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Using Cognitive and Affective Illustrations to Enhance Older Adults' Website Satisfaction and Recall of Online Cancer-Related Information

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This study examined the effect of adding cognitive and affective illustrations to online health information (vs. text only) on older adults' website satisfaction and recall of cancer-related information. Results of an online experiment among younger and older adults showed that illustrations increased satisfaction with attractiveness of the website. Younger adults were significantly more satisfied with the comprehensibility of the website than older adults, whereas older adults were more satisfied with perceived emotional support from the website than younger adults. Being more emotionally satisfied with the website led to greater recall of information for older adults, but not for younger adults. Illustrations can be used to enhance older adults' website satisfaction and consequently recall of online cancer-related information.

In 2011, 650 million people worldwide were aged 60 years or older, and it is expected that this group of older adults will expand up to 2 billion by 2050 (World Health Organization,

2011). Many Western countries, such as the Netherlands, experienced an even bigger relative increase in aging populations. This is mainly due to the "baby boomers" or "sixties generation" turning 65 from 2011 onward (Garssen, 2011). Along with this trend, an increase in disease ratings, such as increased cancer incidences, is shown as well. Cancer is mainly a disease of older adults and it is expected that the cancer incidence among older adults aged 65 years or older

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will increase by 40% between 2007 and 2020 (Dutch Cancer Society, 2011).

At the same time, more cancer-related information is presented through the Internet and is sometimes even exclusively presented online (Lippincott, 2004; Morrell, 2002). This poses both possibilities and limitations for older adults. On the one hand, the Internet fulfills a wide range of information and support needs (Iredale, 2011) and increasingly more older adults use the Internet to fulfill those needs (Statistics Netherlands, 2011). On the other hand, older adults may misunderstand these computer technologies because of their inexperience with such technologies and decline in basic abilities, such as cognitive (e.g., decreased working memory) and sensory (e.g., decreased visual acuity) impairments (Becker, 2004).

In an attempt to make online health information more user-friendly, scholars have presented guidelines to improve the usability of websites for older adults (Money, Lines, Fernando, & Elliman, 2011). However, most website designers do not adhere to these guidelines. In using a small font size, drop-down menus, and hypertext links, websites are found to be used less accurately and efficiently by older adults than by younger adults (Bergstrom, Olmsted-Hawala, & Jans, 2012). Moreover, health literacy (i.e., the motivation and ability to obtain, process, and understand health information to make appropriate health decisions) has been found markedly lower in older adults than in younger adults (Baker, Gazmararian, Sudano, & Patterson, 2000; McCray, 2005). These hindering age-related factors make older adults a vulnerable group for poor online health communication.

As a result, the inability to use websites and its content correctly is related to greater dissatisfaction (Parrott, Raup Krieger, Silk, & Egbert, 2008) and might lead to lower levels of information recall. Website satisfaction can be defined as Web users' "predispositions to respond favorably or unfavorably to web content" (Chen & Wells, 1999, p. 28). One can distinguish between different types of website satisfaction. It is often found that people are dissatisfied with the comprehensibility of online medical information, due to low readability of such materials (McInnes & Haglund, 2011). Comprehension refers to "the process of interpreting the meaning of words or pictures to understand their collective meaning" (Houts, Doak, Doak, & Loscalzo, 2006, p. 178). *Satisfaction with the comprehensibility* of the website can be defined as the extent to which Web users are content with the readability level and understandability of the information on the website. On the other hand, Web users might be satisfied with the comprehensibility of the website but still evaluate the website as not satisfying. This might be due to low *satisfaction with the attractiveness* of the website. This refers to the extent to which users find the website well-developed and enjoyable. Furthermore, website users might shape their attitude according to their *satisfaction with the perceived emotional support from the website*. Satisfaction

with perceived emotional support from the website is defined as the extent to which users feel that the website helps to deal with emotions and stress. Previous research has acknowledged the emotional benefits of online information. For instance, using the Internet for cancer-related information led to greater feelings of social support and increased feelings of hope in breast cancer patients, indicating that online information can enhance feelings of emotional support (Fogel, Albert, Schnabel, Ditkoff, & Neugut, 2002; Vilhauer, 2009).

Satisfaction is an important factor in motivating people to process and learn information and is expected to be positively related to recall of information (Ley, 1988; Park & Lim, 2007). Monahan (1995) found that information that evokes positive feelings, such as satisfaction, is better recalled. Similarly, Park and Lim (2007) suggested that positive emotions, such as satisfaction, lead to better recall of information as well. Recall of information refers to the ability to remember and reproduce information (Van der Meulen, Jansen, Van Dulmen, Bensing, & Van Weert, 2008) and is important for patients' health and well-being (McGuire, 1996) and adherence to medical regimes (Ley, 1988). To increase website satisfaction and recall of health-related information, medical texts are often supported with illustrations (Houts et al., 2006). Previous research found that using illustrations was positively related to satisfaction with information and recall of information (Katz, Kripalani, & Weiss, 2006). However, to our knowledge, no studies have looked into what types of illustrations on a website will be beneficial for enhancing website satisfaction and recall of information among older adults. Therefore, this article aims to examine the effect of cognitive and affective illustrations on website satisfaction and recall of cancer-related information among older adults as compared to younger adults.

