, please indicate to what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1 Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>7 Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel informed about the topic presented in the health information. (1)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Q28  On a scale of 1-7, where 1=strongly disagree, 7=strongly agree, please indicate to what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th></th>
<th>1 Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>7 Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have paid attention to information related to sun protection and skin cancer in the past. (1)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I have tried to seek information related to sun protection and skin cancer in the past. (2)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I have found information related to sun protection and skin cancer useful in the past. (3)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I have looked for information related to sun protection and skin cancer in (4)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Q32 On a scale of 1-7, where 1=strongly disagree, 7=strongly agree, please indicate that to what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1 Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>7 Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think most of the technological gadgets are complicated to use. (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I need very detailed instructions when using any technological interface for the first time. (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I prefer to ask friends how to use any new technological gadget instead of trying to figure it out myself. (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I make good use of most of the features available in any technological device. (4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I love exploring all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statement</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
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<tr>
<td>--------------------------------------------------------------------------</td>
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<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>the features that any technological gadget has to offer. (5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using any technological device comes easy to me. (6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using information technology improves my productivity. (7)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>It is important that you pay attention to this study. Please click on '7 Strongly agree'. (8)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q54 Please answer the following questions on a scale of 1 to 10. Not at all = 1, Extremely = 10.

<table>
<thead>
<tr>
<th></th>
<th>1 Not at all (1)</th>
<th>2 (2)</th>
<th>3 (3)</th>
<th>4 (4)</th>
<th>5 (5)</th>
<th>6 (6)</th>
<th>7 (7)</th>
<th>8 (8)</th>
<th>9 (9)</th>
<th>10 Extremely (10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>How serious are the current threats of skin problems to your health? (1)</td>
<td>🍁🍁🍁🍁🍁🍁🍁🍁🍁🍁🍁</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>How likely are you to have some skin problems in your lifetime? (2)</td>
<td>🍁🍁🍁🍁🍁🍁🍁🍁🍁🍁🍁</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If you were to have some skin problems in lifetime, how serious do you think it would be? (3)</td>
<td>🍁🍁🍁🍁🍁🍁🍁🍁🍁🍁🍁</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q55 To what extent do you agree or disagree with the following statement: 1=strongly disagree, 7=strongly agree.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1 Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>7 Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current risks to my health are scary. (1)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Current risks to my skin health are worrisome. (2)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Current risks to my skin health are overwhelming. (3)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Q80 Please choose true or false based on the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>True (1)</th>
<th>False (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanning pills can help protect skin when you use tanning beds. (1)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>You don't need to use sunscreen in winter. (2)</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Sunscreen with an SPF of 10 is enough for people doing outdoors activities. (3)</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Q56 To what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel very knowledgeable about skin health. (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If a friend asked me about skin health, I could give them advice. (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I had to get some help on skin health, I would need to gather very little information in order to make a wise decision. (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel very confident about my ability to tell the disadvantages of skin health. (4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q46 To what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would recommend this website to others. (1)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would like to forward this website to my acquaintances. (2)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would like to visit this website again in the future. (3)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would like to visit other websites similar to the one that I just browsed. (4)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would like to save this web page for future browsing. (5)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q31 To what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I intend to use high factor protection sunscreen when I sunbathe this summer. (1)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I plan to use high factor sunscreen protection this summer. (2)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I want to use high factor sunscreen protection this summer. (3)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Q58 To what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Being in the sun is relaxing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A tan looks good.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tan people look healthy.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q59 To what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun and UV light damage cause wrinkles.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bad sunburns are unhealthy.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Too much sun exposure causes skin cancer.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Q59 To what extent do you agree or disagree with the following statement: 1=strongly disagree, 5=strongly agree.

