MANUSCRIPT IN PROGRESS

Threatening communication: diffusing the scientific evidence on fear appeal effectiveness among intervention developers and other groups of key actors

Short title: Fear appeals: diffusing the scientific evidence

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Abstract:

BACKGROUND: Threat-based (fear-appeal) interventions are often ineffective yet popular. The current paper reports the evaluation of an intervention that was designed to discourage using threatening communication and that targeted those responsible for this popularity (intervention developers, campaign leaders, policy makers, politicians, scientists and advertising professionals).

METHODS: Of the 153 participants who started, 102 completed both the first phase and the six-week follow-up measurement of the within-subject experiment. In the first phase, participants rated hypothetical behavior change interventions in six health domains (e.g., smoking, alcohol), after which they were presented with an intervention targeting themselves, which provided evidence on the ineffectiveness of threatening communication as persuasive instrument. Participants then rated more hypothetical interventions immediately and after six weeks.

RESULTS: The intervention decreased the effectiveness ratings of threat-based interventions, but to a lower degree than expected, with the mean effectiveness grades immediately post-manipulation still exceeding four on a ten-point scale.

CONCLUSIONS: The tested intervention is not an unequivocal success. It may prove hard to influence the key populations responsible for the continuous use of threat communications in persuasion.

Keywords:

Fear appeals, intervention development, intervention developers, policy makers, politicians, scientists, advertising professionals

Introduction

Behavior change interventions frequently emphasize the severity of negative consequences of undesired behavior, often in a threatening fashion (E. L. Cohen, Shumate, & Gold, 2007), and usually without efficacy (or coping) components (S. L. Smith, 1997). The warning labels on cigarette packs are a well-known example. For a long time, the effectiveness of such threatening communications was a controversial issue, with some papers actively promoting their use (Hammond, Fong, McDonald, Brown, & Cameron, 2006) and others discouraging it (Ruiter & Kok, 2005, 2006). The wide implementation of and interest in warning labels (Goodall & Appiah, 2008; Silpasuwan et al., 2008; Vardavas, Connolly, Karamanolis, & Kafatos, 2009) evidences the tendency of intervention developers to follow the former argument.

Fear appeal theories (Witte, 1992; de Hoog, Stroebe, & de Wit, 2007; also see Goldenberg & Arndt, 2008) hold that threatening information only leads to the desired action if it convinces receivers that they are susceptible to a severe threat, to which the desired behavior is an effective solution (response efficacy) that they can efficaciously perform (self-efficacy). When threat (severity or susceptibility) is low, no threat is perceived. When efficacy (response efficacy or self-efficacy) is low, the resulting knowledge (one is threatened but unable to resolve this threat) triggers defensive responses, that often result in minimizing the threat (e.g. by lowering perceived susceptibility) and prohibit protective action. In other words, theory predicts that empirical studies should find interactions between threat and efficacy, such that threat only has an effect when efficacy is high.

Nonetheless, reviews of the effects of fear appeals have not supported these predictions, often only finding evidence for main effects of threat combined with efficacy (de

Hoog et al., 2007; Witte & Allen, 2000). Simultaneously, controlled studies of the processing of threatening information found evidence for defensive processing (Kessels, Ruiter, & Jansma, 2010; Nielsen & Shapiro, 2009; Ruiter, Kessels, Smerecnik, Wouters, & Jansma, 2012), negative effects on beliefs (Brown & Locker, 2009; Brown & Smith, 2007), and even on behavior (Ben-Ari, Florian, & Mikulincer, 2000). These inconsistencies, together with the intuitive appeal of threatening communications as a behavior change method (see, for example Goodall & Appiah, 2008; Gorn, Lavack, Pollack, & Weinberg, 1996), and the equally intuitive assumption that target population members know which behavior change methods are effective in influencing them (Vardavas et al., 2009), have probably contributed to the enduring popularity of threatening communications (Soames Job, 1988).

