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DOI

[10.1027/2512-8442/a000159](https://doi.org/10.1027/2512-8442/a000159)

Publication date

2024

Document Version

Final published version

Published in

European journal of health psychology

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Citation for published version (APA):

Solovei, A., Daal, G., & Smit, E. S. (2024). The effects of choice and autonomy-supportive language in health messages aimed at cancer prevention. *European journal of health psychology*, 31(3), 101-113. <https://doi.org/10.1027/2512-8442/a000159>

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The Effects of Choice and Autonomy-Supportive Language in Health Messages Aimed at Cancer Prevention

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Abstract: *Background:* Choice and autonomy-supportive language are message features expected to increase the effectiveness of online health communication. However, the evidence regarding their persuasiveness is mixed. *Aims:* This study explores the effects of choice and autonomy-supportive language in an online message aimed at cancer prevention through increasing physical activity. Also, the moderating role of the need for autonomy and the mediating effects of reactance and autonomous motivation are assessed. *Method:* In a two (autonomy-supportive language: present or absent) by two (choice: present or absent) experiment, 218 participants were randomly assigned to an online health message. *Results:* Results revealed no effects of choice, however, autonomy-supportive language had a negative effect on the intention to increase physical activity. Additionally, a smaller indirect effect of autonomy-supportive language on intention via cognitive reactance, autonomous motivation, and attitude was found. The strength of this indirect effect was influenced by the need for autonomy: when individuals with a higher (vs. lower) need for autonomy were exposed to autonomy-supportive language, this led to a stronger decrease of cognitive reactance. *Limitations:* Limitations of the experiment include the cross-sectional, rather than longitudinal nature of the data and the lack of behavioral measurements, with behavioral intention used as outcome variable. *Conclusion:* To conclude, autonomy-supportive language may result in unwanted persuasive outcomes, such as a lower intention to increase physical activity. Yet, for individuals with a higher need for autonomy, autonomy-supportive language can reduce cognitive reactance.

Keywords: choice, autonomy-supportive language, need for autonomy, reactance, autonomous motivation

Theoretical Background

Cancer is the second leading cause of mortality globally, accounting for 1 in 6 deaths worldwide (World Health Organisation, 2020). Recent evidence suggests that between 30% and 50% of cancer cases can be prevented through healthier lifestyles, such as more physical exercise (World Cancer Research Fund International, 2020). Researchers and practitioners in cancer prevention and health communication therefore continuously develop and evaluate strategies aimed at convincing people to adopt healthier lifestyles, for example with online forms of communication (Chou et al., 2013). Such online forms of cancer-related communication have gained traction in the previous two decades due to their possibilities to provide (cost)-effective interventions, with a wide reach and tailored

to the needs of the target audience (Chou et al., 2013; McAlpine et al., 2015; National Cancer Institute, 2024; Neuhauser & Kreps, 2008; Viswanath, 2005). However, several meta-analyses suggest that the effect sizes of online health communication interventions on (predictors of) health behaviors, including lifestyle behaviors that can prevent cancer, are rather small (Krebs et al., 2010; Lustria et al., 2013; Maher et al., 2014). These relatively small effect sizes of online (cancer) communication preventive interventions may be attributed to several factors, including a misalignment between the communication needs of the target group and the types of messages they receive, which can stem from, for example, lower levels of health literacy and language barriers (Neuhauser & Kreps, 2008; World Health Organisation, 2020), as well as from cultural and psychological characteristics, such as preferences for messages that

support greater autonomy and freedom of choice, or explicit guidelines from health professionals (Latimer et al., 2005; Resnicow et al., 2014). Therefore, it is of importance to explore the nature of the persuasive effects of online health communication aimed at the prevention of cancer, as well as the circumstances under which these effects occur (Klein et al., 2022).

Autonomy-Supportive Language and Choice

Autonomy-support is a (health) communication strategy that refers to conveying a message by aiming to promote a person's sense of agency and freedom regarding their decisions towards a behavior. This, in turn, is expected to increase the persuasiveness of the message (Deci & Ryan, 2000; Fransen et al., 2015). This approach is grounded in the self-determination theory (SDT) by Deci and Ryan (2000) which posits that individuals are more likely to engage in and maintain behaviors when they feel that those behaviors are self-chosen and self-endorsed, rather than imposed or controlled externally. A recent taxonomy by Teixeira and Colleagues (2020) identified seven key behavior change techniques for fostering autonomy-support, including: (1) in depth exploring of perspectives and causes of existing behaviors; (2) identifying sources of external pressure; (3) using autonomy-supportive language, which is non-controlling and nonjudgmental; (4) exploring life aspirations and values and linking them to behavioral change goals; (5) providing a meaningful rationale for behavior change; (6) offering choices, thereby enhancing a sense of control; and (7) encouraging self-initiation by experimenting with new, enjoyable behaviors. In online health communication contexts, two techniques that can be feasibly implemented and have been relatively frequently used in research to operationalize autonomy support, either separately or combined (albeit with differing effects in different studies), are the use of autonomy-supportive language and the provision of choice (Altendorf et al., 2019; Resnicow et al., 2008; Smit et al., 2019). These techniques can be easily manipulated in online messages. Autonomy-supportive language refers to using words that suggest or highlight to the recipients their freedom of decision, such as "may," "could" and "would," rather than more controlling words that point more strongly towards some advice to make a certain decision, such as "should" or "must." Through autonomy-supportive words, it is expected that the recipient of the message will feel a heightened sense of control and empowerment, making them more inclined to follow the given health advice (Resnicow et al., 2014; Williams et al., 1999). Provision of choice as an autonomy-supportive message feature refers to presenting the message in a way that lets the recipient choose among various content elements based on their interests (Patall et al., 2008; Smit et al., 2019; Teixeira et al., 2020). A key method of offering such