| People who are important to me want me to use high factor sunscreen protection. (1) | 1 strongly disagree (1) | 2 (2) | 3 (3) | 4 (4) | 5 strongly agree (5) |
| Most of the people I know will use high factor sunscreen protection. (2) |  |  |  |  |  |
| I feel under social pressure to use high factor sunscreen protection. (3) |  |  |  |  |  |
| People who are important to me influence my decision to use high factor sunscreen. (4) |  |  |  |  |  |
| People who are important to me think I should use high factor sunscreen protection. (5) |  |  |  |  |  |
Q57 To what extent do you agree or disagree with the following statement: 1=strongly disagree, 5=strongly agree.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is mostly up to me whether or not I use high factor sunscreen protection. (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have high control over using high factor sunscreen protection. (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have high control over whether I use high factor sunscreen protection. (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I wanted to I could easily use high factor sunscreen protection. (4)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>For me to</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>use high factor sunscreen protection would be difficult. (5) I am certain that you could use high factor sunscreen protection. (6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Q30 Think about the messages you read. To what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>After I encounter information about skin health, I am likely to stop and think about it. (1)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>If I need to act on this matter, the more viewpoints I get the better. (2)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>It is important for me to interpret information about skin health in a way that applies directly to my life. (3)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>After thinking about skin health, I have a broader understanding. (4)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>When I encounter information about skin health, I read or listen to most of it, even though I</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tbody>
</table>
may not agree with its perspective. (5)
Q48 Think about the messages you read. To what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree (1)</th>
<th>Somewhat disagree (2)</th>
<th>Neither agree nor disagree (3)</th>
<th>Somewhat agree (4)</th>
<th>Agree (5)</th>
<th>Strongly agree (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>When I was reading information about skin health, I focused on only a few key points. (1)</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
</tr>
<tr>
<td>If I have to act on this matter, the advice of one expert is good enough for me. (2)</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
</tr>
<tr>
<td>When I was reading information about skin health, I rarely spent much time thinking about it. (3)</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
</tr>
<tr>
<td>There is far more information about skin health I personally need. (4)</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
</tr>
<tr>
<td>I skimmed through the content. (5)</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
<td>⬜</td>
</tr>
<tr>
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</tr>
<tr>
<td>-------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>I didn't spend much time thinking about the information after I read it. (6)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>The information presented too many conflicting viewpoints. (7)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Q85 On a scale of 1-7, where 1=strongly disagree, 7=strongly agree, please indicate that to what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1 Strongly disagree (1)</th>
<th>2 Disagree (2)</th>
<th>3 Somewhat disagree (3)</th>
<th>4 Neither agree nor disagree (4)</th>
<th>5 Somewhat agree (5)</th>
<th>6 Agree (6)</th>
<th>7 Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The website content is easy to access via clicking. (1)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The website is presenting other texts simultaneously. (2)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>The website is easily shared with others via link. (3)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Q86 On a scale of 1-7, where 1=strongly disagree, 7=strongly agree, please indicate that to what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulations trigger a sense of resistance in me.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>I find contradicting others stimulating. (7)</td>
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<td></td>
</tr>
<tr>
<td>When something is prohibited, I usually think, &quot;That's exactly what I am going to do.&quot; (8)</td>
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</tr>
<tr>
<td>I become frustrated when I am unable to make free and independent decisions. (9)</td>
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<tr>
<td>It irritates me when someone points out things which are obvious to me. (10)</td>
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<tr>
<td>I become angry when my freedom of choice is restricted. (11)</td>
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</tr>
<tr>
<td>I resist the attempts of others to influence me. (12)</td>
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<tr>
<td>It makes me</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Score 1</td>
<td>Score 2</td>
<td>Score 3</td>
<td>Score 4</td>
<td>Score 5</td>
<td>Score 6</td>
<td>Score 7</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>angry when another person is held up as a role model for me to follow. (13)</td>
<td></td>
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</tr>
<tr>
<td>When someone forces me to do something, I feel like doing the opposite. (14)</td>
<td></td>
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</tr>
<tr>
<td>I consider advice from others to be an intrusion. (15)</td>
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</tr>
<tr>
<td>Advice and recommendations usually induce me to do just the opposite. (16)</td>
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<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Q78 On a scale of 1-7, where 1=strongly disagree, 7=strongly agree, please indicate that to what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree (15)</th>
<th>Disagree (16)</th>
<th>Somewhat disagree (17)</th>
<th>Neither agree nor disagree (18)</th>
<th>Somewhat agree (19)</th>
<th>Agree (20)</th>
<th>Strongly agree (21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I prefer complex to simple problems. (1)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I like to have the responsibility of handling a situation that requires a lot of thinking. (2)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I really enjoy a task that involves coming up with new solutions to problems. (3)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>The notion of thinking abstractly is appealing to me. (4)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Thinking is not my idea of fun. (8)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>I would rather do something that requires little thought than something that is sure to challenge my thinking</td>
<td>0</td>
<td>0</td>
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</tr>
</tbody>
</table>
I like tasks that require little thought once I’ve learned them. (10)

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<table>
<thead>
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</thead>
</table>

I feel relief rather than satisfaction after completing a task that requires a lot of mental effort. (9)