A recent meta-analysis, designed to resolve the controversy between theory and evidence, found that the theoretical predictions did hold when studies with inferior methodology were excluded (G.-J. Y. Peters, Ruiter, & Kok, 2013). The average effect sizes clearly showed a significant interaction between threat and efficacy, such that threat only had an effect under high efficacy ($d = 0.31$), and efficacy only had an effect under high threat ($d = 0.71$). In fact, the effect of threat under low efficacy was negative ($d = -0.31$) and almost significant ($p = .061$). Given that most interventions using threatening elements do not provide coping information or otherwise influence efficacy (E. L. Cohen et al., 2007; S. L. Smith, 1997), this is a worrying outcome. However, when looking at evidence from other meta-analyses, the picture becomes even bleaker. Insofar as threatening communications do have an effect, this is very weak compared to the effect of other behavior change methods. A meta-analysis comparing different behavior change methods concluded that “no threat-inducing argument had any positive behavioral effect whatsoever” (Albarracín et al., 2005, p. 882). Similarly, as another meta-analysis into condom use where long-term effects of fear

appeals were studied “[...] clearly shows, inducing fear is not an effective way to promote HIV-relevant learning or condom use either immediately following the intervention or later on.” (Earl & Albarracín, 2007, p. 504; for an overview of fear appeal research, see Ruiter, Kessels, Peters, & Kok, 2014; for a recent review drawing different conclusions, see Tannenbaum et al., 2015).

In all, it appears that one of the most popular behavior change methods is an unfortunate weapon of choice at best. This means that there is a need to change these practices, establishing more evidence- and theory-based health promotion practice. Doing so would, interestingly, require the development of a behavior change intervention. However, this intervention would not target a population defined by a health problem, but instead a relatively small population of behavior change professionals and key decision makers. The intervention would need to address those beliefs of behavior change professionals that underlie their choices to utilize threatening information (Bartholomew, Parcel, Kok, Gottlieb, & Fernández, 2011).

A recent qualitative study aimed to identify these beliefs (G.-J. Y. Peters, Ruiter, & Kok, 2014). Intervention developers, policy makers, politicians, scientists and professionals from advertising agencies were interviewed about threatening communication. The main reasons for using threatening communication were to confront people with the consequences of a behavior and to evoke emotions. Emotions were assumed to evoke two goals. The first perceived goal of emotions was to draw attention to the intervention and prompt self-reflection, which would then lead to the desirable behavior, because target population members were assumed to act rationally on hypothesized (successful) increments in risk perceptions. This assumption of rationality also explained the presupposition that achieving awareness or raising risk perception would cause behavior change. This enhanced awareness

was the second perceived goal emotions could serve: explicitly emotionally defined risk was often assumed to directly enhance awareness (G.-J. Y. Peters et al., 2014).

Use of threatening communication was further exacerbated by incomplete theoretical knowledge (G.-J. Y. Peters et al., 2014). This resulted in, for example, threatening interventions to not be considered fear inducing; underestimation of what is required to enhance self-efficacy; and overestimation of efficacy levels in the target population. Most participants did not know many behavior change methods, threatening communication sometimes being the only known solution. Participants often believed the target population could help in identifying useful methods, and some relied on advertising agencies, who mainly advocated originality, confrontation, and humor. The complexity of evaluating behavior change interventions often led participants to adopt proxies for effectiveness such as how well-known an intervention was. Finally, working with external organizations sometimes facilitated the choice for threatening communications: funders or intermediary organizations such as schools sometimes preferred threatening communication, and politicians often desired quick and salient, rather than thoroughly researched, interventions (G.-J. Y. Peters et al., 2014).

On the basis of these beliefs, we developed an intervention that aimed to change beliefs regarding the effectiveness of threat communications among of intervention developers, policy makers, politicians, scientists and professionals from advertising agencies. The current paper reports the outcomes of the evaluation of this intervention. We hypothesized that the intervention will cause threat-based persuasive interventions to be evaluated more negatively. In addition, we measured a number of beliefs about threatening communication to verify the conclusions from our qualitative study (G.-J. Y. Peters et al., 2014). We hypothesized that participants whose professions are proximal to the field of behavior

change science (i.e., intervention developers and scientists) will hold beliefs that are more in line with the scientific evidence than participants whose professions are further removed from behavior change science (e.g. politicians, managers).

