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Framing politics

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Chapter 3

GETTING REAL: THE DURATION OF FRAMING EFFECTS

Manuscript under review

Abstract

A growing number of studies test the effects of news framing on citizens' understanding of politics. By employing experimental designs, these studies report significant effects for a multitude of issues and frames. However, what happens to the framing effect after initial exposure? Based on a "classic" framing experiment ($n = 625$), this paper traces framing effects across a number of delayed time points: after one day, one week, and two weeks. Our results show that framing effects are surprisingly persistent. The duration of framing effects depended on a person's level of political knowledge, with moderately knowledgeable individuals displaying most persistent framing effects. Effects on individuals with high or low levels of political knowledge dissipated much quicker.

“Suppose the effect no longer persists 10 min after treatment. In what real-world scenario would such an effect matter?” (Gaines, Kuklinski, & Quirk, 2007, p. 5)

Introduction

This chapter is guided by a simple question: what if Gaines and colleagues are right? There is a great amount of studies that test the effects of media framing on citizens’ understanding of politics. Largely based on experimental data, these studies report significant effects over a wide array of issues and frames, and have thereby established a solid empirical basis for the “existence” of framing effects (e.g., Berinsky & Kinder, 2006; Druckman, 2001a; Nelson, Oxley, & Clawson, 1997; Slothuus, 2008). The majority of extant framing experiments stress the importance of their findings for politics and political communication, and therefore transcend a simple cause-and-effect model (Gaines et al., 2007; Kahneman, 2000). Yet, the results of these framing experiments are often based on one-shot experimental settings, where the magnitude of the framing effect is tested only immediately after exposure to a frame. Thus, the duration during which the effects endure remains an open question. What happens to the framing effect after the initial exposure? Does it simply vanish, or does it persist? Can or should a one-shot media stimulus have lasting influence on real-life opinions and attitudes? These questions are of obvious importance to framing researchers. Without knowing about the *duration* of framing effects, researchers cannot make convincing arguments about the significance of their findings for politics (Gaines et al., 2007). Accordingly, existing framing experiments may even have exaggerated the influence of media frames on opinion formation – by focusing too much on the establishment of causality rather than including framing into a dynamic model of political communication flows (see also Druckman, 2004). “Enough already with the experiments” demands Kinder (2007, p. 157) consequently, asking for “methodological diversification, experiments and studies oriented to the world outside” (but see Kinder & Palfrey, 1993).

So far, only a handful of experimental studies have taken the duration of framing effects into consideration. Notably, Tewksbury, Jones, Peske, Raymond, and Vig (2000) find that news frames have a curbed, yet still significant, effect on audience perceptions of a political issue a full three weeks after exposure. Druckman and Nelson (2003) report, however, that the framing effects they found had dissipated only ten days after initial exposure (see also Chong & Druckman, 2008). De Vreese (2004) also suggests that framing effects perish quickly with effects being muted after two weeks, even in—or possibly because of—the almost total absence of related elite information in the interim period. However, despite these findings, framing research has still fallen very much short of any more systematic investigation of the *duration* of framing effects.

This study attempts to trace framing effects over time. In our theoretical framework, we combine the scarce information available about the duration of framing effects. Embedded in a

news framing experiment, we then test the magnitude of a framing effect immediately after exposure and at three additional delayed points in time (after one day, one week, and two weeks). We also pay attention to the *conditionality* of framing effects, and trace the influence of differing levels of political knowledge across time. We thus aim to provide a conceptual blueprint for the overdue integration of a time perspective into framing effects research. For too long, framing effect studies have relied almost exclusively on the assumption that their results can be generalized and used to make predictions about real-life politics.

Experimental Framing Effects Research

There is robust empirical evidence for the impact that news frames have on how citizens make sense of politics, and studies have covered a broad range of issues and framing scenarios (see Levy, 2002; Druckman, 2001b). As a result, framing has become ubiquitous in communications research, and serves as one of the most popular approaches for investigating media effects.

