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► **To cite this version:**

Lucia Bosone, Frederic Martinez. When, How and Why is Loss-Framing More Effective than Gain- and Non-Gain-Framing in the Promotion of Detection Behaviors?. *International Review of Social Psychology*, 2017, 1 (30), pp.184-192. 10.5334/irsp.15 . hal-02371949

HAL Id: hal-02371949

<https://hal.science/hal-02371949>

Submitted on 20 Nov 2019

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RESEARCH ARTICLE

When, How and Why is Loss-Framing More Effective than Gain- and Non-Gain-Framing in the Promotion of Detection Behaviors?

Lucia Bosone and Frédéric Martinez

This short paper aims to untangle the effect of loss-framing versus gain and non-gain; explaining when, how and why it influences individuals' intentions to engage in cholesterol screening. We argue that framing-effects are (1) significant only when individuals perceive the issue to be highly relevant and (2) are mediated by perceived negative consequences (resulting from undergoing the test) and response-efficacy. In a 2(issue-relevance: high vs low) × 3(framing: gain vs non-gain vs loss) experiment, 229 participants received a message and answered to a questionnaire measuring personal relevance, perceived negative consequences, response-efficacy, intention. Results validated a mediation model, explaining that loss-framing is more persuasive than non-gain, which is more persuasive than gain-framing, partly because of their effect on individuals' perceptions of response-efficacy.

Keywords: detection behaviors; health promotion; framing-effect; perceived risk

Early detection of diseases can potentially have substantial benefits, such as reduced risk of death. The chances for early detection are enhanced by the performance of appropriate screening behaviors and hence one persuasive task facing health professionals is that of encouraging such behaviors. Vast research (Maheswaran & Meyers-Levy, 1990; Rothman & Salovey, 1997; O'Keefe & Jensen, 2006) aiming to find strategies to increase the persuasive efficacy of promotional messages has been focused on the effect of message framing, a concept referring to the manner in which information is phrased. Message framing specifically concerns the fact that a health-message can be focused on positive outcomes resulting from engaging in a beneficial behavior (i.e. gain-framing) or on negative outcomes resulting from not engaging in the behavior promoted (i.e. loss-framing). The purpose of the present paper is to offer an explanation as to why loss-framing is more effective than gain-framing and non-gain-framing in the promotion of detection behaviors, such as cholesterol screening.

At the beginning, the difference in the effects of loss- and gain-framing was explained with regards to the type of the behavior promoted (Rothman & Salovey, 1997). Based on this first explication, loss-framing was more persuasive in promoting detection behaviors (e.g. Kalichman & Coley, 1995; Rothman et al., 1999), as this type of behavior presents the risk of possibly discovering a health-issue and

individuals are risk-seeking when facing possible losses according to the Prospect Theory principles (Kahneman & Tversky, 1979). However, a recent meta-analysis (O'Keefe & Jensen, 2009) demonstrated that this is only partly true. The analysis of 53 different articles testing framing-effects on detection behaviors demonstrated that loss-framed messages are only slightly more persuasive than gain-framed ones, and that this advantage is significant only for appeals advocating breast-cancer detection behavior, but not for all kinds of detection behavior (such as skin cancer or dental problems). Cholesterol screening has been considered by only one study confirming the superiority of loss-framing, which makes it a sufficiently unexplored behavior to be investigated in the present study as it did not result in controversial findings. We argue that such heterogeneous results on the influence of loss-framing versus gain-framing in the promotion of detection behaviors could depend on two factors: (a) the interaction with the relevance of a specific issue for the target population and (b) the way message-framing is conceived.

Framing-effects Interact with the Personal Relevance of the Issue

The majority of the experimental studies analyzing framing-effects to increase the persuasiveness of health-promotion communications focuses on health-related decisions of individuals for whom the situation – the issue – is personally relevant (e.g. Banks et al., 1995; Lee & Aaker, 2004; Latimer et al., 2008; Garcia-Ratamero et al., 2011). For instance, the effects of a message promoting sunscreen protection are tested on the decision