COGNITIVE AND AFFECTIVE ILLUSTRATIONS

Illustrations are widely used to improve learning from textual information (Levie & Lentz, 1982). Many studies have focused on the effect of adding illustrations to a text (versus text only) on website satisfaction (Van Weert et al., 2011), comprehension (Houts et al., 2006), and recall of information (Katz et al., 2006). Fewer studies have looked into what types of illustrations might be used to optimize these outcomes. Levie and Lentz (1982) described a functional approach to the effects of illustrations and suggested that illustrations could perform multiple functions, such as feeling and thinking. They distinguish between cognitive (thinking) and affective (feeling) functions of illustrations. Cognitive illustrations are explanatory illustrations, supporting a text and aiming to facilitate learning of information by improving comprehension and information recall. For instance, medication instructions can be improved by adding

icons that explain how and when to take the medication as prescribed (for examples, see Morrow, Hier, Menard, & Leirer, 1998). Affective illustrations are illustrations that are irrelevant for understanding the text (Park & Lim, 2004) and aim to enhance enjoyment and affect emotions and attitudes. Text-irrelevant illustrations, such as pictures of flowers and empathic caregivers, can increase arousal and attention (e.g., see Park & Lim, 2007). In the next sections, we discuss how cognitive and affective illustrations might influence website satisfaction and recall of cancer-related information.

The Effects of Illustrations on Website Satisfaction

Cognitive illustrations are found to positively affect satisfaction with information. Previous studies have shown that adding cognitive illustrations increased comprehension with the information (e.g., Morrow et al., 1998). This was also true when cognitive illustrations were added to online information (Van Weert et al., 2011). These findings are in line with the functional approach to cognitive illustrations, assuming that cognitive illustrations aim to facilitate learning (Levie & Lentz, 1982). In contrast to cognitive illustrations, affective illustrations aim to enhance enjoyment and arouse positive emotions, such as attraction and liking (Monahan, 1995). Affective illustrations play an important role in drawing attention to information and increasing satisfaction with information (Park & Lim, 2004). Following Levie and Lentz's (1982) functional approach to illustrations, we assume that affective illustrations influence different dimensions of satisfaction than cognitive illustrations. Affective illustrations are expected to increase both satisfaction with attractiveness and emotional support, as affective illustrations aim to enhance enjoyment and affect emotions and attitudes (Levie & Lentz, 1982). Affective illustrations have been found to increase emotional interest in the information presented as well (Harp & Mayer, 1997). In addition, a previous study showed that adding a cognitive illustration to online information increased satisfaction with the attractiveness of the website (Van Weert et al., 2011). Based on the functional approach and previous studies, we expect: *Adding a cognitive illustration to a text (vs. text only or text with affective illustration) increases satisfaction with comprehensibility of the website (H1a)*. Furthermore, we propose: *Adding a cognitive and/or affective illustration to a text (vs. text only) increases satisfaction with attractiveness of the website (H1b)*. Ultimately, we hypothesize: *Adding an affective illustration to a text (vs. text only or text with cognitive illustration) increases satisfaction with emotional support from the website (H1c)*.

The Effects of Illustrations on Recall of Cancer-Related Information

Also in line with the functional approach of Levie and Lentz (1982) is the role of cognitive illustrations in

learning information. Cognitive illustrations explain (parts of the) information and aim to increase understanding and thereby recall of this information. The cognitive theory of multimedia learning¹ (Mayer, 1999) states that people understand instructional material (i.e., explanation of cancer treatment) better when presented in multiple forms, including verbal (i.e., text) and visual representations (i.e., illustrations). This idea is derived from the dual coding approach, suggesting that people have separate verbal and visual processing systems (Paivio, 1971). According to this approach, combining text and visual results in better memory for information, because these are coded separately in memory and are therefore better retrieved from memory (Paivio, 1971). Thus, messages are expected to be more effective when information is presented with corresponding illustrations, rather than text alone. This is called the *multimedia effect* (Mayer, 1999). Empirical research has indeed found that adding illustrations to textual information is an effective way of enhancing adults' understanding and recall of medical information (Morrow et al., 1998).

Although much research has shown evidence for the multimedia effect in learning from written materials among younger adults (Cherry, Dokey, Reese, & Brigman, 2003; Houts et al., 2006), research on the multimedia effect among older adults is often limited or inconsistent (Brotherstone, Miles, Robb, Atkin, & Wardle, 2006; Liu, Kemper, & McDowd, 2009). Although Brotherstone et al. (2006) found that illustrations enhanced older adults' understanding of the preventive aim of cancer screening, Liu et al. (2009) found that although older adults spent more time looking at illustrations than younger adults, they had poorer comprehension of the illustrations compared to younger adults. The latter study concluded that older adults had more difficulties integrating illustrations with the illustration-related text. This might be due to a decline in cognitive functions, such as working memory, which allows people to process and retrieve information simultaneously during such complex activities (Morrell & Park, 1993). Cognitive illustrations might therefore not always be beneficial for older adults. We therefore propose: *Adding a cognitive illustration to a text (vs. text only or text with affective illustration) increases recall of cancer-related information on a website in younger but not in older adults (H2a)*.