Framing Effects Theory

What theoretical assumptions are framing effects studies based on? In the most general sense, frames can be conceived as patterns of interpretation that are used to classify information sensibly and process it efficiently. Framing stresses certain aspects of reality and pushes others into the background; it has a selective function. In this way, certain attributes, judgments and decisions are suggested (Entman, 1993; D. A. Scheufele, 2000).

Framing studies typically employ either equivalency or emphasis frames (Druckman, 2001b). Equivalency frames refer to logically alike content, which is presented or phrased differently (e.g., Kahneman & Tversky, 1984). Emphasis frames are closer to “real” journalistic news coverage and present “qualitatively different yet potentially relevant considerations” (Chong & Druckman, 2007a, p. 114). Research has, moreover, worked with two alternative operationalizations of frames in the news, namely issue-specific and generic frames (Semetko & Valkenburg, 2000). Issue-specific frames pertain to a specific topic, while generic news frames are applicable to a wide range of topics. This wide application of generic frames makes it easier to compare framing effects across issues and generic frames have thus been utilized in framing experiments (see e.g., Lecheler et al., 2009 for a recent example). It is, moreover, important to note that news frames used in empirical framing studies are characterized by a specific valence (see e.g., Druckman, 2004). This valence pertains to one of the most fundamental characteristics of political discourse, namely that elites attempt to affect support for or rejection of an issue by emphasizing the positive or negative aspects of it. According to de Vreese and Boomgaarden (2003, p. 376), valenced emphasis frames have the capacity to affect opinion on and support for an issue, while neutral emphasis frames are more likely to affect issue interpretation (see also Bizer & Petty, 2005).¹

Based on the conjectural “existence” of framing effects, one of the main goals of current studies is to describe the psychological processes that underlie framing effects and thus enable them (e.g., Lecheler & de Vreese, 2009; Nelson et al., 1997; Price, Tewksbury, & Powers, 1997). Initially, studies conceived these processes as accessibility effects (e.g., Iyengar, 1991). Accessibility effects function by making considerations in the individual’s mind more salient and therefore more likely to be used when forming an opinion (see also Nabi, 2003; Price & Tewksbury, 1997). However, subsequent research suggests that mediating processes of framing—or the “black box” between exposure and effect—might be more complex (e.g., D.A. Scheufele, 2000; Matthes, 2007). For instance, Chong and Druckman (2007a, p.6) delineate framing effects to be mediated via three consecutive steps. First, a consideration must be available to the individual, that is, stored in memory for use. Second, this consideration must be accessible, its’ knowledge must also be “ready for use”. Third, depending on the context and motivation, a consideration may be consciously weighed against other considerations as a person decides about the applicability of their (accessible) interpretations. Thus far, extant research has widely examined and supported this “belief importance change” model of framing effects (see also Lecheler & de Vreese, 2009; Nelson et al., 1997; B. Scheufele, 2004).

Based on the advancing description of cognitive mediation processes, scholars have recently turned to a third complementary explanation for framing effects, namely that news framing also functions by adding *new* beliefs to an individual’s belief content (see Lecheler & de Vreese, 2009; Shah et al., 2004; Slothuus, 2008). This mediational model alludes to one of the most established mechanisms in media effects research - the persuasive effect (see e.g., Petty & Cacioppo, 1986; Eagly & Chaiken, 1993; Zaller, 1992). Originally, belief content change had been widely disregarded in framing effects, because it was argued that framing “operate[s] by activating information *already at the recipients’ disposal*, stored in long-term memory” (Nelson et al., 1997, p. 225, italics in original). However, political news frames often cover information that is remote and complex to the individual, and may therefore regularly convey importance change, *as well as* new information to the individual. Slothuus (2008, p.7) proposes a “dual-process” model of framing effects that combines belief importance and belief content change. Results of his experimental study show that frames do indeed affect opinion via both proposed mechanisms, with belief content change being more significant for individuals with lower political knowledge.