choices in digital messages includes incorporating clickable hyperlinks or dropdown menus within the text, that allow readers to explore additional information on a topic if they want to learn more about it. Previous research indicates that health behavior interventions emphasizing autonomy-support lead to better behavioral outcomes. Studies by Silva et al. (2011) and Moon et al. (2021) showed that autonomy-supportive messages result in increased physical activity and higher intentions to receive flu vaccines, respectively. Furthermore, Legate and Weinstein (2022) showed that during the COVID-19 pandemic, people perceiving messages as autonomy-supportive were more motivated to adhere to stay-at-home orders. In the context of marketing communication, it has been shown that consumers give more positive brand and product evaluations and have an increased purchase intention when allowed to choose the product information that they receive on an online page (Schlosser & Shavitt, 2009).

Based on these previous findings, in our study we expect that when either autonomy-supportive language or choice are included in an online health message, it will lead to a more positive attitude towards the health behavior, that is, a person's favorable evaluation of a behavior based on their beliefs, and to a higher behavioral intention, that is, a person's conscious plan or decision to engage in the behavior of interest, compared to when no choice or autonomy-supportive language are included. Moreover, it is expected that when both autonomy-supportive language and choice are present in a message, the general persuasive effect of that message will increase, as compared to when only one of the two elements is included. This latter effect is proposed because conveying information, for example, regarding autonomy-support, in more than one mode typically makes that information more salient (Mayer & Moreno, 2003). Additionally, as attitude is an important predictor of intention (for reviews, see Godin & Kok, 1996; Montano & Kasprzyk, 2008), it is expected that attitude will mediate the effects of choice and autonomy-supportive language on intention. Therefore, we propose the following hypothesis:

Hypothesis 1 (H1): Being exposed to (a) choice (compared to no choice), (b) autonomy-supportive language (compared to no autonomy supportive language), and (c) both choice and autonomy supportive language (compared to only choice, only autonomy-supportive language, or a control condition) in a health message leads to a more positive attitude towards the behavior, which results in a higher intention to perform the behavior.

Autonomous Motivation

The SDT posits that there is a continuum of motivation experienced by a person to engage in a behavior, from

controlled to autonomous motivation (Deci & Ryan, 2000). Controlled motivation includes external regulation, where behavior is driven by rewards or punishments (e.g., exercising to earn a reward or avoid a fine) and introjected regulation, where behavior is driven by internal pressures like guilt or ego (e.g., exercising to boost self-esteem or avoid guilt). Autonomous motivation includes identified regulation, where behavior is guided by personal values (e.g., exercising because health is valued), and integrated regulation, where behavior is fully aligned with one's identity (e.g., exercising because it is part of a healthy lifestyle). Intrinsic motivation is the most autonomous form, where behavior is performed for inherent enjoyment (e.g., exercising because it is fun; Levesque et al., 2006; Williams et al., 2002).

The SDT proposes that autonomous motivation is a stronger predictor of behavior, compared to controlled motivation, because when someone genuinely appreciates the outcomes of the behavior, they are more likely to maintain it (Hagger et al., 2006). This is also supported by empirical evidence, for example in the context of physical activity (Chatzisarantis et al., 2003) and nutrition (Silva et al., 2011). According to the SDT, autonomous motivation is increased when messages are autonomy-supportive because individuals perceive a higher sense of autonomy and freedom in their decisions (Deci & Ryan, 2000; Teixeira et al., 2011). Empirical evidence from studies conducted in offline settings did indeed confirm the positive effects of autonomy-supportive message features on autonomous motivation, for example in the context of smoking cessation (Williams et al., 1999) and physical activity (Moustaka et al., 2012). Studies conducted in online settings have also found positive effects, such as in the contexts of vegetable intake (Smit et al., 2019) and physical activity (Patrick & Canevello, 2011; Williams et al., 2014). However, two recent online studies focusing on alcohol consumption (Altendorf et al., 2019) and smoking cessation (Altendorf et al., 2020) did not observe these positive effects. This underscores the need for further research to determine the conditions under which autonomy-supportive messages are effective in online health communication. In line with the SDT and given the focus of our study on physical activity – where previous research found positive effects of autonomy-supportive messages – we hypothesize that the presence of autonomy-supportive language and the provision of choice in a message will enhance autonomous motivation, resulting in a more positive attitude and stronger intention to increase physical activity.

Hypothesis 2 (H2): Being exposed to (a) choice (compared to no choice), (b) autonomy-supportive language (compared to no autonomy-supportive language), and (c) both choice and autonomy-supportive language (compared to only choice, only

autonomy-supportive language, or none of both) in a health message leads to more autonomous motivation, and subsequently to a more positive attitude towards the health behavior, which results in a higher intention to perform the behavior.