of beach-goers (Lee & Aaker, 2004) and the effects of a message promoting the use of condoms are tested on the decisions of individuals who have had unprotected sexual encounters in the months preceding the experience (Garcia-Ratamero et al., 2011). These studies demonstrate how framing-effects vary according to issue relevance analyzed as an invoked (measured) factor (choosing a specific sample of participants for whom the issue is personally relevant). Only a few studies considered the effects of issue relevance as a provoked (manipulated) factor. For instance, Maheswaran & Meyers-Levy (1990) analyzed framing effect on individuals' intentions to take a cholesterol screening test, manipulating individuals' perceptions of personal relevance by varying the description of cholesterol as either a relevant or irrelevant issue for their population. The messages began by describing to university students a scientific experiment demonstrating that heart diseases are a concern either for the young (relevant issue, as participants were young students) or for the elderly only (irrelevant issue). A loss-framed message was more persuasive than a gain-framed message in promoting a cholesterol-screening, but only when people were in the relevant issue condition. Indeed, when individuals face an issue that is described as highly relevant for their population, they should also perceive to be personally at risk of having or developing such an issue in the future. In this situation, they will be highly motivated to find the most effective behavioral response to reduce such a risk; they will thus be more sensitive to contextual clues to guide their decision, as an individual's rationality is bound to context (Simon, 1955). It is possible to suppose that the interaction between issue relevance and message framing, both manipulated within a promotional message, will influence the effects of such a message on an individual's intention to get tested. We expected framing-effects to be the most intense in a situation of high issue-relevance, whereas the decision of individuals in a situation of low issue-relevance is not expected to vary according to different message-framings. As a consequence, we suppose that when individuals are exposed to a personally relevant issue, a loss-framed message will engender significantly higher intention to undergo cholesterol screening than non-gain- and gain-framed messages. This is an original hypothesis, as the comparison of the three framings has never been carried out in association with a dimension of issue-relevance experimentally induced and controlled.

The Way the Message is Conceived: Loss versus Non-gain Framing

In most framing studies, a positive frame refers to positive outcomes, whereas a negative frame refers to negative outcomes (Levin et al., 1998). However, in addition to an outcomes' valence, it is important to distinguish between types of outcomes: indeed, the negative outcome could result from the presence of something negative (i.e. loss) or the absence of something positive (i.e. non-gain). Loss-framed messages employed by the studies reviewed by O'Keefe and Jensen (2009) often contained non-gain sentences (e.g. Lee, Brown & Blood, 2000; Rivers, Salovey, Pizarro, Pizarro & Schneider, 2005). For example, in one

of the reviewed study, carried out by Lee, Brown & Blood (2000), participants received a pamphlet describing the behaviors to adopt in order to detect skin cancer. The gain-framed pamphlet stressed the positive consequences of skin self-examination (e.g. "By doing the self-examination... you will be alert to changes in the number, size, shape and color of pigmented areas") whereas, the loss-framed pamphlet underlined the absence of such positive consequences resulting from not engaging in skin self-exams (e.g. "By not doing the self-examination...you will be less alert to changes in the number, size, shape and color of pigmented areas"). Participants' intentions to comply were no different between the loss- and gain-framed messages. Could the confusion between loss and non-gain statements be the reason for the heterogeneous literature on the effects of loss-framing in the promotion of detection behaviors? Indeed, non-gain framed messages has been demonstrated to induce individuals with a milder reaction than loss-framed messages, because the pain of a loss is more intense than the pain of a non-gain (Dijkstra, Rothman & Pietersma, 2011).

We thus argue that individuals reading a non-gain-framed message are not as interested in attentively evaluating the risks of a behavior as individuals reading a loss-framed message, because they do not feel the need to avoid the negative consequences and dangers resulting from engaging or not in a behavior, as they do not perceive these consequences to be painful enough to justify an attentive evaluation. Loss-framing is thus expected to be more effective than non-gain framing in promoting detection behavior; however, a non-gain framing is still expected to be slightly more effective than a gain-framing to promote such behavior. Let's see why.

Loss-framing versus Non-gain-framing versus Gain-framing: The Role of Perceived Negative Consequences and Response-Efficacy