Another important aspect in framing research is the study of moderators, that is, of variables that can enhance, limit or even obliterate a framing effect (e.g., Chong & Druckman, 2007a). By exploring moderators, framing studies take into consideration the fact that the magnitude (as well as process) of framing must depend on individual as well as circumstantial characteristics of the respective framing scenario. So far, research has identified a number of individual-level moderator variables such as political knowledge (e.g., Nelson et al., 1997) or values (e.g., Shen & Edwards, 2005) as well as contextual moderators, attempting to bring the study of framing closer to “real life”, such as source characteristics (e.g., Druckman, 2001a),

issue characteristics (e.g., Iyengar, 1991; Lecheler et al., 2009), interpersonal communication (e.g., Druckman & Nelson, 2003) or competitive framing (e.g., Chong & Druckman, 2007b; Sniderman & Theriault, 2004).

Among these, political knowledge emerges as one of the most prominent moderating variables of framing. However, despite the effort of a growing number of studies, the empirical evidence remains very much divided: One group of scholars thinks that less knowledgeable individuals are more susceptible to framing effects (e.g., Kinder & Sanders, 1990; Schuck & de Vreese, 2006). A second group, however, suggests the opposite (Krosnick & Brannon, 1993; Nelson et al., 1997). These results notwithstanding, the differing impact of political knowledge on the magnitude of framing effects could hinge on a number of factors, such as the type of effect or dependent variable at stake (Lecheler & de Vreese, 2009). We will address the role of political knowledge further below.

Framing Experiments

A large majority of available results on framing effects stems from experimental studies (Druckman, 2004; Kinder, 2007; but see Gerber, Karlan, & Bergan, 2009). This seems natural, given the fact that a well-designed experiment is a primary means of determining cause and effect, and for disentangling the complex processes that account for the effect (e.g., Kinder & Palfrey, 1993; Lavine, Lodge, Polichak, & Taber, 2002; McDermott, 2002).

Framing experiments have created a solid empirical basis of the existence and basic mechanisms of framing for future framing studies to build on. However, the extensive use of experimentation has left some researchers speculate to what extent “realism” must play a larger role in future framing effects research (e.g., Barabas & Jerit, 2008; Kinder, 2007). Kinder (2007, p. 157), for instance, criticises the use of experimental designs for future framing studies. The author emphasises that framing experiments may have exaggerated the power of the media, simply because they ensure that “frames reach their intended audiences”, instead of being deflected off a typically uninvolved media user. As a remedy, he suggests the use of real-life events to generate natural experiments. However, Kinder also acknowledges that doing so requires a “decisive shift in the deployment of frames in some real-world setting” – a condition very rarely fulfilled (see Boomgaarden & de Vreese, 2007; Gerber et al., 2009).

How *can* researchers—in the absence of such events—keep track of realism in their framing effect studies, and still retain the qualities that a good experimental design offers? A number of recent studies suggests a greater focus on “experimental realism” (McDermott, 2002, p. 333) in their design: Druckman (2004, p. 685), for instance, challenges the generalizability and persistence of many discovered framing effects. He suggests a greater focus on the experimental frame exposure scenario, the “context of the study”. Chong and Druckman (2007b) present their participants with competing framing scenarios – yet still within an experiment. In doing so, the authors create a more realistic setting, as most media exposure on a particular issue is characterized not just by repetition of one specific, but a multitude of competing frames (see

also Jerit, 2009; B. Scheufele, 2004; Sniderman & Theriault, 2004). Future studies still need to test in experimentation how repetitive and consonant exposure to news frames changes magnitude as well as process of framing effects (see Noelle-Neumann, 1973; Peter, 2004).