Reactance

Reactance is a motivational state aimed at reestablishing free behaviors that have been (threatened to be) eliminated (Burgoon et al., 2002). The theory of reactance (Brehm, 1966) posits that when a person is exposed to a persuasion attempt and feels a potential threat to their autonomy in making decisions, a state of reactance will occur. Dillard and Shen (2005) proposed that reactance consists of two measurable dimensions: *affective reactance* and *cognitive reactance*. Affective reactance refers to the anger experienced in response to a freedom-limiting message, while cognitive reactance refers to negative thoughts and counterarguing by the message receiver (Rains & Turner, 2007). Including autonomy-supportive language and/or choice in a message is a way to reduce reactance, because reactance occurs as a response to a feeling of threatened autonomy and restricted freedom of decision (which are mitigated through autonomy-supportive messages; Fransen et al., 2015; Knowles & Linn, 2004). Several studies have shown that reactance has a negative effect on the attitude and intention towards a health behavior (Miller et al., 2007; Moyer-Gusé & Nabi, 2010; Rains & Turner, 2007), which is also what we hypothesize in our study. Furthermore, in line with the SDT, we expect that both cognitive reactance and affective reactance will mediate the effect in H2, between autonomy-supportive message features (i.e., choice and autonomy-supportive language) and autonomous motivation, so that a reduced reactance will lead to an increased autonomous motivation. Therefore, the following hypothesis is put forward:

Hypothesis 3 (H3): Being exposed to (a) autonomy-supportive language (compared to lack of autonomy-supportive language), (b) choice (compared to no choice), and (c) both autonomy-supportive language and choice (compared to only autonomy-supportive language, only choice, or none of both) in a health message leads to a decreased (i) affective reactance and (ii) cognitive reactance, and subsequently to increased autonomous motivation, resulting in a more positive attitude, and, subsequently, a higher intention to perform the behavior.

Need for Autonomy

According to the SDT, every person has a basic need for autonomy, that is, an intrinsic motivation to exercise

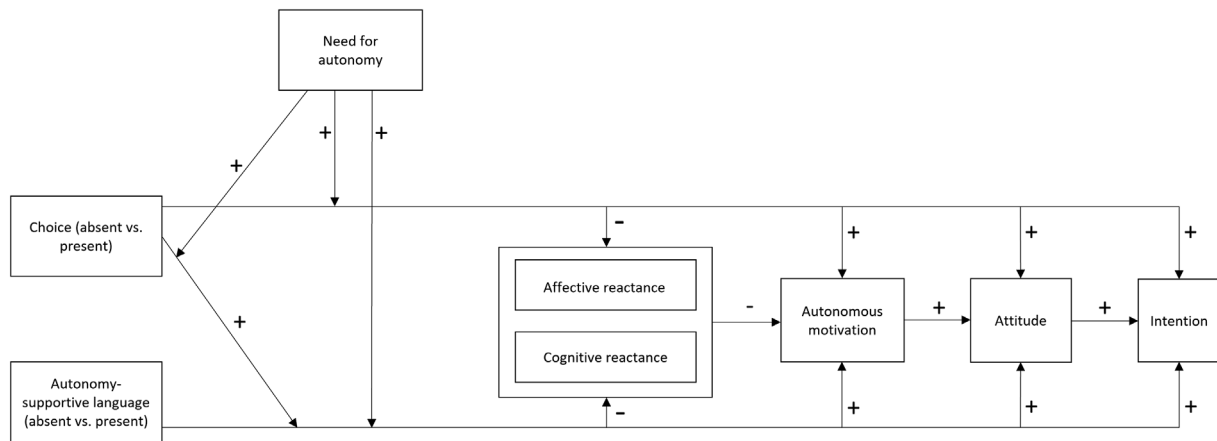


Figure 1. Conceptual model.

self-governance and independence in decision-making. Yet, the level of need for autonomy may differ among individuals (Deci & Ryan, 1985). These variations in the need for autonomy are based on individual differences in causality orientations that explain how people interpret and respond to their environment in terms of tending to be more autonomy-oriented (characterized by seeking personal choice, self-initiative, and a preference for messages that highlight personal choice and alignment with individual values) or control-oriented (characterized by relying on external pressures and rewards, and a preference for messages that emphasize clear guidelines, external rewards or consequences, thereby motivating behavior through external pressures; Ng et al., 2012).

Smit and colleagues (2015) propose that the individual's need for autonomy may moderate the persuasiveness of autonomy-supportive messages. Several studies have previously tested this moderation effect in a health communication setting, for instance, in the context of fruit consumption (Resnicow et al., 2008; Smit et al., 2019), colorectal cancer screening (Resnicow et al., 2014), alcohol consumption (Altendorf et al., 2019) and physical activity (Bol et al., 2019). All studies, besides the study of Altendorf and colleagues, showed that autonomy-supportive messages were more effective for people with a higher (vs. lower) need for autonomy. In line with these results, it is expected that the need for autonomy moderates the effects of autonomy-supportive language and choice on attitude and intention in such a way that a message with autonomy-supportive language and/or choice will be more persuasive for people with a higher need for autonomy than for people with a lower need for autonomy.