While in the past, differential effect of loss- and gain-framing has been connected to the type of behavior, either of prevention or detection (Rothman et Salovey, 1997), more recent reviews have demonstrated that the difference in the effects of loss- and gain-framing, according to the type of behavior, are slight or non-significant (O'Keefe & Jensen, 2006, 2007). Indeed, at the start of the research on message-framing, loss-framing was supposed to be the most effective in promoting detection behaviors, as they have the specific function of detecting health issues and are consequently perceived as risky since they present the possibility of discovering a health-issue (Rothman & Salovey, 1997; Salovey, Schneider & Apanovitch, 2002). Recent findings (Bartels, Kelly and Rothman, 2010) suggest however, that framing-effects did not depend on the function of the behavior, but rather on an individuals' perception of the type of consequences that detection would have on their life. In their study (experiment 2), participants were presented with a message promoting a screening test aiming to detect the presence of a specific enzyme that was invented for the purpose of their study. Such an enzyme was presented as either increasing or decreasing susceptibility to pancreatic disorders, depending

on the experimental condition. Results demonstrated that a gain-framed message was the most persuasive in promoting the screening test aimed to detect the enzyme described as conferring excellent health. A loss-framed message was instead the most persuasive when the screening test promoted was aimed to detect the enzyme described as harmful. Even if the authors did not measure participants' perceived risks, it is clear that the changes between the first and second conditions was not the function of the screening test (i.e. detecting an enzyme) but rather its possible consequence: in the first condition, the absence of an enzyme important for good health; in the second condition, the presence of a harmful enzyme. In our opinion, these results support the idea that the influence of message-framing does not depend on the risks of discovering a health issue, but rather by the type of consequences that such a discovery would have for the individuals. This interpretation is proposed on the observation that detecting an enzyme conferring excellent health (first condition) would have had positive consequences on the life of their participants, whereas detecting an enzyme harmful for their health (second condition) would have had adverse consequences.

In the present paper, we thus argue that a loss-framed message (i.e. which includes statements about risk of loss rather than statements about risks on non-gain) will be more effective than a gain- or non-gain framed message (i.e. which includes statements about risk of non-gain rather than statements about risk of loss) because of its effect on this specific dimension, defined as *perceived negative consequences*. This dimension concerns individuals' perceptions of the life-changing consequences resulting from the possible discovery of a high level of cholesterol. Given that the main barrier to participate in screening tests is not only the possibility to discover a health issue, but more importantly the life-changing consequences that such issue would have for individuals (Lee, 2000; Green et al., 2008), perceived negative consequences is a valid predictor of the intention of individuals to engage in a specific detection behavior. We expected "perceived negative consequences" to be influenced by issue-relevance and message-framing, becoming in this way a valid mediator of their effect on behavioral intention. Loss-framing is then expected to increase individuals' perceptions of negative consequences more than gain-framing due to their nature: given that a gain-framed messages focus on the positive outcomes of getting tested, it creates a positively framed context that will not influence individuals' perceptions of the targeted issue. Also, loss-framing is expected to increase individuals' perceptions of negative consequences more than non-gain-framing because individuals in loss-framing conditions have higher negative reactions than in non-gain framing conditions: indeed, the pain of a loss is more intense than a pain felt for a non-gain (Dijkstra et al., 2011; Idson et al., 2000). The superiority of loss-over both gain- and non-gain-framing with regards to perceived negative consequences is expected to be true only for individuals in a situation of high issue-relevance.

Although loss-framing is expected to be the most persuasive, we also suppose that non-gain-framing will be

slightly more effective than gain-framing. This is due to a second mediating dimension that is expected to influence framing-effects. Indeed, we also expect that individuals' intentions will partly depend on their perception of the test as effective, a dimension defined *response-efficacy*. Perceived response-efficacy concerns individuals' perceptions of a specific behavior as an effective response to reduce a specific health risk and it is one of the main predictors of the decision to engage in a specific health behavior: individuals do not choose to adopt a behavior if they do not consider it as effective to respond to a specific issue (Rogers, 1983; Witte, 1992; Witte et al., 1998; Keller, 2006; Bosone, Martinez & Kalampalikis, 2015). We expected individuals' perceptions of response-efficacy to be influenced by issue-relevance and message-framing, and to influence in turn participants' intentions to get tested. Response-efficacy represents in fact what could be defined as the "utility" of a specific health-behavior. According to the prospect theory (Kahneman et Tversky, 1979), individuals consider a risky behavior as useful when facing possible losses, as in this situation they are risk-seeking. We can thus suppose that individuals will perceive a risky screening test that could lead to the discovery of an issue with life changing consequences as more effective when exposed to a loss-framed message than when exposed to a non-gain one (as loss creates more intense negative reactions than non-gain; Idson et al., 2000; Dijkstra et al., 2011). Also, as the non-gain-framed message still presents losses even if in a milder way (as it does not focus on the presence of negative outcomes but on the absence of positive ones), non-gain framing is expected to slightly increase response-efficacy as compared to gain-framing, being thus slightly more effective in increasing individuals' intentions to get tested. This is expected to be true only for individuals in a situation of high issue-relevance.