Limited evidence is also found for the effect of affective illustrations on recall of information. Particularly older adults showed increased levels of recall when affective illustrations were presented (Mather & Knight, 2005). This greater focus on positive information in older adults' memory is called the positivity bias (Mather & Carstensen, 2005). Mather and Knight (2005) explain this by the socioemotional

¹The definition of multimedia learning applies to the term "multimodal" (which refers to the idea that people use two or more sense modalities) rather than "multimedia" (which refers to the idea that people use two or more medium representations).

selectivity theory (Carstensen, Isaacowitz, & Charles, 1999), which asserts that older adults have more emotion-related goals and use these goals to encode and memorize information. The socioemotional selectivity theory is a life-span theory predicting that the perception of time influences motivational goals in life (Carstensen, Fung, & Charles, 2003). When one perceives much time left in life, goals related to knowledge acquisition are activated, whereas when time is perceived as limited, a shift toward goals related to emotion regulation is observed (Carstensen et al., 1999). For instance, social interactions, such as contact with family members, that optimize emotional experiences become of greater importance and are more valued by older adults (Carstensen et al., 2003).

According to the socioemotional selectivity theory (Carstensen et al., 1999) there are two ways in which emotional goals influence older adults' information recall. First, information that is relevant to emotional goals is made more salient in older adults' attention and memory. As older adults use their emotional goals to memorize information (Mather & Knight, 2005), affective illustrations might make their emotional goals more salient, resulting in more effective information processing and, consequently, in better recall. Cognitive illustration might not make these goals salient, and might therefore not be processed well. Second, because older adults hold more emotionally meaningful goals, they allocate more cognitive resources toward emotion regulation (Carstensen et al., 1999). This focus on emotion regulation positively influences memory for information that gratifies emotional well-being (Mather & Carstensen, 2005). Hence, information that is perceived as emotionally satisfying might be remembered better by older adults than less emotionally satisfying information. We might therefore expect that not only affective illustrations will influence older adults' recall of information, but also the satisfaction with emotional support that is perceived from a website. Thus, regardless of adding illustrations, satisfaction with emotional support may lead to increased recall of information for older adults, but not for younger adults. Following the socioemotional selectivity theory, we expect: *Adding an affective illustration to a text (vs. text only or text with cognitive illustration) will increase recall of cancer-related information for older adults, but not for younger adults (H2b)*. In addition, we propose: *Higher levels of satisfaction with emotional support from the website will increase recall of cancer-related information for older adults, but not for younger adults (H3)*.

This article examines the effect of cognitive and affective illustrations on satisfaction with attractiveness, comprehensibility, emotional support from a website, and recall of cancer-related information in older adults as compared to younger adults. In assessing age differences, we chose age younger than 65 years for the younger age group and age 65 and older as the older age group. These two age groups have been found as worthy of separate analysis in several studies on adulthood development (Staudinger

& Bluck, 2001) and disease in adulthood (Silliman, Troyan, Guadagnoli, Kaplan, & Greenfield, 1997).

METHODS

Design

A 4 (condition: text only vs. additional cognitive illustration vs. additional affective illustration vs. both illustrations) by 2 (age group: younger [< 65 years] vs. older [≥ 65 years]) between-subjects factorial design was used to examine the effect of cognitive and affective illustrations on website satisfaction and recall of information. For this experiment, a webpage of the Netherlands Cancer Institute (NKI) was used on which information about radiofrequency ablation (RFA) treatment was explained. This treatment for lung cancer patients uses radiofrequency waves to destroy the tumor. Because of the unknown character of RFA treatment, little prior knowledge was expected, which enhances the validity of the recall measurement. Four different versions of the webpage were created, containing either text-only information, information supported by two cognitive illustrations, information supported by an affective illustration, or information supported by both the cognitive and affective illustrations, respectively.

Pretest Illustrations

To select the most appropriate cognitive and affective illustrations for the NKI webpage, a pretest was conducted among 46 students. Seven cognitive colored drawings illustrating a part of the content of the text were tested: Four depicted the RFA treatment involving a needle, and three represented a pneumothorax, which is a complication that can occur during RFA treatment. The illustrations were evaluated with three items on a 7-point semantic scale ($\alpha = .85$). Items included, for instance, "the illustration does not fit the text/does fit the text." Results showed for the RFA treatment that one illustration scored significantly higher than the other three, $F(3,180) = 34.75$, $p < .001$, $\eta^2 = .37$. For the pneumothorax, results yielded no significant effects, but based on the mean scores, one of the illustrations scored better than the other two ($M = 5.27$, $SD = 1.40$ vs. $M = 4.77$, $SD = 1.51$ and $M = 4.80$, $SD = 1.52$).

Seven affective illustrations were tested, again using three items with a 7-point semantic scale ($\alpha = .81$). The affective illustrations were colored photos that represented, for instance, a doctor smiling to a patient. Items involved "the illustration does not give a good feeling/does give a good feeling." Results showed that one affective illustration scored significantly higher than others, $F(6,315) = 8.25$, $p < .001$, $\eta^2 = .14$. On the basis of this pretest, the cognitive and affective illustrations were chosen as stimulus materials (see Figures 1 and 2, respectively, for the cognitive and affective illustrations embedded in the NKI webpage).