The contestability of extant framing effects research does not only depend on the exposure scenario itself, but also on the over-time persistence of the produced effect. All expressed criticism on the generalizability of framing effects alludes to the necessity of including the variable “time” into future studies (Chong & Druckman, 2007a). After all, a time-persistent framing effect allows researchers to draw conclusions on the political and societal relevance of their results. If experimental framing effects prove to be very short-lived, one must continue to question the applicability of purely experimental designs for framing effects studies. De Vreese (2004, p. 206) argues that longitudinal experimental designs are a “worthwhile path to pursue in the quest to disentangle the robustness and persistency of effects”. Gaines et al. (2007) strongly advocate the further use of survey experiments in social science research, but only if these are enriched with a focus on time and the duration of effects. The authors even suggest that

determining the rates of decay of various treatment effects and deriving the political implications could be one of the most informative tasks that users of survey experiments undertake in the future (p. 6).

Future framing effects research must, thus, not move away from employing purely experimental designs, nor must it continue on producing simple immediate measurement results. By accompanying the participant from the laboratory to the outside world, realism and experimental standardization can be united. This is what this study attempts to accomplish.

The Duration of Framing Effects

The greater part of extant framing effects studies emphasizes the relevance of their results for politics (see Druckman, 2004; Kahneman, 2000). However, such assumptions cannot be sustained without further investigation of the persistence or duration of these results (Gaines et al., 2007). Only recently have framing scholars actually begun to include duration into their designs (e.g., Druckman & Nelson, 2003). With a small number of studies under way, knowledge and data regarding the rate of decay of framing effects after initial exposure and measurement remains inconclusive.

Tracing the effects of media messages over time is of course not a novel idea. Already in 1951, Hovland and Weiss presented their study on learning effects over time. The authors found that individuals tend to forget the source of a message – but are still affected by its content after weeks. What went down in history as the “ sleeper effect ” initiated a consistent line of studies in learning, persuasion or agenda-setting effects research, all of which included time as a significant variable in their designs (e.g., Iyengar & Kinder, 1987; Kleinnijenhuis, van Hoof, & Oegema,

2006; Mutz & Reeves, 2005; Wanta & Hu, 1994). Despite these efforts, scholars continue to be bashful when it comes to examining the over-time persistence of their effects. Studies that *do* consider durability arrive, moreover, at equivocal results, only test one delayed time point, or fail to put full analytical focus on their over-time design. So far, these studies have not established a substantive or empirical standard on *when* exactly a framing effect could be described as “lasting” or not (Gaines et al., 2007).

Tewksbury et al. (2000, p. 818) find a weaker, yet still significant, effect of advocate frames on issue interpretation three weeks after initial exposure. Cautiously, the authors conclude that “exposure to a single news article ... was sufficient to partially direct the comments made by subjects some time later”. Conversely, Druckman and Nelson (2003) report that their issue framing effect on opinion had dissipated only ten days after initial exposure (see also Chong & Druckman, 2008). De Vreese (2004) also suggests that framing effects perish, after only two weeks. He indicates that the dilution of effects of a strategic frame on political cynicism may be ascribed to the almost total absence of access to related elite information in the interim period during data collection (see also Peter, 2004). The conclusions drawn by a majority of studies on duration of framing effects let us very carefully suggest that one-shot framing effects might dilute relatively quickly, and that only multiple exposure to (the same) news frames can produce lasting effects. Thus, so far, the theoretical backbone regarding the duration of framing must remain speculative, as none of the existing studies present substantial ideas on a standard of how to perceive the power of framing effects over time.

A starting point for understanding the duration of framing effects is a look at the psychological processes that enable the effect, that is, the mediators of framing over time. As discussed above, some authors hold framing effects to be mediated by accessibility changes, i.e. by making certain considerations more salient and therefore more likely to be used when forming an opinion (e.g., Iyengar, 1991; Nabi, 2003; Price & Tewksbury, 1997). According to Feldman and Lynch (1988), accessibility is likely to dwindle quickly, depending on how much time has elapsed since its last activation. The exact rate of decay depends on factors such as the total number of repetitions so far, or the strength of related attitudes (see also Fazio, 1995). A majority of framing authors, however, argue that framing effects are applicability effects, which means that a news frame renders certain belief considerations more important. These important belief considerations are, in turn, more likely to be incorporated into subsequent judgments (e.g., Nelson et al., 1997; D.A. Scheufele, 1999). An applicability effect model suggests that news frames alter the composition of an issue attitude, and a stronger and stable effect might be the result (see B. Scheufele, 2004). Yet, again, we do not have sufficient empirical evidence as to how long exactly belief importance changes are likely to last.