We thus expect the effects of the interaction between message framing and issue relevance to be mediated by both perceived negative consequences and response-efficacy, in line with the principles of the Protection Motivation Theory (Rogers, 1983) and the Multiple Parallel Process Model (Witte, 1992). Indeed, according to these social cognition models, people facing a health issue engage in two types of appraisal: threat appraisal, assessing the threat they are exposed to in terms of its severity and of the gravity of its consequences, and response-appraisal, evaluating the efficacy of the possible response to such threat.

The Present Study

The main purpose of the present study is to go further than testing framing-effects promoting detection behaviors, analyzing how framing-effects vary according to two factors that could explain the heterogeneity of results about the influence of loss-framing promoting detection behaviors (O'Keefe & Jensen, 2009): the way in which the sentences are framed and the interaction with issue-relevance. We thus advance the following hypothesis:

HP1: framing-effects will be significant (loss-framing will be more effective than non-gain

framing which will be slightly more effective than gain-framing) in the promotion of cholesterol screening but only when cholesterol is described as a highly relevant issue for the target population, as only in this situation individuals will feel concerned because at higher risk of developing cardiac issues.

HP2: individuals facing a highly-relevant issue will have higher intention to get tested when exposed to a loss-framed message (than when exposed to a non-gain- or gain framed message) because (a) they will perceive such test as highly risky, as the discovery of such issue would lead to heavy negative life-changing consequences; and (b) they will perceive such risky test as an effective response to reduce the risks of the targeted issue. Also, non-gain-framing will slightly increase individuals' perceived response-efficacy as compared to gain-framing, increasing as a consequence behavioral intentions.

Overall, the present study aims to untangle the heterogeneous effects of loss- framed messages in the promotion of detection behaviors (O'Keefe & Jensen 2009). The study includes a gain- and non-gain-framing conditions to be compared to the effects of loss-framing: the messages will present either the positive consequences earned by engaging in cholesterol screening (gain) vs. the positive consequences lost (non-gain) vs. the negative consequences resulting (loss) by not-engaging in cholesterol screening. It does not include a non-loss-framing condition, as non-loss framed sentences would be used in a positively framed message and the present paper aims to explain the influence of negative (loss) framing. The present study will also test a new mediation model of the effects of issue relevance and message-framing on individuals' intention to get tested with regards to response-efficacy.

Method

Participants and design

Two-hundred twenty-nine psychology first-year undergraduates (48 males and 181 females, with a mean age of 21.36, *SD* = 3.07) were randomly allocated to experimental condition, according to a 2(Issue Relevance: high vs. low) × 3(Message Framing: gain, non-gain, loss) between participants experimental design. The first part of the

booklet presented participants with a written appeal, of 330 words, promoting cholesterol screening. The message started by varying issue relevance. The second part of the message described the role of cholesterol in the development of heart diseases. The messages closed with different statements varying the message framing. The different levels of the independent variables are reported in **Table 1**.

Students read the message in a normal classroom environment, and were then asked to answer a questionnaire, which measured the following dimensions:

- To check the manipulation of issue relevance, a six-item scale was created and defined as “personal relevance” (Cronbach’s alpha (N = 6) = 0.85); it included three items by Maheswaran and Meyers-Levy concerning personal concern (“involvement”; e.g. “I feel personally concerned by this message”; 1990) and three items concerning perceived vulnerability (e.g. “If I underwent a cholesterol screening, I would discover my cholesterol level to be too high”);
- Perceived negative consequences, a four-item scale (Cronbach’s alpha (N = 4) = 0.71; e.g. “A high cholesterol level would modify my everyday life habits”) built for the purposes of the present study to measure individuals' perception of the negative consequences resulting from detecting an illness;
- Perceived response-efficacy, a four-item scale (Cronbach’s alpha (N = 4) = 0.88; e.g. “Cholesterol screening is useful to personal health”) as employed by Maheswaran and Meyers-Levy (“attitudes towards the behavior”; 1990);
- Behavioral intention, a four-item scale (Cronbach’s alpha (N = 4) = 0.85; e.g. “I intend to get tested soon”) inspired by the work of Maheswaran and Meyers-Levy (1990).