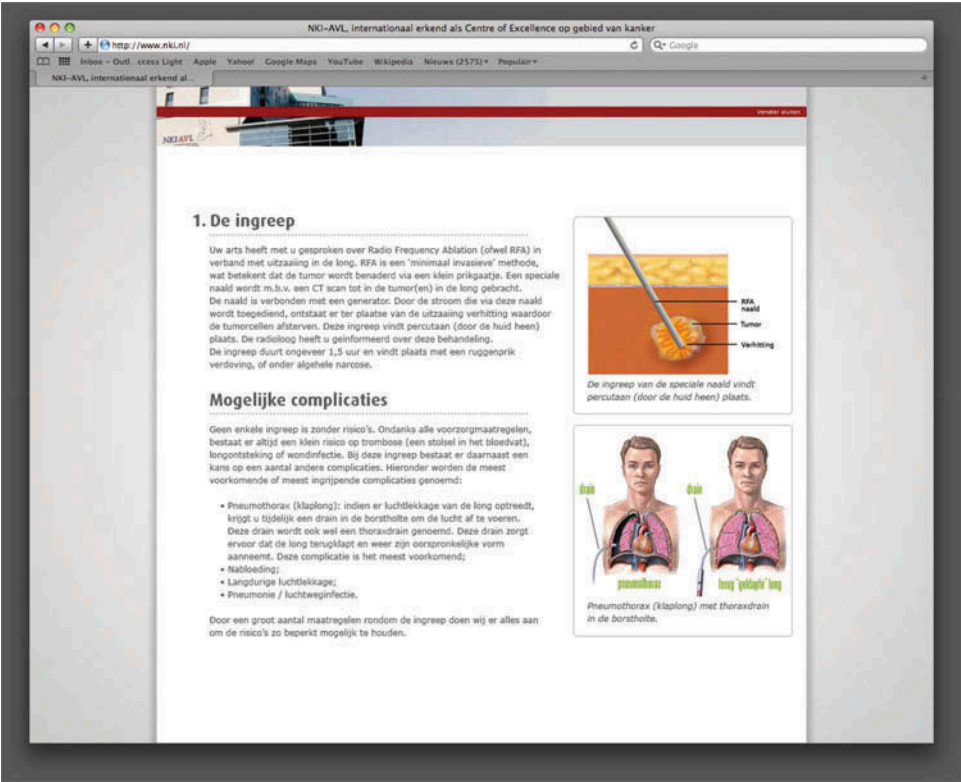


FIGURE 1 Snapshot of the NKI webpage containing the cognitive illustrations (color figure available online).

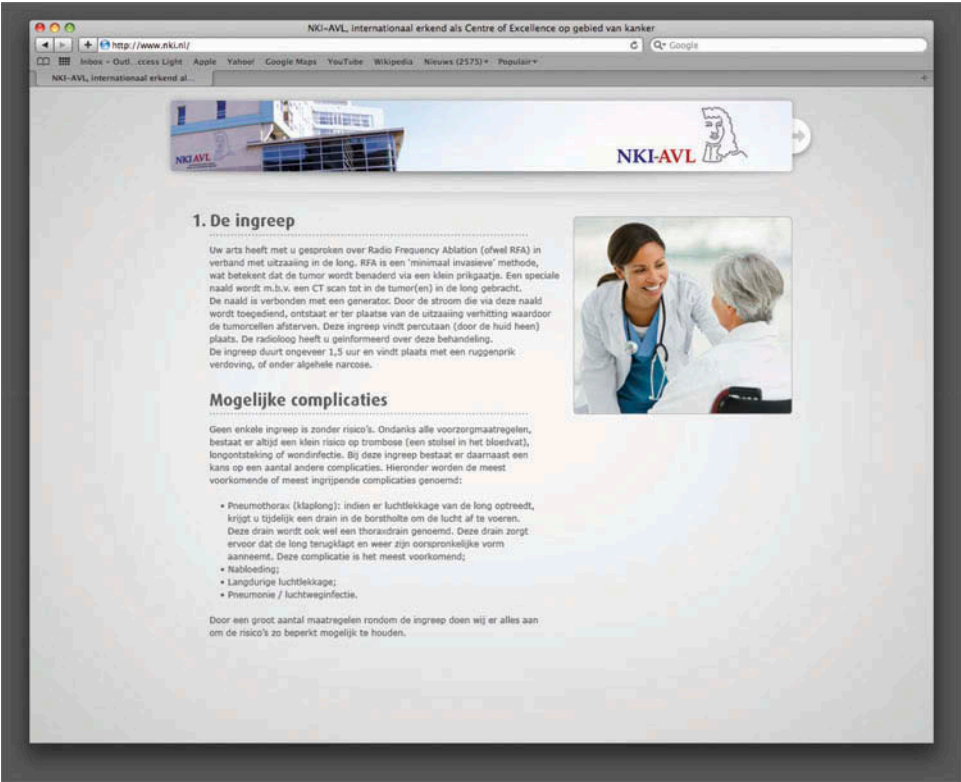


FIGURE 2 Snapshot of the NKI webpage containing the affective illustration (color figure available online).