Some answers are provided by extant literature on learning and memory, where scholars have argued that at least parts of learned information sticks in memory for a while, ready for later activation (e.g., by means of a “sleeper effect” as described by Lodge et al., 1995; see also Chong & Druckman, 2008). It is important to note that learning effects can involve the learning

of new belief considerations, but also the learning of an evaluative judgment connected to the respective news frame (see also Matthes, 2007; Slothuus, 2008). Yet, rates of forgetting apply to learned information also, albeit forgetting is held to be a much slower process than accessibility-decay (e.g., Hovland & Weiss, 1951; Lodge et al., 1995). We assume that the cognitive process that underlies news framing over time is a combination of accessibility, applicability, and learning effects, with the extent to which each process applies depending on a number of individual or contextual characteristics, such as familiarity with the issue or prior beliefs (e.g., Chong & Druckman, 2007a; Fazio, 1995; B. Scheufele, 2004).

In sum, this article aims to answer some of many open questions regarding the duration of framing effects. Extant studies point towards a quick dissolution of the effects. However, one must consider these findings as provisional, not only because there is still some evidence of persistent framing effects (Tewksbury et al., 2000). Rather, because a majority of the gathered data stems from studies that have considered only one delayed time point and have failed to put full focus on the study of framing over time.

Political Knowledge as a Moderator of Framing Effects over Time

Whatever the rate of decay of framing effects over time may be, it is likely to vary from individual to individual. A rapidly growing number of studies focus on variables that cause such individual differences, that is, variables that moderate the magnitude as well as process of framing effects (e.g., Druckman & Nelson, 2003; Shen & Edwards, 2005). Thus far, a number of individual and contextual moderator variables of framing have been identified (for a summary, see Chong & Druckman, 2007a). Among these, political knowledge has emerged as one of the most intuitive and intriguing moderators of framing. However, studies on the duration of framing effects have so far not addressed its impact over time.²

As indicated above, empirical evidence on the *immediate* effects of political knowledge is still inconsistent. One set of studies suggest that more knowledgeable individuals must be affected to a greater extent by frames (e.g., Krosnick & Brannon, 1993; Nelson et al., 1997). The rationale behind this is that only individuals with higher levels of knowledge can comprehend and integrate a framed message into their mental stockpile. Yet, a second group of studies argues that individuals with higher levels of knowledge are also more likely to *resist* a frame, exactly because they potentially have considered the issue sufficiently enough to allow them to argue against a message (e.g., Chong & Druckman, 2007a). Moreover, as social psychology literature assures, high levels of knowledge often co-occur with strong attitudes and high levels of personal importance attached to a (political) issue (e.g., Wood, Rhodes, & Biek, 1995). It is these strong attitudes, which provide an attitudinal shield against a news frame, and often lead knowledgeable individuals to halt a news frame's effects on subsequent judgments (Haider-Markel & Joslyn, 2001; Lecheler et al., 2009).

Along these lines, low knowledge individuals should be more susceptible to *immediate* frame exposure, simply because they do not possess enough relevant consideration to initially “fight off” the frame. However, the strong effect some experimental frames have on individuals with low levels of knowledge may be facilitated by forced exposure and the dependent variable at stake. Low knowledge individuals may therefore be more susceptible to a “persuasive” framing effect (i.e. a framing effect on opinion via belief importance change *as well as* via the acquisition of *new* beliefs as expressed by Slothuus (2008)), which is not only connected with the lasting integration of a judgment, but also with the reception of new information about an issue. Higher knowledge individuals, though, may be able to actively process information and incorporate it into their existing opinions (i.e. a “classic” framing effect that occurs when certain available beliefs are rendered more important than others). Accordingly, future framing studies may be required to make use of extant knowledge in persuasion literature, take frames as an independent variable and therefore distinguish between the classic “framing effect” and the—complementary—“effects of a frame” (see Lecheler & de Vreese, 2009; D.A. Scheufele, 1999).