Furthermore, as previously noted, the SDT suggests that autonomous motivation emerges in individuals when their autonomy needs are met. Therefore, given that autonomy-supportive language and choice are expected to fulfill

the need for autonomy (Deci & Ryan, 2000), individuals with a higher need for autonomy are likely to experience enhanced autonomous motivation compared to those with a lower need for autonomy when exposed to such message features. Also, Burgoon et al. (2002) argue that reactance is associated with one's need for autonomy, so that a person with a higher need for autonomy is likely to experience a higher degree of reactance against persuasive attempts. Therefore, the effects of providing autonomy-supportive language and choice on reducing reactance should be more visible among individuals with a higher (vs. lower) need for autonomy. Based on this, as shown in Figure 1, it is expected that all of the effects described in the previous hypotheses are more likely to occur in people with a higher need for autonomy than in people with a lower need for autonomy. The following hypothesis is put forward:

Hypothesis 4 (H4): Need for autonomy moderates the effects mentioned in H1-3, so that those effects are stronger for individuals with a higher (vs. lower) need for autonomy.

Method

Participants

Participants (Dutch-speaking) were recruited through a message in the biweekly newsletter of the Dutch branch of the World Cancer Research Fund (WCRF) global network, as well as through the authors' personal networks. The sample consisted of 218 participants (69% female, 31% male) between 18 and 84 years old ($M = 37.77$, $SD = 16.27$). As compensation for their participation, respondents were offered a WCRF wristband and the opportunity to enter a prize draw in which they could win one of five €50 gift vouchers for an online Dutch retailer.

Experimental Design, Procedure, and Materials

The study was approved by the Institutional Review Board of the Amsterdam School for Communication Research, University of Amsterdam (2017-PC-8484). Participants were randomly assigned to one of the four conditions in an online 2 (choice: present vs. absent) \times 2 (autonomy-supportive language: present vs. absent) between-subjects experiment. When participants clicked on the link to the online questionnaire, they were first presented with general information about the study and the informed consent form. Next, they had to answer general questions regarding their sex, age, current physical activity level, and need for autonomy. Afterwards, they were randomly directed to one of the four experimental stimuli. These were four web-site pages created for the purpose of the study, in collaboration with and based on the official website of the Dutch branch of the WCRF network. Each page contained the same information (approximately 600 words) about the importance of physical activity for preventing cancer. The information depicted in the stimuli was used on the existing WCRF website and contained scientifically proven facts, written in an accessible language. After reading the web pages, participants were redirected to the questionnaire. A pilot test of the entire survey and manipulations was performed with 12 participants. Based on the pretest, the choice manipulation was slightly adapted, by excluding a verbal element from it, so that it could be better distinguished from the autonomy-supportive language manipulation.

Manipulations

The presence of autonomy-supportive language was manipulated by including a sentence in the introductory text on the web page: “You can select for yourself which topics you want to read about, depending on your personal interests and lifestyle,” in order to give respondents a feeling of autonomy to read the content that is in line with their personal preferences. The presence of choice was manipulated by including hyperlinks that had to be clicked on, in order to read each of four available content sections. If the participants wanted to read about a certain content section, they could click on its respective hyperlink, and a new web page would open with that specific information. Afterwards, participants could return to the web page listing the four content sections, and either click on another hyperlink with information or continue filling out the questionnaire. In the condition without choice and autonomy-supportive language all four content sections were included on the same page in a static manner, not under hyperlinks. All textual and visual content was kept identical across conditions.

Manipulation Checks

The autonomy-supportive language manipulation was checked for by asking participants to answer *yes* or *no* to the statement: “It has been emphasized in the text that I could select myself which topics I wanted to read about, depending on my interests and lifestyle.” The choice manipulation was checked for by asking participants to answer “yes” or “no” to the statement: “I could choose myself which topics I wanted to read about by clicking on those topics.”

Measures

For all constructs described below, a higher score indicated a higher level of the construct. Unless stated otherwise, the answer options ranged from 1 = *very unlikely* to 7 = *very likely* and the overall construct scores were computed as the mean of the different scale items.

Need for autonomy was measured with the Health Causality Orientations Scale (HCOS; Smit & Bol, 2020). In this study, participants read five health scenarios, for which they were asked to indicate how likely they would be to: (1) seek an expert’s advice, and (2) rely on their own opinions. The final score for need for autonomy ($M = 1.34$, $SD = 1.55$) was calculated by subtracting the need for expert advice score ($M = 4.15$, $SD = 1.14$, $\alpha = .73$) from the need for relying on own opinion score ($M = 5.50$, $SD = 0.92$, $\alpha = .73$).

Affective reactance was measured with four Likert scale items, based on a scale developed by Dillard and Peck (2000). The items asked whether, while reading the web page, the participant felt *irritated*, *angry*, *annoyed*, and *aggravated* ($M = 1.57$, $SD = 1.88$, $\alpha = .94$).

Cognitive reactance was measured with four Likert scale items which assessed counterarguing, based on Van Reijmersdal et al. (2016). The items asked whether, while reading the web page, participants *contested*, *refuted*, *doubted* and *countered* the information ($M = 2.17$, $SD = 1.19$, $\alpha = .86$).

Autonomous motivation was measured using six Likert scale items from the Treatment Self-Regulation Questionnaire (Levesque et al., 2006). The items referred to the statement “If I were to increase my physical activity, I would do it because,” and were, for example, “I want to take responsibility for my own health” ($M = 5.85$, $SD = 1.14$, $\alpha = .92$).