Procedure

Participants ($n = 436$) were recruited via online panels (i.e., proefpersonen.nl and the “Booming experience” panel) and snowballing technique to obtain a heterogeneous sample. Participants were eligible to participate when they (1) were 18 years or older, (2) had no prior knowledge on RFA treatment, and (3) were able to read and write Dutch. Participants who indicated having prior knowledge on RFA were excluded from further analysis (i.e., scoring higher than 4 on a 7-point scale; $n = 6$). When participants entered the online survey, an introductory text was shown, followed by questions on background characteristics. Next, participants were randomly assigned to one of the four webpages stratified by age group. They were instructed to read the information on the webpage carefully and they were told that they were not able to return to the webpage after turning to the next page. On average, participants spent 90.86 seconds ($SD = 76.90$) on the website. Older participants did not take significantly more time viewing the webpage than younger participants ($M_{\text{younger}} = 85.96$, $SD = 64.97$, vs. $M_{\text{older}} = 98.92$, $SD = 92.89$), $F(1, 434) = 2.93$, $p = .088$, $\eta^2 = .01$. Immediately after viewing the webpage, recall of information was assessed. This was followed by the webpage again, but this time participants were instructed to focus on the feelings and thoughts that were elicited when looking at the website. Again, immediately after exposure, website satisfaction was administered.

Measures

Website satisfaction. Website satisfaction was measured by the Website Satisfaction Scale (WSS) based on items of the website attitude scale (Chen & Wells, 1999) and items of the Leisure Satisfaction Scale (LSS: Beard & Ragheb, 1980). Part of this scale was also used in a previous study (Van Weert et al., 2011). Satisfaction with comprehensibility included three items, such as “the website is understandable” ($\alpha = .89$), satisfaction with attractiveness included five items, such as “the website is well developed” ($\alpha = .81$), and satisfaction with emotional support included four items, such as “the website helps dealing with stress” (4 items, $\alpha = .93$), all to be scored on a 7-point Likert scale, ranging from 1 (*totally disagree*) to 7 (*totally agree*).²

Recall of information. The assessment of information recall was based on the Netherlands Patient Information Recall Questionnaire (NPIRQ: Jansen et al., 2008). Questions were generated from the RFA information and were pretested among 12 students. This resulted into 11 open-ended recall questions, such as “can you name the most common complication during an RFA treatment?” All

questions were provided with the answer options “not discussed,” “discussed, but I can’t remember the details,” and “discussed, namely . . .” Based on the RFA text, a codebook was developed for allocating scores to each of the recall questions. Recall scores could range from 0 (*not recalled*), to 1 (*recalled partially*), to 2 (*recalled correctly*). Two independent coders double coded the recall scores of 81 (18.6%) respondents. Interrater reliability appeared to be good (mean $\kappa = .87$, range .66–1.00). The 11 items were computed into a total recall score, ranging from 0 to 22. Additionally, percentages of recall scores were calculated.

Background characteristics. Background measures included age, gender, level of education, Internet use, prior medical knowledge, information preferences, and monitoring coping style. Educational level was divided into low, middle, and high level of education. Internet use was assessed asking for the number of hours spent on average per week on the Internet. Prior medical knowledge about lung cancer and RFA knowledge was measured by two items asking about the amount of knowledge the participants had on lung cancer and RFA measured on a 7-point Likert scale.

Statistical Analysis

Descriptive statistics were used to describe the sample characteristics. To determine whether experimental conditions and age groups differed on gender, age, educational level, Internet use, and (RFA) medical knowledge, F-statistics and chi-statistics were conducted where appropriate. For testing the effects of illustrations on website satisfaction and recall, four separate analyses of variance (ANOVAs) were conducted with satisfaction with comprehensibility (*H1a*), satisfaction with attractiveness (*H1b*), satisfaction with emotional support (*H1c*), and recall of information (*H2a/b*) as dependent variables, and condition and age groups as factors. Additional Tukey’s HSD test and independent-sample *t*-tests were conducted to check for age differences within conditions. For testing the relationship between satisfaction with emotional support and recall for the two age groups (*H3*), a simple moderation analysis was performed using the conditional process modeling program PROCESS, Model 1 (Hayes, 2012). All effects were subjected to bootstrap analyses with 5,000 bootstrap samples and a 95% confidence interval (CI). Recall of information was used as the dependent variable, with satisfaction with emotional support as the independent variable, and age groups as a moderator.

RESULTS

Sample Characteristics

Four-hundred and thirty-six participants filled out the online questionnaire ($n = 436$). Of these participants, 271 were younger adults (<65 years; $M = 47.47$, $SD = 15.61$) and

²An overview of all website satisfaction sub scales with belonging items can be provided by the corresponding author upon request.