The immediate moderating influence of political knowledge on framing effects may not necessarily be mirrored in its *over-time* impact. Investigating political knowledge as a moderator over time requires a consideration of its quality as a processing variable, that is, as a promoter or preventer of effective integration of framed information into the individual’s mental stockpile. Lower knowledge individuals might be prone to a more significant immediate framing effect, but they are also less likely to actively and lastingly integrate the new information into their overall mental stockpile (e.g., Lecheler & de Vreese, 2009). Higher knowledge individuals possess this ability, but are also more likely to resist integration of a news frame, or to quickly relapse to their broad stock of available considerations. Consequently, only individuals who are sufficiently motivated, who display vulnerability to being framed *and* are knowledgeable enough to also integrate the framed message might be affected on a long-term basis. In persuasion research, Zaller (1992, p. 19) refers to this group of individuals as the “moderately aware”, and labels them as most susceptible to media effects, because “they pay enough attention”, but “lack the resources to resist”. Surprisingly, Zaller’s three-group solution on the moderating power of political knowledge has been largely neglected in extant framing research (for an exception, see Slothuus, 2008).

In sum, we note that no extant study on the duration of framing effects has examined how one of the most significant moderators of framing research, political knowledge, functions over time. This is surprising given the central role political knowledge plays in political communication research, and framing research in particular. Putting emphasis on the durability of framing effects requires a more systematic analysis of the rate of decay of the effect across multiple time points and under the inclusion of moderators.

Hypotheses and Research Questions

We formulate two sets of hypothesis plus a research question. Based on an abundance of framing studies, we assume that news frames have a significant immediate impact on the dependent variable, support for a specific issue. Yet, extant studies have furnished us with limited systematic information about the persistence of framing effects. Therefore, we formulated a research question.

H1: News frames affect opinion, so that a news frame stressing “opportunities” results in higher levels of support for an issue, and a news frame stressing “risks” in lower levels of support.

RQ1: Do framing effects persist over time?

Second, we argue that this decay differs from individual to individual. Based on extant studies, we assume that individuals with lower levels of political knowledge will initially be more affected by our frames, simply because they do not possess the mental stockpile to resist the considerations emphasized by the news frame. When focusing on the over-time effect of political knowledge, and thus on the quality of knowledge as a processing variable, we carefully suggest that Zaller’s (1992) “moderately” aware should be affected most persistently. However, given the paucity of relevant research on the influence of political knowledge on framing effects over time, we pose a second research question

H2: Individuals with low levels of political knowledge are more affected by news frames than individuals with moderate or high levels of political knowledge.

RQ2: Do individuals with moderate levels of knowledge display the most persistent framing effects?

Method

To investigate the duration of framing effects, we conducted an online survey experiment with four measurement points among a representative sample of Dutch citizens. As a research subject, we chose the issue of the enlargement of the European Union (EU). Specifically, we tested framing effects on support for the economic development of the EU’s two newest members, Bulgaria and Romania. Overshadowed by the “big bang” enlargement of 2004 with ten new EU member states, Bulgaria and Romania (who entered the EU in January 2007) continue to receive relatively little media attention. This made our experimental design easier to put into practice: First, we expected media coverage in the interim-post exposure period to be

restricted (de Vreese, 2004). Second, we also assumed that pre-treatment exposure to one of our frames was limited (Chong & Druckman, 2008).

