A novel approach to tailored communication

Optimizing online health information for older patients

Nguyen, M.H.

4

Chapter 4

Perceived active control in a digital environment: Underlying mechanisms of mode tailoring effects on website attitude and information recall

This chapter is under review as: Nguyen, M. H., Bol, N., & Lustria, M. L. A. Customization of online information: Underlying mechanisms of mode tailoring effects on website attitude and information recall.

A version of this chapter has been awarded with a Top Student Paper Award from the Communication & Technology division at the 2018 Conference of the International Communication Association in Prague, Czech Republic.

ABSTRACT

Previous studies have traditionally studied effects of system-initiated *message content* tailoring to match individual characteristics. Recent work has explored the effectiveness of tailoring to match individual modality preferences and processing styles. Using a web-based experiment, this study investigated the cognitive mechanisms of user-initiated *mode tailoring* effects on attitudinal and cognitive outcomes in a representative sample of Internet users (N = 392; 25–86 years). Structural equation modeling showed that mode tailoring – enabling users to self-tailor the presentation mode (via textual, visual, audiovisual information) on a health website – increased users' perceived active control, which in turn contributed to higher perceived relevance and website engagement, and reduced cognitive load. Positive indirect effects of mode tailoring of digital information (vs. no tailoring) through these mechanisms were found for both website attitude and information recall. The findings suggest that perceived active control is the key driver of mode tailoring effects. Implications for theory and message design in digital information environments are discussed.

INTRODUCTION

One of the relative advantages of Web-based approaches is the ability to tailor content, structure and presentation to match individual information needs and preferences. *Tailoring* messages has been shown to be more effective, than providing non-tailored messages in influencing attitudes and behavior change (Lustria et al., 2013; Noar et al., 2007). Typical tailoring studies have mainly studied the effects of adjusting the *message content* to match the recipients' individual characteristics. More recent work has also considered tailoring the message *presentation mode* to individual information modality preferences and processing styles to maximize message effectiveness (Smit et al., 2015). One assumption supporting the use of mode tailoring is that the way in which information is being delivered may affect how this information is evaluated, processed, and remembered (Kreuter et al., 2000; Lang, 2000; Ritterband et al., 2009). Furthermore, individuals vary in their information mode preferences (e.g., textual vs. audiovisual online information; Heo & Cho, 2009), processing styles (e.g., verbal vs. visual learners; Truluck & Courtenay, 1999; Wehrwein et al., 2007), and cognitive motivations (e.g., low vs. high need for cognition; Bakker, 1999). Studies examining different mode tailoring strategies – based on preference for charts and graphs versus illustrated visuals, and textual versus (audio)visual information – have shown favorable cognitive, evaluative and behavioral outcomes (Jensen et al., 2012; Linn et al., 2015; Nguyen et al., 2017; Nguyen et al., 2018).

Traditionally, tailoring starts with an assessment of individual characteristics, preferences and/or theoretical constructs related to the intended behavioral outcome (e.g., as informed by theories like the stages of change or health belief models). This information is then used to design messages that are deemed more personally relevant. For example, an expert system is employed to collect user data, generate tailored messages based on an analysis of individual data, and deliver this information in a pre-planned format. A different approach, however, is to let the user *initiate* the tailoring process and customize the presentation mode by selecting personally relevant information elements. The latter approach is particularly suitable for digital information environments, and has shown promising effects on user evaluations and message processing in various contexts (Chung & Nah, 2009; Nguyen et al., 2017; Sundar & Marathe, 2010). For example, a recent study found that having the option to self-tailor the preferred mode of information presentation, led to more positive evaluations, increased attention, and improved recall (Nguyen et al., 2017; Nguyen et al., 2018)). What remains relatively unclear, however, is what cognitive processes drive the effects of user-initiated mode tailoring. Questions that have remained largely unaddressed are, for instance: What mechanisms explain the effects of user-initiated mode tailoring on information processing?

Is user-initiated mode-tailored information more effective, as users perceive to have active control over their information environment, and are thus able to engage with the content, select personally relevant information elements, and process information more easily?

To address these questions, this study sets out to understand *why* mode tailoring is effective, which refers to adjusting information to individual preferences for presentation modality, using textual, visual, and/or audiovisual information (Nguyen et al., 2017). Specifically, the current study investigates which underlying mechanisms help explain the effects of user-initiated mode tailoring on attitudinal (i.e., website attitude) and cognitive outcomes (i.e., information recall) in an online context. Gaining a better understanding of these underlying processes will enhance our understanding of why user-initiated mode tailoring (from now on 'mode tailoring') is effective. Ultimately, we aim to extend the existing theoretical models of tailoring and contribute to the literature on effective message design in digital information environments.

Theoretical approaches to understand mode tailoring effects

Both the elaboration likelihood model (ELM) and the limited capacity model of motivated mediated message processing (LC4MP) suggest that message processing is dependent on the *ability* and the *motivation* to process information (Lang, 2006; Petty & Cacioppo, 1986; Petty et al., 2002). According to the ELM, several factors may influence the ability to process information – the cognitive resources available to the individual, relevant knowledge and individual differences in need for cognition. Motivation to engage in an activity (e.g., attend to a message) also influences message processing. The ELM posits that when individuals perceive messages to be personally relevant, they are more likely to be motivated to process information more deeply, and consequently form more robust attitudes toward the message. Similarly, the LC4MP suggests that when individuals are motivated and are able to allocate sufficient cognitive resources to a message, the message will be successfully processed, stored in memory, and can be easily retrieved from memory (i.e., recalled) later. Together, the ELM and LC4MP suggest that for information to be evaluated more positively (i.e., website attitude) and processed adequately (i.e., information recall), designers should develop messages that may increase individuals' motivation and ability to process information. In the following sections we will elaborate on the mechanisms that might play a role in optimizing message processing conditions as afforded by mode tailoring.