TABLE 1
Sample Characteristics ($n = 436$)

Variable	Younger adults (<65 years), $n = 271$		Older adults (≥ 65 years), $n = 165$		p
	n	(%)	n	(%)	
Gender					$<.001$
Male	98	36.2	92	55.8	
Female	173	63.8	73	44.2	
Age (years)					.001
Mean (SD)	47.47 (15.61)		70.34 (4.33)		
Range	18–64		65–85		
Education					.006
Low	54	19.9	54	32.7	
Middle	78	28.8	47	28.5	
High	138	50.9	63	38.2	
Internet use (hours per week)					.603
Mean (SD)	13.17 (9.76)		12.66 (9.13)		
Range	1–70		0–50		
Medical knowledge lung cancer (scale 1–7) ^a					.142
Mean (SD)	2.34 (1.46)		2.15 (1.18)		
Range	1–7		1–6		
Medical knowledge RFA (scale 1–7) ^a					.494
Mean (SD)	1.28 (0.67)		1.24 (0.62)		
Range	1–4		1–4		
Time spent on the website (in seconds)					.088
Mean (SD)	85.96 (64.97)		98.92 (92.89)		
Range	2.96–580.08		6.33–808.28		

Note. Not all figures add up to 100%, due to missing data. Conditions stratified by age group did only significantly differ on gender. SD, standard deviation.

^aA higher score indicates more knowledge.

165 were older adults (≥ 65 years; $M = 70.34$, $SD = 4.33$). The eight experimental conditions stratified by age group differed significantly on gender, $\chi^2 = 19.68$, $p = .006$. Besides age, $F(1, 434) = 338.15$, $p = .001$, $\eta^2 = .44$, the two age groups significantly differed on gender, $\chi^2 = 16.02$, $p < .001$, and educational level, $\chi^2 = 10.40$, $p = .006$. Controlling for gender and educational level did not alter the main and interaction effects of condition and age group. Therefore, we did not control for gender and educational level in the following analyses. Sample characteristics are presented in Table 1.

Website Satisfaction

Adding cognitive illustrations did not significantly increase satisfaction with comprehensibility compared to text only, $p = .861$, adding an affective illustration, $p = .892$, or adding both illustrations, $p = .911$, in both younger and older adults. We did find a main effect for age on satisfaction with comprehensibility, $F(1, 423) = 8.99$, $p = .003$, $\eta^2 = .02$, indicating that younger adults scored significantly higher on satisfaction with comprehensibility than older adults ($M_{\text{younger}} = 5.95$, $SD = 0.98$ versus $M_{\text{older}} = 5.62$, $SD = 1.29$). When compared within conditions, this

difference only reached significance in the text only condition, $t(99) = 2.09$, $p = .039$. Thus, Hypothesis 1a was rejected.

A significant main effect was found for condition on satisfaction with attractiveness, $F(3, 423) = 9.26$, $p < .001$, $\eta^2 = .06$. Satisfaction with attractiveness was increased by adding cognitive illustrations, $p < .001$, an affective illustration, $p = .016$, or both illustrations, $p < .001$, compared to text only. Hence, Hypothesis 1b was supported. Furthermore, no main effects were found for condition on satisfaction with emotional support, $F(3, 422) = 0.53$, $p = .662$, $\eta^2 = .00$. This indicated that adding an affective illustration did not increase satisfaction with emotional support, rejecting Hypothesis 1c. A significant main effect was found for age, $F(1, 422) = 4.95$, $p = .027$, $\eta^2 = .01$, indicating that older adults reported in general being more satisfied with the perceived emotional support from the website than younger adults ($M_{\text{younger}} = 3.98$, $SD = 1.44$ versus $M_{\text{older}} = 4.29$, $SD = 1.31$). All main and interaction effects are reported in Table 2.

These findings showed that both cognitive and affective illustrations increase satisfaction with attractiveness compared to text only, but do not increase satisfaction with comprehensibility and emotional support. Furthermore, younger adults were more satisfied with the

TABLE 2
Website Satisfaction with Comprehensibility, Attractiveness, and Emotional Support
Stratified by Condition and Younger (< 65 yrs.) and Older (≥ 65 yrs.) Adults (*n* = 430)

	<i>n</i>	Satisfaction with comprehensibility		Satisfaction with attractiveness		Satisfaction with emotional support	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Text only	101	5.73	1.22	4.45	1.10	3.98	1.54
Younger adults	61	5.93	0.91	4.45	1.04	3.84	1.53
Older adults	40	5.43 ^{b*}	1.54	4.46	1.20	4.19	1.55
Cognitive illustration	113	5.85	1.07	5.07 ^{a***}	0.90	4.03	1.43
Younger adults	73	5.93	1.07	5.10	0.91	3.84	1.51
Older adults	40	5.71	1.05	5.00	0.87	4.37	1.23
Affective illustration	103	5.74	1.16	4.86 ^{a*}	0.87	4.16	1.28
Younger adults	64	5.84	1.09	4.88	0.86	4.06	1.26
Older adults	39	5.58	1.27	4.82	0.89	4.33	1.30
Both illustrations	113	5.95	1.04	5.10 ^{a***}	0.98	4.23	1.36
Younger adults	67	6.08	0.82	5.13	0.97	4.20	1.46
Older adults	46	5.75	1.30	5.06	0.99	4.29	1.21
Total	430	5.82	1.12	4.88	0.99	4.10	1.40
Younger adults	265	5.95	0.98	4.91	0.98	3.98	1.44
Older adults	165	5.62 ^{c**}	1.29	4.84	1.02	4.29 ^{c*}	1.31

Note. Website satisfaction subscales range from 1 to 7. A higher mean indicates more satisfaction with the website. *M*, mean; *SD*, standard deviation. Figure does not add up to *n* = 436 due to missing data.