Methods

Design and ethics

This study used a within-subjects design, where we measured participants' initial effectiveness ratings before our manipulation (at t_0), immediately afterwards (at t_1), and after six weeks (at t_2). We chose to employ a within-participants design because we anticipated recruitment to prove challenging (see below). The study was approved by the ethical review committee of the faculty of psychology and neuroscience of Maastricht University.

Recruitment

We aimed to recruit participants from five populations of key actors: intervention developers, policy makers, politicians, scientists and professionals from advertising agencies. Because these populations are small and relatively interconnected, we used a snowballing method to recruit participants. We first approached interviewees from the qualitative study we described earlier as well as relevant contacts from our networks, whom we asked whether they would like to participate and/or invite people they knew from one of the key populations. During the data collection phase, we monitored the number of participants from each key population, and we tried to specifically approach more participants from key populations where sample sizes remained low.

Participants

In total, 153 participants started the first phase of the study, 117 completed it (114 of whom provided their e-mail address for follow-up), and 102 completed the second phase (see Figure 1 and the Procedure section). Participants' characteristics, separate per self-identified role, are shown in Table 1. The proportion of participants that dropped out before completing the first and second phase differed significantly between self-identified roles, but only with small effect sizes (Cramèr's Vs of .23 and .20, respectively). Managers, politicians, policy-makers and advertising professionals were slightly more likely to drop out. Three quarter of the entire sample at t_0 was female (75% at t_0 , 73% at t_2), and the average age was 42 years (both at t_0 and t_2). At t_0 , thirty-two percent of the participants worked at a national health promoting organization, thirty percent for a regional health promoting organization, eight percent for a company, ten percent for a university, and twenty percent for the government (6% municipal, 2% provincial, and 12% national).

[INSERT TABLE 1 HERE (temporarily included in this version of the manuscript for the convenience of peer review; caption text is "Sample sizes at t_0 , t_1 and t_2 and sample characteristics.")]

	N t_0	N t_1	N t_2	% female	age (SD)
Intervention developers	40	34	31	85	40.3 (11)
Program/campaign leaders	31	24	21	87	41.4 (9.2)
Policy makers	30	21	18	67	44 (10.9)
Managers	15	8	7	53	50.2 (11.3)

	N t ₀	N t ₁	N t ₂	% female	age (SD)
Politicians	5	4	3	40	52.2 (7.4)
Scientists	27	21	19	74	38.4 (8.2)
Advertising professionals	5	5	3	60	40.2 (9.8)
Total	153	117	102	0	42.3 (10.5)

Procedure

Before starting the study, participants arrived at an introductory webpage that explained the background of the study using a mildly misleading cover story. The cover story was misleading in that it did not explain that the study focused on threatening communication, instead simply explaining that the study addressed effective behavior change methods, and explained the procedure. This introduction also explained that starting the study (i.e. clicking the link at the bottom of the page) implied agreement to the informed consent.

The link opened an instance of LimeSurvey (LimeSurvey Project Team / Carsten Schmitz, 2017). On the first page, participants provided their age, gender, employer category, and self-identified role (see Measurements section for details). The next six pages contained hypothetical problem scenarios and intervention descriptions, which participants graded on a scale of 1 to 10 (the scale used to grade tests in schools and at universities in the Netherlands; for a visualisation of the procedures, see the JARS/CONSORT flowchart in Figure 1; American Psychological Association, 2008). On the next page, participants' beliefs were measured, and on the following page, the manipulation was presented (i.e. our intervention to influence their beliefs), measured the time participants spent on that page,

and assessed whether participants thought the information was clear. Participants were then prompted to assess whether they had understood the information, and were asked whether they were convinced, and if not, why not. The following six pages again contained (different) hypothetical interventions, which participants again rated on a scale of 1 to 10. Finally, participants were thanked for their participation and their e-mail address was requested so that they could be emailed about the second phase. On this page, participants also had the option of sending 'tell-a-friend' emails to up to five other potential participants.