The facilitating role of perceived active control. One way to increase people's motivation and ability to process information is to provide them with active control over the information being processed. User control theory supports the idea that having control over the pace, order and content provided in online contexts (i.e., hypermedia) can increase the *motivation* to process information and may improve learning *ability* given individual differences in processing styles (Dillon & Jobst, 2005; Eveland & Dunwoody, 2001). As such, user-initiated mode tailoring could enhance information processing in two ways. First, providing the option to toggle between presentation modes may increase feelings of active control over the information environment, which consequently enhances the *motivation* to attend to the message. In the same way, the option to choose the presentation mode and sense of active control may enhance the *ability* to process information by considering potential differences in cognitive abilities such as learning styles. Altogether, online information that is tailored *by* users rather than *for* users is expected to be particularly effective at improving both ability and motivation to process information. Similarly, based on principles derived from self-determination theory (Ryan & Deci, 2000), the agency model of customization proposes that user-controlled efforts to adjust online information can contribute to a greater feeling of agency and intrinsic motivation to use the online information, which in turn can evoke favorable cognitive, attitudinal and behavioral responses through mechanisms that signify involvement, identification, and control (Kang & Sundar, 2016; Sundar, 2008). We therefore expect *perceived active control* to be the main driver of mode tailoring effects, facilitating both the motivation and ability to process online information. As such, we first hypothesize that:

> H1: Mode tailoring will contribute to greater perceived active control, which will enhance (a) website attitude and (b) information recall.

Increasing motivation: Perceived personal relevance and website engagement. Several studies have shown that tailoring messages to one's personal values or beliefs, or individual preferences and characteristics increases the sense of *personal relevance* of that message, thus increasing the motivation to attend to messages (Jensen et al., 2012; Kreuter & Wray, 2003; Lustria et al., 2016). Similarly, user-initiated mode tailoring may also increase the motivation to process information. There is evidence that user-initiated tailoring gives users a sense of active control over the information, because by giving them the ability to pick personally relevant elements they are able to decide for themselves what information they consult and how they consult it (e.g., Kalyanaraman & Sundar, 2006; Sundar & Marathe, 2010). Enabling users to play a more active role in deciding how online information is being presented creates a situation in which the resulting information – the product of one's own customization efforts – self-evidently becomes more personally relevant to the user. This in turn, can lead to more positive attitudes toward the online content and better recall of information. Thus, we hypothesize that:

> H2: Mode tailoring contributes to greater perceived active control, which in turn heightens perceived personal relevance, consequently enhancing (a) website attitude and (b) information recall.

Studies have shown that tailored messages receive more attention and are processed more deeply than non-tailored information (e.g., Kreuter & Wray, 2003; Lustria et al., 2016; Ruiter et al., 2006). For example, Lustria and colleagues' (2016) model of tailoring effects showed that tailoring enhances attention and elaboration through increased personal relevance. In an online context, previous studies have shown that tailoring health websites boosts participant exposure, enhances *website engagement*, and leads to more positive attitudes toward the website (e.g., Crutzen et al., 2011; Danaher, Boles, Akers, Gordon, & Severson, 2006). More specifically, several studies have shown that compared to standard information, exposure to web-based tailoring is associated with: greater time viewing the website, an increase in the number of web pages visited, higher satisfaction with the website, and increased likelihood to revisit the website (Danaher et al., 2006; Severson, Gordon, Danaher, & Akers, 2008). Attention – operationalized by website engagement in this study – is an important prerequisite for information recall. The more users are engaged in organizing, encoding, and storing information at a self-paced rate, the more likely this information can be recalled correctly (Bol et al., 2016; Lang, 2000; Nguyen et al., 2017). Mode tailoring allows users to customize presentation modes (via textual, visual, and/or audiovisual information), increasing perceptions of active control that may consequently increase users' engagement in the website. This in turn, may contribute to more positive evaluations and recall of the online information. Therefore, we hypothesize that:

> H3: Mode tailoring contributes to greater perceived active control, which in turn increases website engagement, consequently enhancing (a) website attitude and (b) information recall.

Increasing ability: Perceived cognitive load. Until now, little is known about the underlying cognitive processes that explain mode tailoring effects. One idea is that mode tailoring facilitates information processing by adapting to individual cognitive abilities and processing styles. Cognitive theory of multimedia learning (CTML) proposes a rationale for how multimodal information is optimally processed, and suggests that: (1) individuals are limited and vary in their capacity to process information and multimodal presentations can aid information processing by reducing cognitive load, and (2) whenever individuals process information, they actively select, organize, and integrate information parts that make sense to their unique situation (Baddeley, 1992; Mayer, 1999; Mayer, 2002; Paivio, 1971). Following these principles, CTML particularly lends support for mode tailoring, as the purpose of mode tailoring is for users to find an optimal fit between their individual information preferences, cognitive needs and processing styles on the one hand, and the mode(s) through which information is being presented on the other hand. In essence, providing the possibility to tailor the mode of presentation helps optimize processing conditions by reducing the *perceived cognitive load*. Therefore, we hypothesize that:

> H4: Mode tailoring contributes to greater perceived active control, which in turn reduces perceived cognitive load, consequently increasing (a) website attitude and (b) information recall.

METHOD

The current study aims at exploring the underlying mechanisms that might explain the effects of *user-initiated mode tailoring* on attitudinal (i.e., website attitude) and cognitive outcomes (i.e., information recall) in an online environment. To test the hypotheses, we conducted a one factor (condition: mode-tailored vs. standardized website) between-subjects online experiment whereby study participants were exposed to a health-related website. This experiment involved the use of a website that allowed users to self-tailor the mode of information presentation via textual, visual and/or audiovisual information. Ethical approval was given by the institutional review board from the Amsterdam School of Communication Research (2016-PC-7506).

Participants

In total, 515 Dutch adults completed the questionnaire, of which 392 participants were included in the sample for analysis (M_{age} = 54.71, SD_{age} = 14.50, range 25 – 86; 52.8% male; 28.6% low education, 42.9% middle-high education, 28.6% high education). Participants were excluded if they: (1) did not select at least one mode of presentation (i.e., text, visuals, or video) in the mode-tailored condition (n = 31; see 'Procedure'), or (2) did not view the website for at least 30 seconds, which was the minimum time needed to view the information (n = 24; for a similar procedure, see Nguyen et al., 2017). Furthermore, participants were excluded if they: (1) ignored the instructions by not closing the website before continuing with the questionnaire, interfering with our measurement of recall (n = 26); (2) ignored the instructions and did not open at least one of the two webpages in addition to the homepage (*n* = 21); or (3) indicated having technical problems with the survey or website (*n* = 1). We also excluded participants for which we could not track website use data because they turned on private browsing (*n* = 71). As participants could meet more than one exclusion criterion, the numbers do not add up to the total number of participants excluded (*n* = 123).