^aMean differs significantly compared to the text-only condition (main effect of condition).

^bMean differs significantly compared to younger adults within the text-only condition (interaction effect).

^cMean differs significantly compared to younger adults within the total group (main effect of age).

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

comprehensibility of the website than older adults and older adults were more satisfied with the perceived emotional support from the website than younger adults.

Recall of Cancer-Related Information

Younger adults recalled on average 38.5% of the information correctly and older adults 36.1%, $F(1, 428) = 1.08$, $p = .300$, $\eta^2 = .00$. Results also yielded no significant main effects for condition, $F(3, 428) = 0.18$, $p = .910$, $\eta^2 = .00$, nor an interaction effect between condition and age group, $F(3, 428) = 0.59$, $p = .619$, $\eta^2 = .00$. No significant differences were found between younger and older adults' recall of information when cognitive illustrations were added to the website ($M_{\text{younger}} = 8.41$, $SD = 4.58$ vs. $M_{\text{older}} = 7.93$, $SD = 4.63$; $t(114) = 0.54$, $p = .592$) or when an affective illustration was added to the website ($M_{\text{younger}} = 8.20$, $SD = 5.07$ vs. $M_{\text{older}} = 8.74$, $SD = 5.05$; $t(103) = 0.54$, $p = .594$). Therefore, Hypotheses 2a and 2b were not supported, indicating that cognitive illustrations do not increase information recall in younger (and older) adults and affective illustrations do not increase information recall in older (and younger) adults. Total recall scores for each condition and recall scores stratified by age group are shown in Table 3.

For testing the relationship between satisfaction with emotional support and recall of information for younger and older adults ($H3$), PROCESS showed no significant interaction effect between satisfaction with emotional support and age group on recall of information, $b = 0.51$, $SE = 0.35$, $t = 1.46$, $p = .145$. However, a conditional effect of satisfaction with emotional support on recall of information for the older adults was revealed, $b = 0.56$, $SE = 0.28$, $t = 1.97$, $p = .050$, indicating that when older adults perceived higher emotional support from the website, they recalled significantly more information. This effect was not significant for the younger adults, $b = 0.05$, $SE = 0.20$, $t = 0.24$, $p = .811$, confirming Hypothesis 3. This conditional effect is depicted in Figure 3.

DISCUSSION

This study examined the effect of adding cognitive and affective illustrations to online health information on older adults' website satisfaction and recall of cancer-related information. Results showed that both younger and older adults were more satisfied with the attractiveness of the website when any type of illustration was provided. Furthermore, older adults were more emotionally satisfied with the website than younger adults. Being more emotionally satisfied with

TABLE 3
Percentages of Information Recalled Correctly Stratified by Condition and Younger (<65 years) and Older (≥65 years) Adults (*n* = 436)

	<i>n</i>	<i>Percent recall</i>	<i>Recall of cancer-related information</i>	
			<i>M</i>	<i>SD</i>
Text only	101	38.1	8.38	4.54
Younger adults	61	40.2	8.84	3.83
Older adults	40	34.9	7.68	5.44
Cognitive illustration	116	37.5	8.24	4.58
Younger adults	76	38.2	8.41	4.58
Older adults	40	36.0	7.93	4.63
Affective illustration	105	38.2	8.40	5.04
Younger adults	66	37.3	37.3	5.07
Older adults	39	49.7	8.74	5.05
Both illustrations	114	36.7	8.07	5.06
Younger adults	68	38.3	8.43	5.42
Older adults	46	34.3	7.54	4.48
Total	436	37.6	8.27	4.80
Younger adults	271	38.5	8.46	4.75
Older adults	165	36.1	7.95	4.87

Note. Recall of information ranges from 0 to 22 (*M* = 8.27, *SD* = 4.80). The higher the score the more information was recalled correctly. *M*, mean; *SD*, standard deviation.

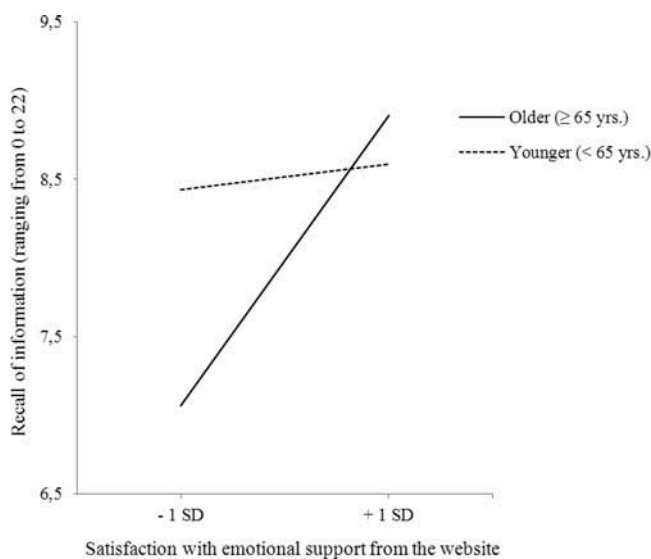


FIGURE 3 Interaction effect between satisfaction with emotional support and age on recall of information.

the website led to greater recall for older adults, but not for younger adults, which is the major finding of this study. In this section, the theoretical contribution of the study is highlighted, followed by limitations and future research directions. Furthermore, the practical implications are discussed.