All measures were built on a 7-point response scale, ranging from 1 (Not at all) to 7 (Extremely). Participants were then thanked and fully debriefed.

Results

Manipulation check

The manipulation of Issue Relevance was validated by its main influence on personal relevance, $F(2, 223) = 43.12$, $p = 0.001$, $\eta_p^2 = 0.16$. The situation was perceived as

Table 1: Examples of independent variables manipulation.

Conditions		
<i>Relevant-issue</i>	<i>Irrelevant-issue</i>	
<p>According to a recent study conducted by the French National Institute of Health Education and Prevention, even people under 25 years of age have a high risk of acquiring coronary heart disease. [...] the risk of becoming a victim of a heart attack is real, and important to be aware of even if you are under 25 years of age.</p>	<p>According to a recent study conducted by the French National Institute of Health Education and Prevention, senior citizens have a very high risk of acquiring coronary heart disease. [...] the risk of becoming a victim of a heart attack is of utmost concern for those over 65 years of age.</p>	
Gain	Non-gain	Loss
<p>By taking the diagnostic blood test, you can find out your current cholesterol level.</p>	<p>By not taking the diagnostic blood test, you will not find out your current cholesterol level.</p>	<p>By not taking the diagnostic blood test, you will ignore your current cholesterol level.</p>

more personally relevant when participants were in the “relevant issue” condition ($M = 3.93$, $SD = 1.29$) than when in the “irrelevant issue” condition ($M = 2.93$, $SD = 1.02$). Message Framing did not influence personal relevance, $F(2, 223) = 2.07$, $p = 0.129$. Their interaction had surprisingly a tendentially significant effect, $F(2, 223) = 2.72$, $p = 0.07$, $\eta_p^2 = 0.02$. More precisely, when in the “relevant issue” condition, individuals felt the situation as more personally relevant when exposed to a loss-framed message ($M = 4.29$; $SD = 1.45$) than to a non-gain- ($M = 3.66$; $SD = 1.19$) or a gain-framed one ($M = 3.85$; $SD = 1.16$). On the contrary, when in the “irrelevant issue” condition, participants evaluated the situation as more personally relevant when exposed to a gain-framed message ($M = 3.22$; $SD = 0.99$) rather than a loss- ($M = 2.82$; $SD = 1.07$) or a non-gain-framed one ($M = 2.77$; $SD = 0.95$). The effects of Personal Relevance will thus be controlled in all the following analyses.

Hypotheses testing

As Personal Relevance directly depended on Issue Relevance, and was unexpectedly influenced by its interaction with Message Framing, we decided to test the effects of Message Framing according to Personal Relevance; to do so, Personal Relevance was included in the model as a covariate in place of Issue Relevance. To test our principal hypothesis about the three types of Message Framing (loss-more effective than non-gain-, which in turn is expected to be more effective than gain-framing), two contrasts were created: C1 testing our principal hypothesis (loss: +1; non-gain: 0; gain: -1) and C2 testing the residual variance (loss: -1; non-gain: +2; gain: -1; Brauer & McClelland, 2005). Then, regression analyses were conducted by regressing the dependent measures (intention, perceived negative consequences and perceived response-efficacy) on Personal Relevance (Z scores), C1 and C2 and their interaction with Personal Relevance.

Intentions

As predicted, the effect of C1 was significant ($\beta = 0.25$, $t(222) = 4.71$, $p = 0.001$) whereas the effect of C2 was not

($\beta = -0.06$, $t(222) = -1.03$, $p = 0.31$). Individuals receiving the loss-framed information are statistically more willing to engage in the suggested behavior ($M = 3.48$, $SD = 1.74$), as compared to those receiving the non-gain ($M = 2.65$, $SD = 1.22$) or the gain-framed information ($M = 2.49$, $SD = 1.26$). Personal Relevance had a significant effect on behavioral intentions, $\beta = 0.42$, $t(222) = 7.72$, $p = 0.001$. The more participants perceived the issue to be personally relevant, the higher their intention to undergo the test was. More importantly, the interaction between Personal Relevance and C1 was significant ($\beta = 0.26$, $t(222) = 4.79$, $p = 0.001$; **Figure 1**) whereas the interaction between Personal Relevance and C2 was not, $\beta = 0.001$, $t(222) = 0.02$, $p = 0.98$.