Procedure

Data for the experiment were collected through an online research panel supplied by Flycatcher by means of an online questionnaire (certified by the International Organization for Standardization; ISO 20252 for market and opinion research and ISO 26362 for research panels). The sample was stratified based on gender, level of education, and geographical distribution to create a representative sample of the Dutch population above 25 years of age. Individuals under the age of 25 were not approached for participation, as colorectal cancer rarely affects those who are younger than 25 years (American Cancer Society, 2017a; Netherlands Comprehensive Cancer Organisation, 2017)

Participants were informed that the study was about online health information and answered a brief baseline survey. After this, participants were instructed to look at a website within the context of a hypothetical colorectal cancer scenario. The instructions for the scenario were as follows:

> "You are about to take a look at a website for colorectal cancer patients from the Gastro-Intestinal Oncological Centre Amsterdam (GIOCA), part of the Academic Medical Center (AMC). The website covers information on how patients can prepare for their appointment at the GIOCA. Although it is likely that you do not colorectal cancer yourself and that you are not familiar with the GIOCA, we would like to ask you to imagine that you possibly have colorectal cancer and that you will visit this hospital in the near future."

Participants were then randomly assigned to view either a mode-tailored or standardized version of the website. The instructions for viewing the website were as follows:

> "To optimally view the website, it is important that your browser window is set to the maximum size, and that your sound is on. Afterwards you will receive a number of questions about the website. You can view the website as long as you wish. If you are finished viewing the website, you can close it and continue with the questionnaire. Below you see an example of the website. Click here to continue to the website."

For the mode-tailored condition, the following instruction was added before participants could click on the link:

> "You can customize this website as you wish. With the on/off switches in the horizontal bar you can choose how the information will be presented. You can choose text, images, videos, or any combination of different modes: whichever you prefer most."

Upon opening the mode-tailored website, all modes were switched off to ensure that participants would select their own preferred mode(s) of information and would not go with the default presentation of information. After engaging in the scenario and the website, participants answered a follow-up questionnaire to assess mediating variables and outcome measures. Participants received a financial incentive from the research company upon successful completion of the study.

Stimulus materials

The study websites contained health-related information from an existing website of a multidisciplinary outpatient clinic in the Netherlands (henceforth referred to as 'the clinic'). The clinic is a highly specialized center that provides fast diagnostics in complex cases of colorectal cancer. The website consisted of three webpages: a homepage, one webpage with general information about the clinic (e.g., the fast diagnostics procedure, which doctors they would meet), and one webpage with information on how patients could prepare for consultations (e.g., information about symptoms, questions to ask, and what to bring to the appointment). Both website versions contained the exact same content including text, visuals and videos. The mode-tailored website was different in that it allowed participants to self-select their preferred modes of information presentation. On the standardized website, all information and modes were offered in a fixed manner. Mode tailoring was operationalized through an interactive built-in tool, which enabled users to self-select whether online information would be presented through verbal (text), visual (pictures and illustrations), audiovisual (videos) information, or through a combination of any of these presentation modes (see Figure 4.1a for the mode-tailored website and Figure 4.1b for the standardized non-tailored website). A comparable mode tailoring tool has been tested in other study settings prior to the

Figure 4.1a. Mode-tailored website with text and video selected.

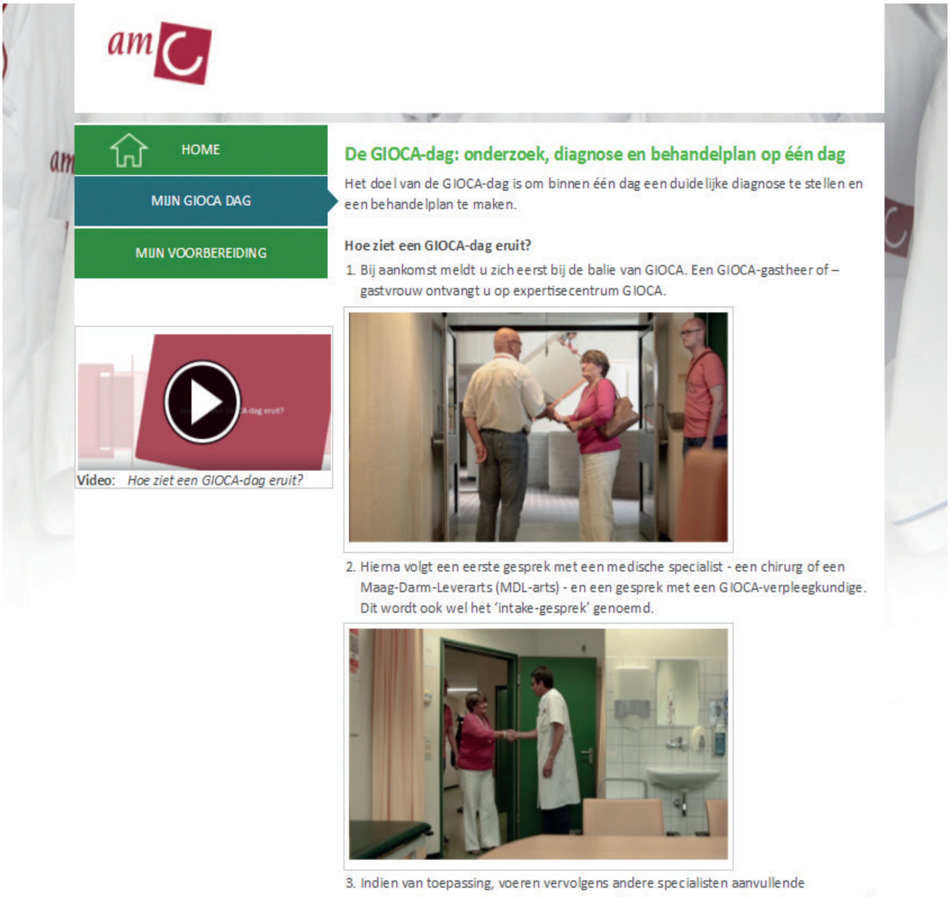

Figure 4.1b. Non-tailored standardized website with text, visuals and video (bottom).