After six weeks, participants who provided their e-mail address started receiving automated e-mails inviting (reminding) them to participate in the follow-up (Cook, Heath, & Thompson, 2000). Participants received an e-mail every four days (96 hours) until they completed the follow-up or until 10 e-mails had been sent. The e-mail contained a link that participants could press (or copy-paste in their browser) to start the second phase, which consisted of twelve pages where the same interventions were rated as during the first phase of the study. Finally, participants could select a charity to which Maastricht University would transfer € 25,00 as an incentive for participation. When all data were collected, participants were e-mailed a debriefing.

Measurements

Because we anticipated that recruiting participants would be challenging, we invested a lot of effort in keeping the study as brief as possible, while also keeping it interesting. These goals had two consequences: we severely limited the number of variables we measured, and we measured our dependent variable by letting participants rate hypothetical interventions.

First, participants typed in their age and then selected their gender (male or female). They then indicated at what kind of organization they worked (national health promoting

organization, regional health promoting organization, company, municipal government, provincial government, national government, university, or 'other, please specify'). Finally, participants indicated their role in their organization (intervention developer, campaign leader [often senior intervention developers], policy maker, manager, politician, scientist, or advertising professional). Then, participants rated six interventions (see Intervention rating section), and then a number of beliefs about different behavior change methods were measured. Each belief was judged as true or false on a five-point scale (save some loss in translation, the five points corresponded to "Absolutely not true", "Mostly not true", "I don't know", "Mostly true" and "Absolutely true"). The statements were averaged into indices for the five beliefs ("interventions should increase risk perception", 4 items; "threatening interventions should enhance efficacy", 2 items; "interventions should use emotion and confrontation", 3 items, "common sense is reliable in intervention development", 2 items; and "increasing perceived severity also increases perceived susceptibility", 1 item). Note that these statements were designed as indices, not as repeated measures of the same construct (G.-J. Y. Peters, 2014).

Participants were then shown the page with the manipulation. The server stored the time participants spent on this page. In addition, participants indicated whether they thought the information was clear (1 = "very unclear" to 5 = "very clear"). They were then asked to indicate to what degree they were convinced by the information (1 = "absolutely not" to 5 = "completely"). If their answer was not "completely", they were asked to type in what they did not found convincing. Finally, participants rated interventions for six more scenarios. In the follow-up, participants rated interventions for twelve scenarios.

Intervention rating

To measure participants' preference for threatening communications, we developed hypothetical problem scenarios, and for each scenario, descriptions of three possible interventions. We developed two scenarios for each of six behavioral domains: smoking, alcohol, exercise & diet, traffic, condom use, and 'blue pox', a hypothetical disease that would necessitate consumption of large quantities of water. The proposed interventions differed in the main determinant they targeted (and therefore, in the behavior change method they employed). The first intervention targeted perceived threat using threatening communication (without addressing efficacy); the second intervention targeted knowledge (often using principles from the elaboration likelihood model or active learning); and the third intervention targeted social cognitive determinants (e.g. subjective norm, self-efficacy or skills, using modeling or another method for these determinants; see Bartholomew et al., 2011). At t_0 , participants rated interventions for six scenarios (one for each health problem); at t_1 , participants rated interventions for the six remaining scenarios; and at t_2 , participants rated interventions for all twelve scenarios (see Figure 1).