Perceived negative consequences

When receiving the loss-framed message, participants evaluated the consequences as more negative ($M = 3.88$, $SD = 1.14$) than those exposed to the non-gain-framed message ($M = 3.76$, $SD = 1.15$), but as less negative than those exposed to the gain-framed one ($M = 4.16$, $SD = 0.91$). The main effect of C1 approached significance ($\beta = -0.11$, $t(222) = -1.75$, $p = 0.08$) whereas the effect of C2 was not significant ($\beta = -0.07$, $t(222) = -1.09$, $p = 0.28$). Personal Relevance had a significant effect on individuals perception of the negative consequences resulting from discovering an issue, $\beta = 0.25$, $t(222) = 3.75$, $p = 0.001$. The more participants perceived the issue to be personally relevant, the more they perceived the consequences to be negative. More importantly, neither the interaction between Personal Relevance and C1 ($\beta = 0.07$, $t(222) = 1.04$, $p = 0.31$) nor the interaction between Personal Relevance and C2 was significant, $\beta = -0.001$, $t(222) = -0.02$, $p = 0.98$.

Response-efficacy

Neither the effect of C1 ($\beta = 0.09$, $t(221) = 1.37$, $p = 0.17$) nor the effect of C2 was significant ($\beta = -0.02$, $t(221) = -0.26$, $p = 0.79$). Personal Relevance had not a significant effect on response-efficacy, $\beta = 0.05$, $t(221) = 0.79$, $p = 0.43$. More importantly, the interac-

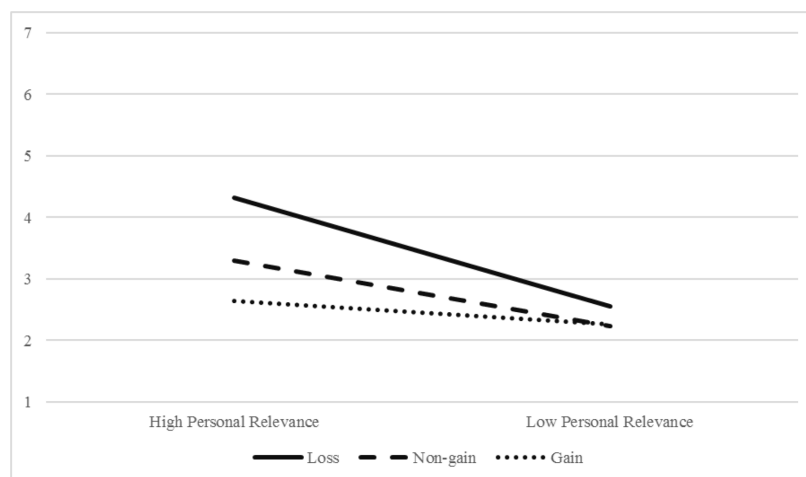


Figure 1: The effect of the interaction C1*Personal Relevance on behavioral intention. Note: to clearly represent data we dichotomized Personal Relevance on the median.

tion between Personal Relevance and C1 was significant ($\beta = 0.27, t(221) = 4.03, p = 0.001$; **Figure 2**), whereas the interaction between Personal Relevance and C2 was not, $\beta = -0.03, t(221) = 0.52, p = 0.61$.

Mediation analyses

To test our mediation hypothesis while controlling for the influence of Personal Relevance, we conducted a mediation analysis (PROCESS; Hayes, 2012) testing whether the interaction between C1 and Personal Relevance is mediated by “response-efficacy”. “Perceived negative consequences” was not included as the regression analysis showed that this dimension was not influenced by the interaction between C1 and Personal Relevance. This macro ran 5,000 bootstrapping to estimate the indirect effects. All paths for the full process model are illustrated in **Figure 3** and their corresponding coefficients are provided in **Table 2**.

The total effect (c1) of C1 \times Personal Relevance on behavioral intention is significant ($\beta = 0.67, t = 6.2157, p < 0.001$; the direct effect c2 remains significant ($\beta = 0.51, t = 4.75, p < 0.001$). The specific indirect effect

Table 2: Path coefficients from the mediation model.

Path section	Coefficients (SE)
a1	0.4672*** (0.1006)
b1	0.3489*** (0.0678)
c1	0.6721*** (0.1081)
c2	0.5091*** (0.1073)

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$.

through “response-efficacy” is also significant ($ab = 0.16, 95\% CI = [0.09, 0.25]$).