Our data revealed some interesting findings that can contribute to the theoretical framework of using illustrations in online health communication. The results revealed that emotion regulation plays an important role in older

adults' memory for cancer-related information. When older adults perceived information as emotionally gratifying (i.e., high levels of satisfaction with emotional support from the website), recall of information was significantly higher than when older adults perceived information as not emotionally gratifying (i.e., low levels of satisfaction with emotional support from the website). This effect was not found for younger adults, which is in agreement with the socioemotional selectivity theory (Carstensen et al., 1999) that asserts that older adults hold more emotionally meaningful goals than younger adults and put more effort into memorizing information that is relevant to their goals (i.e., emotional well-being).

The data partially supported Levie and Lentz's (1982) functional approach to illustrations. An affective illustration led to increased satisfaction with the attractiveness of the website, which is consistent with the affective function of illustrations. However, it did not increase satisfaction with emotional support from the website. The data showed no support for the cognitive function of illustrations: Adding cognitive illustrations was not associated with greater satisfaction with the comprehensibility of the website. However, consistent with the findings of Park and Lim (2004), we found that cognitive illustrations can have affective functions as well, and enhanced satisfaction with the attractiveness of the website. In explaining website satisfaction, age was found to explain some of the variance in website satisfaction. Younger adults were more satisfied with the comprehensibility of the website than older adults, especially when no illustrations were used, and older adults were more satisfied with the perceived emotional support from the website than younger adults.

We could not find evidence for the positivity bias in older adults' memory. Adding an affective illustration did not increase older adults' recall of information. This might be explained by our pretest sample, which consisted of students. As aging leads to differences in perceptions of stimuli (Mather & Carstensen, 2005), older adults may not have perceived the affective illustrations as intended. Similarly, our "healthy" sample might have accounted for not finding the positivity bias as well. It might be possible that our sample did not perceive the affective illustration as emotionally relevant, because of their low personal relevance for the topic. Future research should examine whether older adults perceive different illustrations as affective than do younger ones, as well as whether cancer patients have different perceptions of what illustrations are affective compared to healthy adults. It is therefore desirable to replicate this study among older cancer patients to test the positivity bias in older adults' memory.

We did also not find support for the multimedia effect, stating that adding cognitive illustrations should result in superior results compared to text only information (Mayer, 1999). Adding cognitive illustrations did not lead to an increase in recall of information for either younger or older adults. This might be explained by literature suggesting that other content-related and person-related factors, such as readability of the text and health literacy level of the learner, play a more important role than illustrations (McInnes & Haglund, 2011). Older adults are usually found to have lower health literacy, which might influence the extent to which they learn information (McCray, 2005; Mårtensson & Hensing, 2012). As we did not measure health literacy, we do not know whether our sample of older adults indeed had lower health literacy than the younger age group and whether differences in health literacy levels would have influenced the effects of cognitive illustrations. Future research should further examine whether health literacy influences processing of cancer-related information.

Although our results give insight into how illustrations influence older adults' website satisfaction and recall of cancer-related information, some other factors might explain our results as well. "Age alone is a meaningless demographic" (Lippincott, 2004, p. 106) and chronological age is of course not the only factor our two age groups differ on. Both age groups are very heterogeneous entities, varying on multiple levels (both within and between groups). Especially the older age group is a very heterogeneous group; individual differences increase as people get older (Dannefer, 1988). Future research should unravel the complex underlying structure of age and other factors, such as gender, education level, and Internet experience (Loos, 2012). For instance, we did not find differences in Internet experience between the older and younger age group in our sample, which might have biased the results. Although older adults increasingly use the Internet, they use the Internet less frequently than younger adults at the moment (Statistics

Netherlands, 2011). However, it is expected that Internet use among older populations will grow due to the process of generational change and the use of information and communication technology (ICT) facilities. Today's younger adults will be the future's older adults. The current lower Internet experience in the older generation will thus be resolved in time (Duimel, 2007).

As illustrations are used by website designers to enhance website satisfaction and recall of information, these results can contribute to a better understanding of how and when illustrations are effective for older adults. Our results showed that cognitive and affective illustrations can increase satisfaction with attractiveness, but do not contribute to enhanced satisfaction with the comprehensibility and emotional support from the website. The results also showed that perceiving emotional support from a website is related to older adults' ability to correctly recall cancer-related information. It is therefore important to consider what kind of online information provision leads to enhanced emotional support in older adults. Website designers could take these results into account when creating information for older adults on the Web to optimize website satisfaction and recall of information.

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