Measures

Outcome variables. *Website attitude* was measured with nine items (the website is creative, well developed, well organized, enjoyable, sophisticated, user-friendly, confusing [reverse coded], coherent, and the website looks nice) on a 7-point Likert scale ranging from 1 (totally disagree) to 7 (totally agree; M = 5.13, SD = 1.06; α = .92). Items were derived from the Website Satisfaction Scale (Bol et al., 2015; van Weert et al., 2011) and previous studies assessing website attitudes (Kalyanaraman & Sundar, 2006; Sundar & Marathe, 2010). Confirmatory factor analysis (CFA) revealed a reliable satisfaction scale with good fit, χ^2 (13) = 18.31, p = .146, root mean squared error of approximation (RMSEA) = .032, Standardized Root Mean Square Residual (SRMR) = .0175, Tucker-Lewis Index (TLI) = .995, comparative fit index (CFI) = .998. *Information recall* was measured with seven open-ended questions based on the website content, such as “which topics will be discussed with the medical specialist and nurse?” (Jansen et al., 2008b). A codebook was developed beforehand to allocate recall scores. Each answer could result in a maximum of two points with ‘0’ if incorrect, ‘1’ if partially correct, and ‘2’ if entirely correct. This resulted in a sum score ranging from 0–14 points, which was then converted to percentage correctly recalled (M = 25.82, SD = 22.07). The first author coded all answers and the second author double coded 19% of the recall answers (n = 74). The intercoder reliability was good (mean κ = .925, p < .001).

Mediating variables. *Perceived active control* over the website was assessed with four items derived from the perceived interactivity scale, e.g., “while I was on the website, I was always aware where I was” and “I felt that I had a great deal of control over my visiting experience at this website” (M = 5.55, SD = 1.19; α = .92; Liu, 2003; Song & Zinkhan, 2008; Voorveld et al., 2011). *Perceived personal relevance* of the website was measured with three items, e.g., “the website seemed personally made for me” (M = 4.68, SD = 1.43; α = .87; Jensen et al., 2012; Lustria et al., 2016). *Perceived cognitive load* while using the website was measured with two items based on the Paas cognitive load rating scale (Paas, 1992), e.g., “viewing the information on the website took me a lot of effort” (reversely coded; M = 2.28, SD = 1.33; Pearson’s r = .77). All items were measured on a 7-point Likert scale with ‘1’ being ‘totally disagree’ and ‘7’ being ‘totally agree’. Finally, *website engagement* was operationalized by the amount of time spent on the website measured in seconds (M = 361.27, SD = 424.82; Bhat et al., 2002; Nguyen et al., 2017).

Manipulation check. To check whether participants took note of the mode tailoring manipulation, they were asked to rate the statement “I could decide how the information was presented on the website” with answer options ranging from 1 (totally disagree) to 7 (totally agree; M = 5.21, SD = 1.70).

Background variables. Background variables included demographic variables (i.e., age, gender and education level), participants’ experience with cancer (i.e., being diagnosed with cancer themselves and knowing someone being diagnosed with cancer). The frequency of Internet use in hours per week was also assessed (M = 19.83, SD = 13.63). Finally, *Internet efficacy* was assessed with three items, e.g., “in general, I find websites easy to use” (M = 5.58, SD = 1.34; α = .94; Ajzen, 1991). Furthermore, participants’ website use was obtained using a built-in tracking system.

Statistical analyses

Pearson's correlations for all variables are reported in Table 4.1 for the full sample (N = 392). To test for successful manipulation and randomization, t tests and Chi-square tests were conducted. The hypothesized model (H1 – H4) was tested using structural equation modeling (SEM) in AMOS version 22. Before model testing, we performed two steps to ensure multivariate normality for accurate maximum likelihood estimation. First, as distributions of the time variable 'website engagement' were skewed right, we log-transformed the data (for a justification, see Okan, Galesic, & Garcia-Retamero, 2016; Ratcliff, 1993; Yan & Tourangeau, 2008). Second, we used Mahalanobis distance method to identify outliers (n = 29) that exceeded the critical value at p < .05 (Kline, 2011; Tabachnick & Fidell, 2007). After log-transformation and omission of outliers, multivariate normality assumptions were met (Multivariate kurtosis = 1.66, c.r. = 1.62; Gao, Mokhtarian, & Johnston, 2008; Kline, 2011).[2] Model fit based on N = 363 was assessed with Chi-square, the root mean squared error of approximation (RMSEA), the Standardized Root Mean Square Residual (SRMR), the Tucker-Lewis Index (TLI), the comparative fit index (CFI). The expected cross-validation index (ECVI) was reported to assess the model's potential for replication. To test the effects, bootstrapping was performed to obtain 95% bias-corrected confidence intervals based on 5,000 bootstrap iterations (Bollen & Stine, 1992; MacKinnon, Lockwood, & Williams, 2004). In the figures presenting the SEM analysis, measured/observed and latent variables are denoted with rectangles and circles, respectively.

RESULTS

Manipulation and randomization check

The manipulation of mode tailoring succeeded – those in the mode-tailored condition had higher perceptions of being able to decide how the website information was presented (M = 5.99, SD = 1.25) than the participants in the standardized website condition (M = 4.54, SD = 1.76), t(390) = -9.32 , p = < .001, d = 0.95. The randomization check was considered successful, as the two experimental conditions did not differ on participants' background, including age, t(390) = -0.21 , p = .836, d = 0.02; gender, $\chi^2(1)$ = 0.14, p = .705; education level, t(390) = -0.18, p = .855, d = 0.02; experience living with cancer, $\chi^2(1)$ = 0.00, p = 1.000; knowing someone else living with cancer, $\chi^2(1)$ = 0.43, p = .512; Internet use, t(390) = 0.55, p = .582, d = 0.06; and Internet efficacy, t(390) = -1.20, p = .230, d = 0.12.

[2] Log-transforming our data and/or excluding outliers yielded the similar results, demonstrating the robustness of our model. However, preference was given to removing outliers from the sample for model testing (N = 363) to ensure multivariate normality, because model fit indices, parameter estimates, and significance tests are then considered more reliable (Lei & Lomax, 2005).