The average grade of the threatening intervention was the dependent variable. In addition to threatening interventions, participants graded interventions based on knowledge and social cognitive determinants. There were four reasons we included these interventions as well. First, they allowed us to examine whether judgments would be influenced by the presence of alternatives. Second, they supported our cover story. Third, we hoped that this comparison of different hypothetical interventions would render the experience more fun, thereby decreasing drop-out. Fourth, they allowed us to examine specificity of the effects of our manipulation. By including the knowledge-based interventions, we could examine whether our manipulation caused participants to also devalue a non-threatening, but

nonetheless probably ineffective intervention (L. W. H. Peters, Kok, Ten Dam, Buijs, & Paulussen, 2009). By including the interventions based on social cognitive determinants, we could examine whether our manipulation also caused participants to rate such theory-based interventions higher (as theory-based interventions have been shown to be more effective than non-theory based interventions; L. W. H. Peters, Kok, Ten Dam, Buijs, & Paulussen, 2009; Webb, Joseph, Yardley, & Michie, 2010). We first showed the threatening intervention in isolation so that participants' grades would not be affected by comparison with the other intervention types. Because we expected that most participants would recognize the intervention based on social cognitive determinants as the most effective, we added this last. Thus, the study was set up to collect intervention grades for interventions in six behavioral domains, for three intervention types, and when no, one or two other interventions were presented (for threat-based interventions; but one or two for knowledge-based interventions, and always two for interventions based on social cognitive determinants).

To minimize order effects, we used a counterbalanced design to present the 12 scenarios. We generated a 6x6 Latin square using the 'williams' package (Sailer, 2008) in R (R Development Core Team, 2012; Williams, 1949; see Pezzullo, 1999 for more information). This Latin square is shown in Figure 1. Because we wanted to vary the order differently for the first six scenarios (at t_0) and the last six scenarios (at t_1), we assigned every participant a number between 1 and 36 (consecutively; i.e. the 1st and 37th participants had number 1; the 2nd and 38th participants had number 2, et cetera). This number determined the order of the scenarios at t_0 and t_1 based on an assignment square we constructed (see Figure 1). The column in which a participants' number occurred determined which Latin square row was used at t_0 , and the row in which the number occurred determined which Latin square row was used at t_1 . For example, for the 23rd participant (and the 59th participant, et cetera), row

5 of the Latin square determined the order in which the behavioral domains were presented at t_0 , and row 4 determined the order at t_1 (therefore, at t_0 , this participant saw and rated all three interventions for smoking, but only the threatening intervention for diet and exercise). At t_2 , for every participant that started the follow-up a new number was generated (again, consecutively), and this number's coordinated in the assignment square in Figure 1 again determined the order of the scenarios. The order of the first six scenarios (which had been presented at t_0 in the first phase of the study) was determined by the column of this participants' number, and the order of the seventh to the twelfth scenario (which had been presented at t_1 in the first phase) was determined by the row of this number. Within each single scenario, we varied the order of the two or three interventions randomly. Ideally, we would have counterbalanced this as well, but we decided against this as we expected that we would not be able to recruit sufficient participants.

JARS (CONSORT) flowchart illustrating the flow of the participants through the study

All generated hypothetical scenarios (second row) and interventions (third row)

First scenario						Second scenario					
A	B	C	D	E	F	A	B	C	D	E	F
T	K	S	T	K	S	T	K	S	T	K	S

Latin square

1	A	B	F	C	E	D
2	B	C	A	D	F	E
3	C	D	B	E	A	F
4	D	E	C	F	B	A
5	E	F	D	A	C	B
6	F	A	E	B	D	C

Assignment square

	1	2	3	4	5	6
1	1	2	3	4	5	6
2	7	8	9	10	11	12
3	13	14	15	16	17	18
4	19	20	21	22	23	24
5	25	26	27	28	29	30
6	31	32	33	34	35	36

Behavioral domains: A = diet & exercise, B = bluepox, C = alcohol, D = smoking, E = traffic, F = adherence
Interventions: T = threat-based, K = knowledge-based, S = based on social cognitive determinants

The six routes participants could take

1:	A	B	F	C	E	D
	T	T K	T K S T	T K	T K S	
2:	B	C	A	D	F	E
	T	T K	T K S T	T K	T K S	
3:	C	D	B	E	A	F
	T	T K	T K S T	T K	T K S	
4:	D	E	C	F	B	A
	T	T K	T K S T	T K	T K S	
5:	E	F	D	A	C	B
	T	T K	T K S T	T K	T K S	
6:	F	A	E	B	D	C
	T	T K	T K S T	T K	T K S	