Attitude was measured on a seven-point scale based on Moorman and Van den Putte (2008). The scale included the stem sentence: “For me, being more physically active is . . .,” and the four semantic differential items: *bad* (1) – *good* (7), *unhealthy* (1) – *healthy* (7), *unwise* (1) – *wise* (7), and *unpleasant* (1) – *pleasant* (7) ($M = 6.08$, $SD = 1.23$, $\alpha = .89$).

Intention was measured with three 7-point Likert scale items, adapted from De Bruijn and Rhodes (2011). The items asked whether the participant *has the intention to*,

plans to, and probably will increase physical activity in the next 4 weeks ($M = 4.47$, $SD = 1.78$, $\alpha = .95$).

Control Variables

Age was assessed with the item “What is your age in years?” (open answer) and sex was assessed with the items “What is your sex?” (i.e., male, female, other). While no respondents in our sample picked the category “other,” it should be mentioned that this answer category can be perceived as stigmatising by marginalized groups, and a set of more conclusive options could be used alternatively in order to better measure this variable (Bittner & Good-year-Grant, 2017).

The baseline level of physical activity was measured as a control variable as well, using four items adapted from the International Physical Activity Questionnaire (Craig et al., 2003). Two items measured how many days per week participants performed *vigorous* (e.g., running, playing tennis) and *moderate* (e.g., biking, working in the garden) physical activities, respectively. Answer options ranged from *less than 1 day per week* (0) to *7 days per week* (7). Two items measured how many hours on average per day participants performed vigorous and moderate physical activities, respectively. The moderate physical activity score was computed by multiplying the number of days per week the activity is practiced with the number of hours per day the activity is practiced ($M = 7.59$, $SD = 11.30$). The vigorous physical activity was computed in the same way, and at the end, multiplied by two ($M = 5.62$, $SD = 9.17$), because, according to the IPAQ, vigorous physical activity weights twice as much as moderate physical activity in the general physical activity score. Then, the scores for vigorous physical activity and moderate physical activity were summed up, to compute the general physical activity score ($M = 13.22$, $SD = 15.74$). A higher score indicated a higher rate of physical activity.

Data Analysis Strategy

For the data analysis we made use of path analyses in structural equation modelling (with AMOS 29), which allowed to test the conceptual model specified in Figure 1 at once, rather than with separate statistical tests. The model fit was evaluated with three indicators: chi-square (should be nonsignificant), RMSEA (should be smaller than .05), and CFI (should be higher than .95; Kline, 2011). The results of the model fit are specified in the results section. All variables in the model were included as observed (i.e., computed in SPSS 26). All the hypothesized relationships were added to the model as follows: the independent variables autonomy-supportive language and choice, the moderator need for autonomy, and the interaction variables between

the two independent variables, between the need for autonomy and each of the two independent variables, as well as the three-way interaction between need for autonomy and the two independent variables. The correlations between all variables in the model are shown in Table 1 in the Appendix. The significance of the hypothesized mediation effects was assessed through the bias-corrected bootstrapping procedure in AMOS, which is a robust technique for testing the significance of mediation (i.e., indirect) effects, particularly in the case of smaller sample sizes (Hair et al., 2017). The control variables sex, age and baseline physical activity were not significantly correlated to any of the outcome and mediating variables in our study (i.e., cognitive reactance, affective reactance, autonomous motivation, attitude, and intention), and where therefore not included in the path analysis model as covariates.

Results

Manipulation Check

To check whether the manipulations of autonomy-supportive language and choice worked out as intended, two chi-square tests were performed, with the autonomy-supportive language/choice variable (present/absent) and the respective manipulation check variable (yes/no). Results revealed significant effects in the expected direction, both for choice ($\chi^2(1) = 52.02$, $p < .001$), and for autonomy-supportive language ($\chi^2(1) = 8.25$, $p = .005$). Participants exposed to the choice condition more often answered that they could choose what they wanted to read by clicking on the topics ($n = 105$), than not ($n = 5$). Similarly, participants who were exposed to the autonomy-supportive language condition more often answered that it was emphasized in the text that they could themselves select what they wanted to read ($n = 78$), than not ($n = 31$). Therefore, we considered the manipulations to be noticed as intended.

Model Fit and Hypotheses Testing

The model was identified and had a good model fit ($\chi^2(3) = 1.53$, $p = .675$, RMSEA = .00 and CFI = 1), allowing to proceed to hypothesis testing. It should be noted that the serial mediation relationships proposed in H2 and H3 (i.e., among cognitive/affective reactance, autonomous motivation, and attitude) were tested using cross-sectional data. This limits the robustness of determining the direction of the effects, a point that is further addressed in the Discussion section.