Website use patterns

In total, participants (*N* = 392) spent 6 minutes on average on the website (*M* = 361.27 s, *SD* = 424.82 s, range = 30–4024). They visited on average almost all three pages (*M* = 2.87, *SD* = 0.34, range = 2–3), and made on average nine (re)visits to these pages (*M* = 8.71, *SD* = 5.62, range = 2–34). Participants started playing about one out of three videos (*M* = 0.91, *SD* = 0.99, range = 0–3). Those who started a video, watched on average 22.73% of the entire video (*SD* = 13.17, range = 0–85.51).

Participants in the mode-tailored website condition spent on average 334.15 s on the mode-tailored website (*SD* = 356.08), compared to 385.02 s on the standardized website (*SD* = 476.54), $t(390) = 1.18$, $p = .237$, $d = 0.12$. In both conditions, participants visited on average almost all three pages ($M_{\text{tailored}} = 2.85$, *SD* = 0.36 vs. $M_{\text{standardized}} = 2.88$, *SD* = 0.33), $t(390) = 0.81$, $p = .417$, $d = 0.09$. However, participants in the mode-tailored website condition (re)visited significantly more webpages in total (*M* = 11.31, *SD* = 5.78) than those in the standardized website condition (*M* = 6.43, *SD* = 4.36), $t(335.70) = -9.34$, $p < .001$, $d = 0.95$. Furthermore, participants in the mode-tailored website conditions started on average less videos (*M* = 0.80, *SD* = 0.91) than those in the standardized website condition (*M* = 1.00, *SD* = 1.05), $t(389.94) = 2.03$, $p = .043$, $d = 0.20$. Table 4.2 shows the website use patterns of the 183 participants in the mode-tailored website condition and the 209 participants in the standardized website condition.

With regard to mode actions on the mode-tailored website, participants made on average 5 clicks to (de)select the text, visuals, or video mode on the mode tailored website (*M* = 4.87, *SD* = 3.01, range = 1–15). Most people started their mode selection with text (*n* = 139, 76.0%), whereas a smaller number of people selected visuals (*n* = 25, 13.7%) or video (*n* = 19, 10.4%) as their first mode. The first mode selection was on average made around 19 seconds (*M* = 18.47, *SD* = 14.62, range = 2–80). During the entire visit of the website, the large majority of the participants selected multimodal information (i.e., text, visuals and video: *n* = 155, 84.7%; text and visuals: *n* = 16, 8.7%; text + video: *n* = 1, 0.5%; visuals and video: *n* = 1, 0.5%) over unimodal information (i.e., text-only: *n* = 8, 4.4%; visuals-only: *n* = 1, 0.5%; video-only: *n* = 1, 0.5%).

Table 4.1. Correlation matrix of study variables ($N = 392$)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	–													
2. Gender [a]	.17**	–												
3. Education	–.34***	–.07	–											
4. Cancer self [b]	.29***	.04	–.07	–										
5. Cancer other [b]	.02	–.09	.07	.01	–									
6. Internet use	–.09	.08	.04	–.08	.02	–								
7. Internet efficacy	–.22***	–.09	.13*	–.05	–.05	.12*	–							
8. Tailored condition	.01	.02	.01	–.00	–.04	–.03	.06	–						
9. Active control	.01	–.04	–.02	–.00	–.01	.02	.21***	.11*	–					
10. Cognitive load	.14**	.20***	–.12*	.01	–.12*	–.00	–.23***	.01	–.45***	–				
11. Personal relevance	.15**	–.07	–.12*	.09	.01	–.06	.11*	.06	.61***	–.31***	–			
12. Website engagement	.13**	.02	–.09	.06	.12*	.00	–.17**	–.06	.15**	–.02	.11*	–		
13. Website attitude	.04	–.06	–.08	.01	–.00	.00	.24***	.07	.63***	–.30***	.57***	.08	–	
14. Information recall	–.07	–.19***	.16**	.00	.14**	.00	.04	–.10	.29***	–.34***	.20***	.28***	.23***	–
Mean	54.71	.53	4.32	.11	.87	19.83	5.58	.47	5.55	2.28	4.68	361.27	5.13	25.82
SD	14.50	.50	1.76	.31	.33	13.63	1.14	.50	1.19	1.33	1.43	424.82	1.06	22.07

Note. [a]Gender was dummy coded into 1 = male, 0 = female. [b]Experience with cancer was dummy coded into 1 = has (had) cancer/knows someone with cancer, 0 = has (had) no cancer/ does not know someone with cancer.
* $p < .05$. ** $p < .01$. *** $p < .001$.

4

Table 4.2. Website use patterns of the mode-tailored and standardized website ($N = 392$)

	Mode tailored website ($n = 183$)		Standardized website ($n = 209$)		Total ($n = 392$)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Time spent on website	334.15	356.08	385.02	476.54	361.27	424.82
Number of web pages visited	2.85	0.36	2.88	0.33	2.87	0.34
Number of (re)visits webpages	11.31[a***]	5.78	6.43	4.36	8.71	5.62
Number of visits Homepage	4.93	2.64	1.89	1.67	3.31	2.65
Number of visits Page 2	3.21	3.04	1.95	1.59	2.54	2.45
Number of visits Page 3	3.17	3.05	2.59	2.29	2.86	2.68
Number of videos started	0.80[a*]	0.91	1.00	1.05	0.91	0.99
Number of (re)starts of videos	0.87	1.05	1.08	1.17	0.98	1.12
Number of starts Video 1	0.32	0.50	0.37	0.55	0.35	0.53
Time spent on Video 1 (%)[b]	16.64	11.71	15.56	12.78	16.03	12.29
Number of starts Video 2	0.31	0.53	0.35	0.52	0.33	0.52
Time spent on Video 2 (%)[b]	32.50	17.69	29.61	16.39	30.81	16.92
Number of starts Video 3	0.23	0.46	0.35	0.53	0.30	0.50
Time spent on Video 3 (%)[b]	19.45	9.86	21.98	10.10	21.10	9.98
Number of mode actions	4.87	3.01	-	-	-	-
Time until first mode action	18.47	14.62	-	-	-	-
	n	%			*n*	%
First mode chosen						
Text	139	76.0	-	-	-	-
Visuals	25	13.7	-	-	-	-
Video	19	10.4	-	-	-	-
Mode combinations						
All three modes	155	84.7	-	-	-	-
Text and visuals	16	8.7	-	-	-	-
Text and video	1	0.5	-	-	-	-
Visuals and video	1	0.5	-	-	-	-
Text-only	8	4.4	-	-	-	-
Visuals-only	1	0.5	-	-	-	-
Video-only	1	0.5	-	-	-	-

Notes. [a]Mean differs significantly from the standardized website condition. [b]The percentage of the video watched was calculated based on the first view. Page 2 = 'My GIOCA-day'; Page 3 = 'How to prepare'; Video 1 = 'What does a GIOCA-day look like' (2:53 min); Video 2 = 'Practical information for a hospital visit' (1:09 min); Video 3 = 'How to prepare for the medical consultation' (2:37 min).
* $p < .05$. *** $p < .001$.