[INSERT FIGURE 1 HERE (temporarily included in this version of the manuscript for the convenience of peer review; caption text is “Figure 1: The JARS (CONSORT) flowchart; the overview of all generated interventions; the Latin square that was used to determine the order of the scenarios; the assignment square that was used to assign participants to a row of

the Latin square; and the six routes a participant could take (for each row of the Latin square, the behavioral domain order combined with the interventions that were presented to and rated by the participants).”)]

The intervention

We attempted to keep the intervention as brief as possible. It consisted of roughly one page of information. This text did three things. First, to target relevant beliefs, it summarized the scientific evidence: threatening communication is ineffective, even potentially counter-effective, unless efficacy is high (mainly based on the outcomes of our meta-analysis, see RELATED MANUSCRIPT 1). Second, to explain what should be done instead in an intervention, the text explained that the choice of behavior change method should be based on the relevant determinants, population and context, as well as practical considerations that may prohibit choosing certain methods if the parameters for effectiveness could not be satisfied (Bartholomew-Eldredge et al., 2016). Finally, the text recommended one method that could generally be applied without danger (modeling).

We decided to include this last recommendation because whereas utilizing threatening communication is often used as some sort of "one-size-fits-all" behavior change method, adequate theory- and evidence based intervention development is generally (and in fact, correctly) considered a very complicated business. In other words, we expected the self-efficacy of many participants regarding developing true theory- and evidence based interventions to be low. As sufficient self-efficacy is generally regarded as a necessary precondition for behavior (and therefore behavior change; Fishbein & Ajzen, 2010; Fishbein et al., 2001), we deemed it important to offer an easy desirable behavior. Therefore, we

included this recommendation to provide participants with a new "one-size-fits-all" solution they could use.

Analyses

Analyses were conducted in R (R Development Core Team, 2017) using the RStudio graphical user interface (RStudio Team, 2016). RMarkdown was used to produce a readable output file, supported by the knitr and pander packages (Allaire et al., 2017; Daróczi & Tsegelskyi, 2015; Xie, 2015). The data were prepared using the reshape and plyr packages (Wickham, 2007, 2011), and analyses were conducted using the userfriendlyscience, lme4 and lmerTest packages (Bates, Mächler, Bolker, & Walker, 2014; Kuznetsova, Bruun Brockhoff, & Haubo Bojesen Christensen, 2016; G.-J. Y. Peters, 2017a, 2017b).

The main hypothesis (that the intervention we developed to discourage indiscriminate reliance on threatening communication would decrease participants' estimated effectiveness of threatening interventions) was tested using multilevel linear modeling with the lme4 package (Bates et al., 2014). For other analyses, we adopted a hybrid approach based on acknowledging, first, that "the primary product of any research inquiry is one or more measures of effect size, not p values" (J. Cohen, 1990), second, that the widths of sampling distributions of such effect sizes urge severe caution when interpreting these effect sizes (G.-J. Y. Peters & Crutzen, 2017), and third, that visualizations have considerable added value when communication study results (Gelman, Pasarica, & Dodhia, 2002; L. D. Smith, Best, Stubbs, Archibald, & Roberson-Nay, 2002). We therefore use diamond plots (G.-J. Y. Peters, 2017a) and refrain from reporting p values or exact estimates except in the test of the main hypothesis. However, such exact results are available in the Open Science Framework repository at https://osf.io/a7drb/?view_only=43341c1a8cd04d5098a62b9815dcc188, and so

are the data file as well as the analysis scripts. In these diamond plots, we will use a confidence level of 99.99% for means to obtain an estimate with high confidence, 99% for means when comparing subgroups to correct somewhat for the decrease in 'plot-wise confidence', and 95% for associations in recognition of the width of effect size sampling distributions.