<p>| | | | | | | | |</p>
<table>
<thead>
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</tr>
</thead>
</table>
Q82 To what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree (8)</th>
<th>Disagree (9)</th>
<th>Somewhat disagree (10)</th>
<th>Neither agree nor disagree (11)</th>
<th>Somewhat agree (12)</th>
<th>Agree (13)</th>
<th>Strongly agree (14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I know how to find helpful health resources on the Internet. (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>I know how to use the Internet to answer my health questions. (2)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>I know what health resources are available on the Internet. (3)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>I know where to find helpful health resources on the Internet. (4)</td>
<td></td>
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</tr>
<tr>
<td>I know how to use the health information I find on the Internet to help me. (5)</td>
<td></td>
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</tr>
<tr>
<td>I have the skills I need to evaluate the health resources I find on the Internet. (6)</td>
<td>[ ]</td>
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</tr>
<tr>
<td>I can tell high quality from low quality health resources on the Internet. (7)</td>
<td>[ ]</td>
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<td>[ ]</td>
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</tr>
<tr>
<td>I feel confident in using information from the Internet to make health decisions. (8)</td>
<td>[ ]</td>
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<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>
Q50 To what extent do you agree or disagree with the following statement, where 1=strongly disagree, 7=strongly agree.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I thought about what actions I might take based on what I browsed. (1)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>I found myself making connections between the skin health information and what I’ve read or heard about elsewhere. (2)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>I thought about how and what I had browsed related to other things I know. (3)</td>
<td></td>
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</tr>
<tr>
<td>I tried to think of the practical applications of what I browsed. (4)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>I thought about what actions</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>should be taken by policymakers based on what I browsed (5)</td>
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</tr>
<tr>
<td>I tried to relate the skin health information to my own life. (6)</td>
<td></td>
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</tr>
</tbody>
</table>
Q52 How much attention have you paid to the skin health on the following media channels: (1 = very little attention, 7 = very close attention).

<table>
<thead>
<tr>
<th>Media Channels</th>
<th>1 very little attention (1)</th>
<th>2 (2)</th>
<th>3 (3)</th>
<th>4 (4)</th>
<th>5 (5)</th>
<th>6 (6)</th>
<th>7 very close attention (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social media (e.g. Facebook, Twitter)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Health magazines (2)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Newspapers (3)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>TV news reports (4)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Entertainment TV programs (5)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Online forum (e.g. MedHelp) (6)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>News report on the Internet (e.g. BBC News Health) (7)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Medical Apps on smartphone (e.g. Medical Encyclopedia) (8)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
</tbody>
</table>
Q84 Which of the following pictures have you seen on the website (Please do not check the website for the answer)?
- Image:Aussiebrazil (1)
- Image:Flag pins australia brazil (2)
- Image:Australia (3)

Q86 Most modern theories of decision-making recognize the fact that decisions do not take place in a vacuum. Individual preferences and knowledge, along with situational variables can greatly impact the decision process. In order to facilitate our research on decision-making we are interested in knowing certain factors about you, the decision maker. Specifically, we are interested in whether you actually take the time to read the directions; if not, then some of our manipulations that rely on changes in the instructions will be ineffective. So, in order to demonstrate that you have read the instructions, please ignore the sports items below. Instead, simply continue reading after the options. Thank you very much. Which of these activities do you engage in regularly? (write down all that apply)
- Basketball (1)
- Soccer (2)
- Running (3)
- Football (4)
- Swimming (5)
- Tennis (6)
- Volleyball (7)

Q62 These last questions ask for some demographic information.

Q64 What is your age? Please respond in numerals (e.g., 22)

Q66 Please specify your gender.
- Male (1)
- Female (2)
- Other (3)

Q68 With which race/ethnicity do you identify? Please check all that apply.
- Caucasian/White (1)
- African American/Black (2)
- Hispanic or Latino/a (3)
- Asian/Pacific Islander (4)
- Native American or American Indian (5)
- Other (6) ____________________
Q70 Please specify your estimated family income for last year (US dollars).
☐ 0-$20000 (1)
☐ $20001-$50000 (2)
☐ $50001-$70000 (3)
☐ $70001-$100000 (4)
☐ $100001-$150000 (5)
☐ more than $150000 (6)

Q72 What is the highest education level you have completed?
☐ Less than high school. (1)
☐ Some high school. (2)
☐ High school degree. (3)
☐ Some college. (4)
☐ College degree. (5)
☐ Some graduate school. (6)
☐ Masters or law degree. (7)
☐ MD, PhD or other advanced degree. (8)
Q95 On a scale of 1-7, where 1=strongly disagree, 7=strongly agree, please indicate to what extent do you agree or disagree with the following statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Somewhat disagree (3)</th>
<th>Neither agree nor disagree (4)</th>
<th>Somewhat agree (5)</th>
<th>Agree (6)</th>
<th>Strongly agree (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I currently live in a place with abundant sunshine. (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Most time of the year, I live in a place with abundant sunshine. (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q74 Thank you for your participation. If you have any question, please send an email to niuzm321@gmail.com