Model testing

Based on the model fit criteria, the hypothesized model (N = 363) showed a good fit to the data, $\chi^2(9) = 18.11$, $p = .034$, CMIN/DF = 2.012, TLI = .971, CFI = .987, RMSEA = .053, SRMR = .040 (Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999). The ECVI was 0.155 (close to zero), indicating similar potential for replication as the saturated model (0.155), and higher potential for replication than the independence model (2.092; Byrne, 2016). Figure 4.2 shows the standardized path coefficients and statistical significance for individual pathways in the hypothesized model. Table 4.3 shows the estimates and confidence intervals of the direct, indirect effects and total effects of mode tailoring on website attitude and information recall. The results from hypothesized model are discussed below.[3]

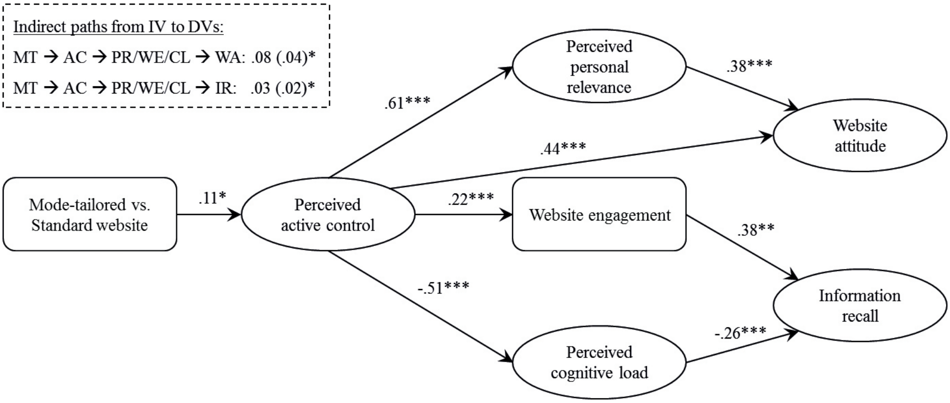

Figure 4.2. Hypothesized model. Model fit (N = 363): $\chi^2(9) = 18.11$, $p = .034$, CMIN/DF = 2.012, TLI = 0.971, CFI = 0.987, RMSEA = .053, SRMR = .040, ECVI = 0.155. Website attitude: $R^2 = .573$; Recall of information: $R^2 = .274$. Estimates presented are standardized path estimates. Including the control variables (i.e., age, gender, education, cancer experience, Internet experience) in the model did not change the significance levels of the estimated paths. Abbreviations: MT = Mode tailoring. AC = Perceived active control. PR = Perceived personal relevance. WA = Website attitude. WE = Website engagement. CL = Perceived cognitive load. IR = Information recall. Non-significant paths from AC → IR, PR → IR, WE → WA, and CL → WA are not drawn in the figure.
* $p < .05$. ** $p < .01$. *** $p < .001$.

3 The hypothesized model and individual paths were not significantly different between younger (25–44 years), middle-aged (45–64 years), and older (≥65 years) participants.

Table 4.3. Standardized direct and indirect effects of mode tailoring on website attitude and information recall (N = 363)

Path	Estimate	*SE*	95% CI	*p*-value
Direct paths				
Condition (Mode tailoring) → Active control	.11	.05	[0.01, 0.21]	.034
Active control → Perceived relevance	.61	.04	[0.53, 0.67]	< .001
Active control → Website engagement	.22	.05	[0.13, 0.32]	< .001
Active control → Cognitive load	–.51	.04	[–0.59, –0.43]	< .001
Active control → Website attitude	.44	.05	[0.34, 0.54]	< .001
Active control → Information recall	.08	.06	[–0.03, 0.19]	.170
Perceived relevance → Website attitude	.38	.05	[0.29, 0.46]	< .001
Perceived relevance → Information recall	.00	.06	[–0.10, 0.11]	.952
Website engagement → Website attitude	.03	.04	[–0.04, 0.10]	.428
Website engagement → Information recall	.38	.05	[0.28, 0.47]	.001
Cognitive load → Website attitude	–.04	.04	[–0.12, 0.05]	.411
Cognitive load → Information recall	–.26	.04	[–0.34, –0.18]	< .001
Indirect paths				
MT → AC → PR	.07	.03	[0.01, 0.13]	.033
MT → AC → WE	.03	.01	[0.00, 0.05]	.022
MT → AC → CL	–.06	.03	[–0.11, –0.01]	.031
AC → PR/WE/CL → WA	.25	.04	[0.18, 0.33]	< .001
AC → PR/WE/CL → IR	.22	.04	[0.13, 0.31]	< .001
MT → AC → PR/WE/CL → WA	.08	.04	[0.01, 0.15]	.033
MT → AC → PR/WE/CL → IR	.03	.02	[0.01, 0.07]	.026
Total effects				
AC → WA	.69	.03	[.63, .75]	.001
AC → IR	.30	.05	[.21, .38]	< .001
MT → WA	.08	.04	[.01, .15]	.033
MT → IR	.03	.02	[.01, .07]	.026

Note. Standardized estimates with bootstrapped standard errors and bias-corrected significance levels are presented. Abbreviations: MT = Mode tailoring. AC = Perceived active control. PR = Perceived personal relevance. WA = Website attitude. WE = Website engagement. CL = Perceived cognitive load. IR = Information recall.