Results

Before examining the effects of the manipulation, we examined the beliefs of our target population, both as individual items and aggregated into their respective indices. We included these beliefs to be able to compare the degree to which these beliefs were held among the target populations. However, only very few politicians (4), managers (9) and advertising professionals (5) participated in the study. Therefore, we dichotomized the data into two groups: those with jobs closely related to behavior change science (intervention developers, campaign leaders, and scientists) and those with jobs further removed (politicians, policy makers, managers, and advertising professionals).

We then produced duo comparison diamond plots (G.-J. Y. Peters, 2017a) to inspect the distributions of the individual beliefs separate for the two subgroups as well as the associations of these beliefs with distance from behavior change science (see Figure 2). These diamond plots suggest that there might be a weak association between participants' proximity to behavior change science and beliefs regarding behavior change, but the data also seem consistent with a lack of such an association.

[INSERT FIGURE 2 HERE (temporarily included in this version of the manuscript for the convenience of peer review; caption text is “Participants' beliefs regarding behavior change.”)]

We then aggregated these beliefs into the belief indices and generated duo comparison diamond plot for these indices (see Figure 3). The patterns in Figure 2 emerged a bit more clearly. The tentative conclusion seems warranted that participants more distant from behavior change science seem to understand behavior change theory less than participants

closer to behavior change science (or at least more involved in the development of behavior change interventions). Note, however, the considerable within-group variation that remains.

[INSERT FIGURE 3 HERE (temporarily included in this version of the manuscript for the convenience of peer review; caption text is “Participants' belief indices regarding behavior change.”)]

We also explored the effectiveness grades that these two groups of participants gave to the threatening interventions. These, too, differed only mildly (see Figure 4). Apparently, participants more distant from the practice of intervention development and behavior change science did not systematically rate threatening interventions as more effective (though as a group, they did rate threatening interventions 0.56 points higher).

[INSERT FIGURE 4 HERE (temporarily included in this version of the manuscript for the convenience of peer review; caption text is “Intervention effectiveness grades by the participants close to and distant from behavior change science.”)]

Finally, we turned to the main research question: was the manipulation effective?

Participants stayed on the manipulation page on average for 7 minutes and 52 seconds, and indicated that they found the information clear (mean = 4.34, SD = 0.73) and convincing (mean = 4.18, SD = 0.87).

[INSERT FIGURE 5 HERE (temporarily included in this version of the manuscript for the convenience of peer review; caption text is “The evaluation of the interventions of each type over time.”)]

The means that were analysed in the multilevel analysis are shown in Figure 4. In this multilevel analysis, subject was specified as random effect, nested within behavioral domain. Intervention type and number of interventions evaluated simultaneously were added as fixed effects. The multilevel analyses yielded regression coefficient estimates for the differences between the intervention types, number of scenario's evaluated ('graded') simultaneously, the effect of time, and the interaction between the intervention type and time (or, more accurately, measurement moment). The fear appeal intervention was already graded lowest at t_0 (the knowledge-based intervention was graded round 0.8 points higher on the 10-point grading scale, and the intervention based on social cognitive theory around 2.3 points higher). Over time, this evaluation decreased, but only for the fear appeal intervention, a decrease which appeared relatively stable over time, albeit relatively small: around 0.65 points (on the 10-point scale that was used for intervention grading) between t_0 and t_1 , and 0.50 points between t_0 and t_1 . The number of interventions that were evaluated simultaneously had a small effect at most: interventions were estimated to be more effective when two were judged simultaneously (but only by 0.27 points), and this effect disappeared when three interventions were judged.

Discussion

The current paper reported the evaluation of a minimal intervention that targeted intervention developers, policy makers, politicians, scientists and advertising professionals. The intervention effectively decreased participants' ratings of threat-based interventions, but only with 0.65 points on a 10-point scale. The effect weakened slightly over time. The investigation of participants' beliefs regarding threatening communication suggested that

at most, minor differences exist between participants closely involved in intervention development and closer the behavior change science, and participants farther removed from intervention development and behavior change science.

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