Results revealed a significant negative direct effect of autonomy-supportive language on intention ($b^* = -.21$, $p = .022$, see Figure 2). This means that when autonomy-supportive language was present on the web page, the

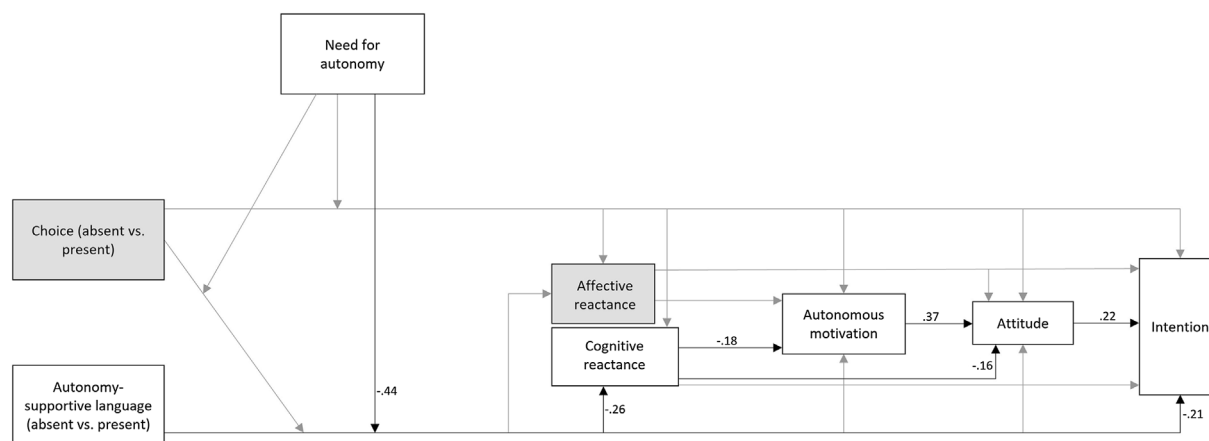


Figure 2. Significant results in the tested SEM model. A black path represents a significant relationship (p -value $< .05$). A grey path represents a nonsignificant relationship (p -value $\geq .05$). Numbers represent standardized effect sizes (b^*). The boxes in grey represent variables from which no significant effects were found. The mediators and outcome variables are psychological constructs that refer to increasing physical activity in the context of cancer prevention.

readers were less inclined to increase their physical activity level. This is contrary to what was hypothesized, thus H1b is rejected. No other significant effects of choice or of the interaction between choice and autonomy-supportive language were found on attitude or intention, thus H1a and 1c are also rejected. Furthermore, no significant effects of choice, autonomy-supportive language, or the interaction between them on autonomous motivation were found. Thus, H2a-c are rejected.

However, as depicted in Figure 2, a significant (cross-sectional) effect between autonomous motivation and attitude was found ($b^* = .37$, $p < .001$), indicating that a higher autonomous motivation was related to a more positive attitude. Bootstrapping analyses furthermore showed a significant indirect effect between autonomous motivation and intention ($b^* = .08$, $p = .014$), while no significant direct effect was found in this regard, indicating that, based on our results, attitude fully mediated the relationship between autonomous motivation on intention.

Cognitive reactance was significantly predicted by autonomy-supportive language. As hypothesized, including autonomy-supportive language in a message decreased cognitive reactance against the message ($b^* = -.26$, $p = .044$). Furthermore, cognitive reactance was negatively related with autonomous motivation ($b^* = -.19$, $p = .012$). Bootstrapping revealed a significant indirect (cross-sectional) effect between cognitive reactance and attitude ($b^* = -.07$, $p = .025$), and cognitive reactance and intention ($b^* = -.07$, $p = .014$). Additionally, a direct (cross-sectional) effect was found between cognitive reactance and attitude ($b^* = -.16$, $p = .022$). This indicates that autonomous motivation partly mediated the relationship between cognitive reactance and attitude, and that autonomous motivation and attitude fully mediated the effect of cognitive reactance on

intention. Considering these results, H3b(ii) is partly confirmed. While the effect of autonomy-supportive language on intention was negative, part of this negative effect was diminished through decreased cognitive reactance, higher autonomous motivation and a more positive attitude. As such, the cognitive reactance-autonomous motivation-attitude-intention mechanism decreased the strength of the negative effect of autonomy-supportive language on intention but did not turn it into a positive effect. No other significant (interaction) effects were found, therefore the rest of H3 is rejected.

Results also showed that need for autonomy moderated the effect of autonomy-supportive language on cognitive reactance ($b^* = -.44$, $p = .006$). Further exploration of the results (see Figure 3), showed that, as hypothesized, autonomy-supportive language had a stronger negative effect on cognitive reactance for people with a higher (vs. lower) need for autonomy. In other words, when autonomy-supportive language was present in the message, cognitive reactance decreased more in people with a higher need for autonomy, compared to people with a lower need for autonomy. This confirms H4 with respect to the relationship between autonomy-supportive language and cognitive reactance. As no other moderation effects of need for autonomy were found, H4 is rejected regarding the effects posited in the rest of the hypothesis.

Discussion

This study has aimed to examine how different types of choice in an online health message aimed at the prevention of cancer through increasing physical activity levels