Our first hypothesis expected that mode tailoring would contribute to greater perceived active control, which in turn would enhance (a) website attitude and (b) information recall. Compared to a standardized website, the mode tailored website significantly increased participants' perceived active control ($\beta = .11$, $p = .034$), which in turn led to a more favorable attitude toward the website ($\beta = .44$, $p = .001$). Perceived active control was however not directly related to recall of information ($\beta = .08$, $p = .170$). Thus, only hypothesis 1a was confirmed.

Furthermore, we hypothesized that greater perceived active control – as afforded by mode tailoring – would increase the perceived personal relevance of the website (H2a), increase website engagement (H3a), and reduce perceived cognitive load (H4a), ultimately leading to more favorable website attitudes. The serial indirect effect of mode tailoring through perceived active control, perceived personal relevance, website engagement and cognitive load was statistically significant ($\beta = .08$, 95% CI [0.01, 0.15], $p = .033$). Perceived active control heightened perceived personal relevance ($\beta = .61$, $p < .001$), increased website engagement ($\beta = .22$, $p < .001$), while reducing the perceived cognitive load ($\beta = .51$, $p < .001$). However, of these three mechanisms, only perceived personal relevance affected the outcome variable website attitude ($\beta = .38$, $p < .001$), confirming only hypothesis 2a.

Finally, we hypothesized a similar indirect effect of perceived active control – as afforded by mode tailoring – on recall of information, via mechanisms of perceived personal relevance (H2b), website engagement (H3b), and perceived cognitive load (H4b). The serial indirect effect of mode tailoring through perceived active control, perceived personal relevance, website engagement and cognitive load was also statistically significant ($\beta = .03$, 95% CI [0.01, 07], $p = .026$). However, only website engagement ($\beta = .38$, $p = .001$) and perceived cognitive load ($\beta = -.26$, $p < .001$) significantly predicted recall of information, confirming hypothesis 3b and 4b.

To summarize, different pathways were distinguished that explain the effects of mode tailoring on website attitude and information recall. While all indirect effects were facilitated by higher perceived active control in the mode-tailored condition, perceived personal relevance explained effects on website attitudes, while website engagement and perceived cognitive load explained effects on information recall.

DISCUSSION

This study investigated what mechanisms could explain the effects of user-initiated mode tailoring – i.e., enabling users to adjust the mode of information presentation via textual, visual and/or audiovisual information – in an online context on attitudinal (i.e., website attitude) and cognitive outcomes (i.e., information recall) among a representative sample (25–86 years). Specifically, this study employed structural equation modelling (SEM) to test specific theory-based mechanisms (i.e., perceived active control, perceived personal relevance, website engagement, and cognitive load) that may influence the effects of mode tailoring on website attitudes and information recall. The implications of our results for theory and effective message design in online environments are discussed below.

Implications

Overall, our study contributes to tailoring research by exploring a different approach to tailoring. Traditional tailoring research has mainly focused on content tailoring, and has thus attempted to find explanations for the effectiveness of message tailoring. In doing so, Lustria et al.'s (2016) model of tailoring effects focused on explaining tailoring effects from a *system*-initiated tailoring perspective. In our *user*-initiated *mode* tailoring model, we confirmed the importance of several mediators proposed by Lustria et al.'s (2016) model of tailoring effects, such as perceived personal relevance and website engagement. This study extends the model by specifying mechanisms relevant for user-initiated mode tailoring, such as perceived active control and perceived cognitive load. Moreover, by testing these mechanisms in a single SEM model, we provide evidence for important mechanisms that may explain variance in the effects of mode tailoring on attitudinal and cognitive outcomes.

Our results demonstrate that perceived active control serves as a key driver in explaining the effects of user-initiated mode tailoring on website attitude and information recall. While the relationships between tailoring, perceived active control and outcomes have been widely assumed in the customization literature, this is one of the few studies that actually investigates these relationships in one single model (see also Kalyanaraman & Sundar, 2006; Sundar & Marathe, 2010). Our finding is consistent with one of the key assumptions in self-determination theory that everyone has a basic need for autonomy which drives people to seek control over different situations one encounters in life (Ryan & Deci, 2000). It is likely that the perception of being in control over the presentation format fulfills the need for autonomy, which then triggers both positive attitudinal and cognitive responses toward the information. Results show that through perceived active control, user-initiated mode tailoring improves attitudes toward digital content and enhances information processing. The notion that perceived active control functions as a key driver of mode tailoring effects, facilitating other important message processing mechanisms, requires more investigation and has important implications for future directions for tailoring research.

Furthermore, the data shows that through perceived active control, mode tailoring increases perceived personal relevance and website engagement, and decreases perceived cognitive load, which ultimately enhances website attitude and information recall. Specifically, we found that enhanced perceived personal relevance contributes to more favorable website attitudes, and that increased website engagement and decreased perceived cognitive load improves information recall. While perceived active control functioned as a key driver of these effects, interestingly, the data specified mechanisms (i.e., perceived personal relevance) responsible for enhancing website attitudes and other mechanisms (i.e., website engagement and perceived cognitive load) that explained improved recall of information. These different pathways substantiate current theoretical and empirical research by providing a better understanding of *why* mode tailoring is effective (i.e., mechanisms of motivation vs. ability) and for *which outcomes* mode tailoring is valuable (i.e., attitudinal vs. cognitive). Our results align with previous experimental work demonstrating that engagement (i.e., attention) primarily has cognitive effects, leading to greater information recall, whereas perceptions of information relevance influence attitudes (Roser, 1990). Altogether, our findings support arguments proposed by user control theorists that providing users with control over the information flow can increase both the motivation (i.e., through perceived relevance and website engagement) and ability (i.e., by freeing up cognitive resources) to process information, consequently enhancing both attitudinal and cognitive learning outcomes (Dillon & Jobst, 2005; Eveland & Dunwoody, 2001).