Discussion

Present data demonstrated that a loss-framed message is more persuasive than a gain- or non-gain framed one when promoting detection behaviors, but only when individuals perceive the situation as highly personally relevant. Our results confirm that only when individuals are highly involved in the situation in fact they look for a behavior to efficiently respond to the situation, and in doing so their decision is influenced by contextual ele-

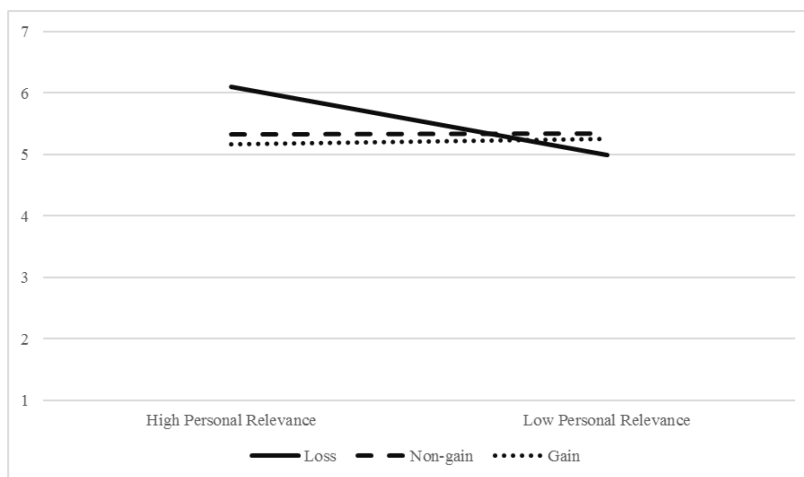


Figure 2: The effect of the interaction C1*Personal Relevance on response-efficacy. *Note:* to clearly represent data we dichotomized Personal Relevance on the median.

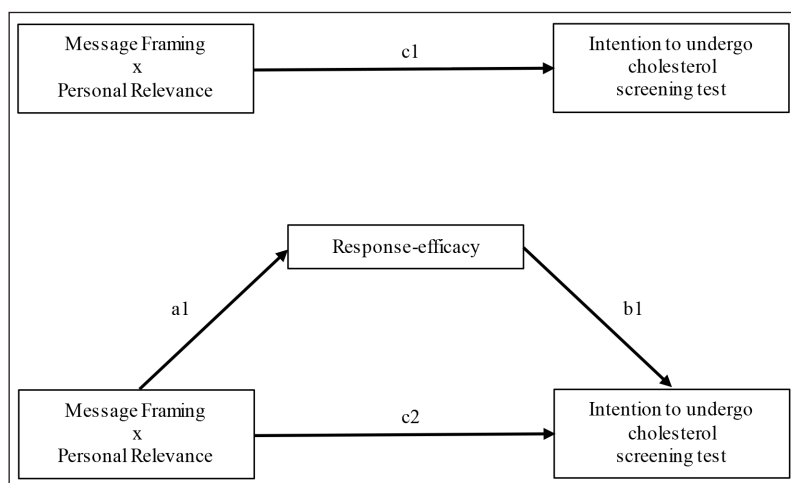


Figure 3: Mediation model.

ments such as message-framing. This is in line with past studies demonstrating that the persuasiveness of loss-over gain-framing when promoting detection behaviors mainly depends on the level of an individual's involvement in the situation (Maheswaran & Meyers-Levy, 1990; Meyers-Levy & Maeswaran, 2004). In addition, the present study also confirms that loss-framing is more persuasive than non-gain-framing, offering thus a valid explication of the heterogeneous results concerning the persuasiveness of loss-framing when promoting detection behaviors (O'Keefe & Jensen, 2009). We also validated a mediation model demonstrating that the persuasiveness of loss-framed message over gain- and non-gain-framed ones for individuals facing a personally relevant issue is partly due to perceived response-efficacy. This validates only part of our hypothesis, as we expected perceived negative consequences to parallelly mediate the interactive effect of message framing and personal relevance on behavioral intention. As negative consequences were perceived as more negative for people exposed to the gain-framed messages (rather than for people exposed to a loss-frame as we expected), perceived negative consequences was not a valid mediation candidate to explain the persuasiveness of loss- over gain- and non-gain-, and wasn't thus included in the mediation analysis. Participants exposed to the loss-framing perceived higher negative consequences than participants exposed to the non-gain-framing as expected: exposure to loss-framed messages trigger stronger reactions than exposure to non-gain framed messages, in line with past findings (Dijkstra et al., 2011). The fact that people exposed to the gain-framing perceived more negative consequences than those exposed to a loss-framing was however unexpected. This could be due to the fact that perceived negative consequences is not influenced by the valence of a framing (positive vs. negative) but rather from its intensity (loss vs. non-gain and gain vs. non-loss; Levin et al., 2008). It is also important to consider that the perception of and reaction to the negative consequences resulting from the discovery of an issue could vary depending on the type of issue concerned. Indeed, the influence of perceived negative consequences on the decision to undergo a screening-test in general could depend on the perception individuals' have of their abilities to cope with such negative consequences, a dimension that could be defined as coping self-efficacy (Schwarzer, 1992). In our study, the influence of perceived negative consequences on the decision to undergo cholesterol screening could have been weak as people could have perceived the consequences of having high cholesterol as easily manageable. Future research could thus focus on the influence of perceived negative consequences on the decision to undergo a screening test when such negative consequences are more difficult to be coped with, such in the case of cancer screening or HIV screening.