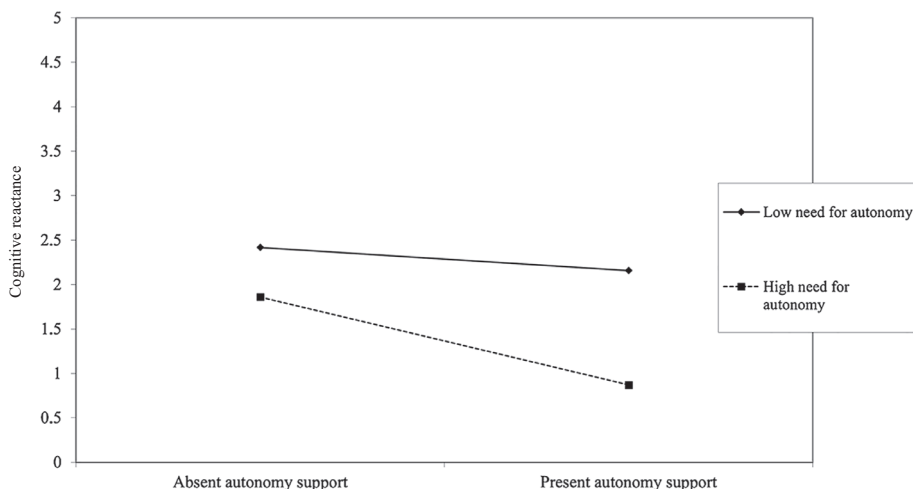


Figure 3. Interaction effects between autonomy supportive language and need for autonomy on cognitive reactance.

influence the persuasiveness of this message. Furthermore, it has investigated the underlying processes of these effects, through autonomous motivation and reactance (affective and cognitive). Finally, the influence of need for autonomy on the persuasive effects of autonomy-supportive language and choice has been assessed.

Overall, a direct effect of autonomy-supportive language on intention was found. Contrary to what was expected, using autonomy-supportive language led to a lower intention to increase physical activity, compared to a control condition. An explanation for this effect may lie in the fact that in the autonomy-supportive message it was emphasized that the participants could select the information they wanted to read about, and as a result they may have skipped some content in the message (e.g., regarding the benefits of increasing physical activity), hence indirectly increasing the effect of the control condition (where the whole content was read) (Knobloch-Westerwick, 2015). In future studies, it could be helpful to also monitor which parts of a text are read in an autonomy-supportive message, for example through self-report or eye-tracking (Casado-Aranda et al., 2023), in order to be able to assess such mechanisms.

Furthermore, the negative effect of autonomy-supportive language on intention was partly decreased through reduced cognitive reactance. Specifically, using autonomy-supportive language led to less cognitive reactance, which in its turn, resulted in higher autonomous motivation, a more positive attitude towards physical activity and, subsequently, a higher intention. This effect of autonomy-supportive language on cognitive reactance is in line with the reactance theory, which suggests that messages supporting autonomy in an individual decrease reactance (Brehm, 1966). Yet, the negative direct effect of autonomy-supportive language on intention was more pronounced, compared to the indirect effect through cognitive reactance,

autonomous motivation, and attitude. A reason for this may be that, in general, cognitive reactance against the benefits of increasing physical activity was low in our sample ($M = 2.11$ out of 7, $SD = 1.19$). This might have led to a floor effect that statistically did not allow for a stronger positive indirect effect of autonomy-supportive language on intention, through cognitive reactance (Field, 2013). Future research may therefore benefit from looking at other types of behavior, for example, promoting the avoidance of drinking or smoking, which may typically lead to stronger cognitive reactance from their adopters, compared to promoting the increase of physical activity (Bensley & Wu, 1991; Erceg-Hurn & Steed, 2011). This may allow for stronger effects of autonomy-supportive messages through cognitive reactance, than the ones found in this study. Furthermore, it could be interesting to assess whether behavior complexity plays a role at explaining effects of autonomy supportive messages as some behaviors may be (perceptually) more effortful (e.g., increasing physical activity), compared to less complex health behaviors such as handwashing or getting a vaccine (Phillips & Mullan, 2023).

While the contrast between the direct and indirect effects from autonomy-supportive language on intention is difficult to explain from a theoretical perspective, our findings do indicate that health messages can lead to different psychological interpretations by message receivers, emphasizing the importance of assessing mediators in health communication research, rather than only focusing on direct effects (Bullock et al., 2010). For increased confidence in the direction of the effect, future research would benefit from robust longitudinal designs, particularly for testing serial mediations.

Moreover, our results showed that need for autonomy moderated the effect of autonomy-supportive language on cognitive reactance. As expected, including autonomy-supportive language in a message had a stronger negative

effect on cognitive reactance for people with a higher (vs. lower) need for autonomy. This is in line with previous empirical studies that have suggested that autonomy-supportive messages are more persuasive for people with a higher need for autonomy, compared to those with a lower need for autonomy (Resnicow et al., 2014; Smit et al., 2019). However, need for autonomy did not moderate the effects of the choice condition. This could be because the WCRF website used for the experimental stimuli included four buttons at the top, that could be clicked on, linking to different sections of the general website. In spite of the instructions that participants received to remain on the main page, web analytics statistics showed that 35% of the page visitors clicked on at least one other button on the website. This may have caused participants in the conditions without choice to still have perceived a certain extent of choice (despite the successful manipulation check). Future studies should pay increased attention to controlling the choice manipulations, especially in ecologically valid online environments.

Contrary to the expectations, no effects were found from autonomy-supportive language and choice on the affective reactance experienced while reading the message. An explanation may be that the low level of affective reactance in our sample ($M = 1.57$ out of 7, $SD = 1.88$), which might again have led to a floor effect. The message stimulus focused on the positive outcomes of performing the behavior (i.e., minimizing risk to cancer), rather than negative outcomes of not performing the behavior, so in terms of valence it used a gain rather than loss frame. Cho and Sands (2011) found that gain frames do not have an impact on affective reactance, as opposed to loss frames that tend to increase affective reactance. Future studies investigating effects on affective reactance in health messages may benefit from focusing on loss frames and/or behaviors that may lead to a higher affective reactance, for example, detection behaviors (e.g., cancer screening), which involve more risk and may therefore result in more negative affect (Latimer et al., 2007).