Study limitations and luture research directions

It is important to acknowledge that while mode tailoring was found to indirectly enhance information recall (through increased perceived active control and website engagement, and reduced perceived cognitive load), this effect was only small. A possible explanation is that requiring the user to tailor the mode of presentation may have demanded more cognitive effort and time for some, thus attenuating the perceived cognitive load at the point of measurement in our study design – which was after a one-time exposure. Although there is some evidence suggesting that customization increases task efficiency and is rated more favorably despite the extra cognitive effort and time investment (e.g., Ariely, 2000; Rivera, 2005), the interactive mode tailoring tool in our study can be considered to be a novel tool that users need some time to familiarize themselves with. Particularly such a novel task might involve cognitive effort (Ariely, 2000), impacting the cognitive resources available to use the website and process the information (Gerjets, Scheiter, Opfermann, Hesse, & Eysink, 2009). For example, a study by Ariely (2000) showed that benefits of control of the information flow are most prominent after repeated exposure, when people have gotten used to the digital interface and are able to use it adequately. Follow-up studies should explore whether repeated use of such a mode-tailored website will lead to higher levels of reduced cognitive load during information processing, and consequently, greater positive indirect effects on information recall.

Dispositional information overload may also present an alternative explanation for differences in perceived cognitive load and information recall. Research has for example shown that cancer information overload (i.e., when people feel overwhelmed by the amount of cancer-related materials in the information environment) may hinder attention to and processing of cancer information (Jensen et al., 2014a). Tailoring may attenuate potential effects of such dispositional information overload by reducing exposure to redundant information and focusing on information that is relevant to the viewer. For example, one study found that system-initiated tailoring effectively increased screening intentions for those who experienced high levels of cancer information overload (Jensen et al., 2014b). In a different study, it was found that limiting the amount of information by exposing participants to relevant news stories only, resulted in higher elaboration and knowledge gain (Beam, 2014). Future research examining the effects of tailored communications should strive to control for factors such as dispositional information overload and the amount of information participants are exposed to.

The current study applied a scenario-based study procedure in which participants were instructed to imagine that they were going to visit the clinic to confirm a possible diagnosis of colorectal cancer. Participants could have imagined themselves in this scenario in different ways, possibly influencing their use, processing and evaluation of the information. However, our strict randomization procedure in this study likely reduced the potential confounding role of such difference. Moreover, scenario-based studies are commonly used in experimental research to mimic responses from clinical patients. Previous studies have shown that so-called 'analog patients' – people instructed to imagine the feelings and thoughts of cancer patients – responded in a similar way as clinical patients on various outcomes important for health communication (van Vliet et al., 2012; Visser et al., 2016). Nevertheless, whether the results of this study are comparable to those of clinical patients warrants further research.

In this study mode tailoring was operationalized as enabling users to self-select their preferred mode of information delivery, making it a user-initiated tailoring process. However, the current research design did not include a condition where participants could self-tailor the content or non-information elements (e.g., background color, font type) as a control condition. Hence, it could be questioned whether the effects of mode tailoring on perceived active control, perceived personal relevance, and website attitude resulted from having control over presentation modes or from having control in general. It seems plausible that perceived personal relevance will only be experienced as a result of perceived active control when information elements are tailored (e.g., content, presentation modality) and not when design elements (e.g., background color, font type) can be adjusted. Yet, the results from this study must be carefully interpreted and need further replication to ensure the generalizability of the results.

Furthermore, future studies could examine additional mediators relevant within the context of tailored digital information. As the effect of user-initiated mode tailoring on perceived active control in our study was only small, it could be that other unobserved mechanisms were more explicitly triggered when users self-tailored their digital information environment. Perceived autonomy support, a concept derived from self-determination theory, refers to the degree to which an individual experiences support in one's personal decisions – in this context as afforded by technology (Ryan & Deci, 2000; Sundar, 2008). It could be that mechanisms, such as perceived autonomy support, further explain effects of user-initiated tailoring next to perceived active control.

Additionally, including additional measures of attention and elaboration besides website engagement (as operationalized by time spent exploring the website) might also be valuable. Eye-tracking research could, for example, give us a more objective measure of which content and information modes people attend to, while self-report measures of attention, elaboration, and engagement can give us insight into how recipients process the information (e.g., Craig Lefebvre, Tada, Hilfiker, & Baur, 2010). Considering that attention and elaboration are proposed as key mechanisms that explain effects of tailored communications (Lustria et al., 2016), future research should explore and measure these message processing variables more carefully and comprehensively.

Overall, to gain a richer and more comprehensive understanding of effective tailoring, we highly encourage future research to further disentangle mechanisms and effects of both mode tailoring and content tailoring, and system-initiated and user-initiated tailoring. Studies that compare the relative effectiveness of content and mode tailoring, or examine possible synergy effects of combining different tailoring strategies, may also be worthwhile. Typical tailoring strategies usually employ a more involved message design process (using different tailoring tactics like behavioral construct tailoring) – this takes more time and may be costlier (Lairson et al., 2008). If comparative studies can prove that user-initiated approaches, like mode tailoring, are just as or more effective than traditional tailoring strategies, then it may be a more cost-effective approach. Finally, further research focusing on different dimensions of tailoring web-based information as well as replication studies in other samples and contexts might also provide insight into *when* and for *whom* which different tailoring approaches are effective.

Conclusion

The central question tailoring scholars often examine is: How do we develop effective messages, that will be perceived as personally relevant, can engage recipients, and can be adequately processed? Various studies have shown that message tailoring – often employing a system-initiated tailoring approach based on complex algorithms – increases perceived personal relevance which then enhances attention, elaboration, and behavioral outcomes (Jensen et al., 2012; Lustria et al., 2016). Our study sought to answer the question: Can user-initiated tailoring strategies such as mode tailoring evoke the same tailored experience that seems to be so important for message processing, elaboration and behavioral outcomes? The current study suggests that this could be effectively reached with mode tailoring. Our results show that increasing active control over the information environment – by enabling users to tailor the mode of information presentation – can also increase the perceived personal relevance of the message, enhance engagement, facilitate information processing by reducing cognitive load, and consequently lead to favorable attitudinal and cognitive responses. Mode tailoring thus seems like a promising and novel strategy to maximize the effectiveness of tailored communications. Future research will have to examine this further and guide us to a deeper and comprehensive understanding of various tailoring strategies, mechanisms, and effects. Overall, this study provides a first insight into the specific mechanisms that explain mode tailoring effects on attitudinal and cognitive outcomes, confirms earlier work examining theoretical models of tailoring effects, and proposes a novel approach to, and extension of, traditional tailoring research in today's digital environment.