The mediation validated in the present study is not however complete but partial; which is in agreement with the Multiple Parallel Process Model (Witte, 1992) and the Social Cognition Model (Bandura, 1977). It is possible to suppose that the partiality of such mediation could

depend on the fact that response-efficacy is not the only dimension of the response-appraisal phase of the health-related decision-making process. Self-efficacy is also an important predictor of health-related decisions; a future study should thus analyze whether the combination of response-efficacy and self-efficacy is an accurate mediator of the interactive effect of message framing and issue relevance.

This research has surfaced some issues that merit further research. The first important issue concerning the main limitations of the research is the use of a paper-and-pencil procedure with no measure of actual behavior within a sample of young university students. Future studies should thus aim to assess and replicate our findings on a wider sample, with a measure of actual behavior. Secondly, current models of health-related decision-making processes (e.g. Witte, 1992; Schwarzer, Lippke & Luszczynska, 2011) underline the importance of personal vulnerability and self-efficacy, along with response-efficacy, as a determinant of an individual's decision to engage in a health-behavior (Krieger et al., 2013). Self-efficacy is in fact an important predictor of health-related decisions, as identified by the social cognition theory (Bandura, 1977), the Protection Motivation Theory (Rogers, 1983) and the Multiple Parallel Process Model (Witte, 1992). Further research should analyze whether the interaction between personal relevance and framing-effect influences self-efficacy. Such influence could depend on the way personal relevance is manipulated; as stated above, personal relevance could be manipulated within two types of risk communication: based on statistics or narratives. Vicarious experience has been demonstrated to be a source of self-efficacy (Bandura, 1977): presenting narratives in health communication could offer individuals a valid vicarious experience, and in this way influencing their self-efficacy. Future research should thus investigate whether presenting narratives to manipulate personal relevance is persuasive because of its effects on self-efficacy, and whether such effects vary depending on the valence and intensity of the narratives (i.e. their framing).

This paper makes several important theoretical contributions. First, present results show once again the importance of personal relevance of the addressed health issue as a key-variable affecting framing effects. When an individual does not perceive a health issue as personally relevant, he does not feel the need to find a behavior to respond to the threat. This prevents him from evaluating the risks and usefulness of a proposed behavior, decreasing then the likelihood of him engaging in it (Witte, 1992). Second, present findings demonstrate that loss-framing has stronger effects than non-gain-framing, offering a valid explanation to the heterogeneity of results analyzing the persuasiveness of loss-framing when promoting detection behaviors (O'Keefe & Jensen, 2009). Third, this research offers an innovative interpretation of the mechanisms underlying framing-effect, answering the main question which today characterizes the research in this domain (Covey, 2014): why does message framing influence behavioral intentions? The data collected

in this study provides original insight on the role of perceived response-efficacy as a key factor predicting framing effects.

Competing Interests

The authors have no competing interests to declare.

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How to cite this article: Bosone, L. and Martinez, F. (2017). When, How and Why is Loss-Framing More Effective than Gain- and Non-Gain-Framing in the Promotion of Detection Behaviors? *International Review of Social Psychology*, 30(1), 184-192, DOI: <https://doi.org/10.5334/irsp.15>

Published: 02 August 2017

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