A strength of this study is that ecologically valid stimuli were included, by using the existing website of the WCRF. This allowed for more generalizable results regarding online messages on websites than experimental stimuli presented in a format that is more obviously designed for research purposes (Bryman, 2015). Moreover, the statistical testing of the model through path analysis allowed for higher validity of the results, compared to separate testing of the hypothesized effects through regression analyses (Kline, 2011).

A limitation of our study is that no behavioral measurement was performed. Recent literature argues for a reconsideration of using intention as an alternative outcome for actual behavior, as intention may not be a stable and

reliable predictor of behavior (e.g., Sniehotta et al., 2014). While an objective measurement of physical activity is preferable, this is often not possible due to limitations in resources. On the other hand, a recent review of the relationship between intention and actual physical activity behavior (Feil et al., 2023) showed that intention predicts over 50% of the physical activity behavior, indicating that while intention-behavior gaps indeed exist, intention is still an informative proxy of physical activity. Moreover, although the manipulation checks confirmed that participants noticed the manipulations they received in our experimental conditions, it is important to note that the manipulation check for the autonomy-supportive language variable may not have fully captured its conceptual scope, because it only evaluated the reader's perceived opportunity to select different elements of the message, without explicitly assessing their perceived autonomy-support. Alternatively, the manipulation check could have more explicitly asked the respondents whether they perceived the message as autonomy-supportive, for example, "The message was formulated in an autonomy-supportive manner" (Altendorf et al., 2019).

Another limitation of our study lies in the cross-sectional nature of the data. While the experimental design allows us to evaluate causal direct effects from the manipulated variables (i.e., provision of choice and autonomy-supportive language) on the mediators and dependent variable, serial mediations are more appropriately tested with longitudinal data. This approach would provide a clearer assessment of the direction of effects among the mediators in the model. The proposed serial mediation in our study was based on existing theories, but our cross-sectional data limits the ability to fully test these theoretical relationships. Therefore, the findings related to the serial mediations in our model should be interpreted cautiously. Future research could benefit from employing longitudinal designs, such as cross-lagged models, to robustly test the directional effects between the proposed mediators (i.e., reactance, autonomous motivation, and attitude). Also, another limitation is the lack of an experimental condition in which controlling language was used, that could be compared to the autonomy-supportive language (for examples see Altendorf et al., 2019; Smit et al., 2019). This would have allowed for a more complete assessment of the effect of autonomy-supportive language, rather than by only comparing it to a control condition.

To conclude, the current study showed that autonomy-supportive language in an online message may negatively affect the intention to increase physical activity as means to cancer prevention. However, especially for people with a higher need for autonomy, autonomy-supportive language also decreased cognitive reactance towards the message, which resulted in higher autonomous motivation and an

increased positive attitude towards the behavior. Health communication efforts should consciously consider how they include autonomy-supportive language in their online messages, as well as to whom they address these messages.

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History

Received June 8, 2024

Revision received July 24, 2024

Accepted July 29, 2024

Published online September 27, 2024

Publication Ethics

Informed consent was obtained from all participants included in the study. The study was approved by the Institutional Review Board of the Amsterdam School for Communication Research, University of Amsterdam (2017-PC-8484).

Open Science

The experimental stimuli and measurements used in the study are available at <https://osf.io/mh5q7/> (Solovei, 2024).

Funding

This work was financially supported by the University of Amsterdam's Graduate School of Communication and by the Innovational Research Incentives Scheme Veni from Netherlands Organization for Scientific Research-Division for Social Sciences (NWO-MaGW) accredited to ESS (project number 451-15-028).

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Appendix

Table A1. Means (*M*), standard deviations (*SD*), and correlations between the variables included in model.

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12
1. Choice	0.50	0.50	–											
2. Autonomy supportive language	0.50	0.50	–.03	–										
3. Need for autonomy	1.34	1.55	–.07	.00	–									
4. Interaction (choice, autonomy supportive language, need for autonomy)	–0.32	0.91	–.35**	–.35**	–.36**	–								
5. Interaction (autonomy supportive language, need for autonomy)	–0.67	1.29	.03	–.52**	–.61**	.61**	–							
6. Interaction (choice, need for autonomy)	–0.62	1.25	–.49**	–.01	–.57**	.65**	.32**	–						
7. Cognitive reactance	2.17	1.19	.01	.00	–.08	.04	–.04	.09	–					
8. Affective reactance	1.58	1.09	.04	–.01	.08	.00	–.08	–.03	.47**	–				
9. Autonomous motivation	5.85	1.14	–.14*	–.05	–.05	.12	.09	.11	–.24**	–.20**	–			
10. Attitude	6.08	1.23	.00	.05	–.01	–.10	–.08	–.05	–.22**	–.10	.38**	–		
11. Intention	4.47	1.78	.06	–.08	–.12	.01	.09	.03	–.02	–.06	.15*	.22**	–	
12. Interaction (choice, autonomy supportive language)	1.32	2.38	.56	.56	.04	–.70	–.34	–.38	–.01	.00	–.11	.01	.05	–

Note. * $p < .05$; ** $p < .01$.