General Design

In a single-factor, post-test only, between-subjects experimental survey design, we randomly assigned participants to one of three conditions. These conditions represented two alternative versions of the “economic consequences” frame (see Semetko & Valkenburg, 2000). Additionally, the design included a control condition. Specifically, one frame pointed out the opportunities Bulgaria and Romania presented for the EU market. The second news frame emphasized the risks the two new EU countries bear for the EU market. Using alternative versions of the same generic frame construction is a good way to guarantee a high amount of control in experimental framing research, particularly when the focus lies on the psychological processes that underlie news framing. This is done to ensure commensurability of the effects across conditions. At the same time, external validity was not compromised, because the reference to economic considerations and consequences is one of the most relevant and discussed aspects in the formation of public opinion towards the EU (e.g., d’Haenens, 2005; de Vreese & Boomgaarden, 2003; McLaren, 2007; Semetko & Valkenburg, 2000) and can therefore be found frequently in real political news coverage on EU integration (e.g., de Vreese et al., 2001; Maier & Rittberger, 2008).

To investigate the durability of the framing effects, we re-tested at three delayed measurement points: after one day (t_2), one week (t_3), and two weeks (t_4). To create a clean experimental design, each participant was only tested at a maximum of two points in time. This means that, after being tested immediately after exposure (t_1), participants were purposely split up into groups, and each participant was assigned to only one additional delayed measurement point. We made sure that the groups were split fairly and that each delayed post-test group contained an equal number of participants in the opportunity, risk, and control condition. During their delayed post-test session, participants were re-interviewed on the basis of the same measures that were used in the immediate post-test.

Interim Period

We included a number of variables to control for any intervening influences that might have occurred during the interim period between first and second measurement. In addition to a number of deflective “filler” questions, the delayed post-test questionnaires t_2 to t_4 also contained measurements of issue-specific media exposure during the interim period. Results showed that participants had been exposed to a minimal level of issue-specific news pieces during their respective interim period (only six percent of all participants had been exposed to issue-specific news). Second, we asked participants, how much attention they had paid to issue-related news during the interim period (1 = “no attention” to 4 = “a great deal of attention”). This measurement revealed that participants paid very little attention to related news ($M = 1.26$, $SD =$

.61). Third, we asked participants whether they had discussed the issue with someone else (e.g., family or friends) during the interim period (1 = “I did not discuss it” to 4 = “I discussed it quite a number of times”). Our findings suggested that hardly any participant had discussed the issue ($M = 1.16$, $SD = .57$). Lastly, we conducted a content analysis of all major print media in the Netherlands during the interim period. The results of the interim content analysis showed that there was virtually no relevant news coverage during the data collection period.³

Sample

CentERdata at the University of Tilburg (The Netherlands) recruited a total of 625 individuals (42.7% female, aged between 16 and 92 [$M = 51.67$, $SD = 15.38$]) from their representative web-panel consisting of approximately 2,000 households across the Netherlands. Recruiting into their panel was done using phone, online and face-to-face contacts. Members of their panels are contacted on a regular basis via an online survey tool and are offered incentives for completing online questionnaires on their home computer. The average response rate was 48 percent (AAPOR RR1).⁴ We chose the rather large sample size in this study to make sure that, with the prospect of decreasing response rates over time, each delayed time group did contain a large enough number of participants per message condition (t_2 : $n = 243$, t_3 : $n = 184$, t_4 : $n = 198$). Moreover, we deemed a large sample size necessary to be able to adequately control for news exposure in the interim period.

Procedure

The experimental procedure consisted of three main steps per participant. First, all participants completed an online pre-test survey, including questions relating to socio-demographic variables, prior attitudes, and political knowledge. Following that, participants in the two t_1 treatment groups were exposed to one constructed news article containing either the opportunity or risk frame manipulation. Then, all participants received the online t_1 post-test questionnaire, asking for the dependent variable of opinion on the economic benefits of Bulgaria and Romania within the EU. Participants in the control group moved directly from t_1 pre- to the t_1 post-test questionnaire without treatment.

Next, participants were assigned to one delayed post-test group (t_2 to t_4). This was to ensure that no participant was tested at more than two points in time, as more frequent testing (and therefore the repeated exposure to the same questionnaire) would have threatened the validity of the experimental design (e.g., McDermott, 2002). At the end of the t_1 questionnaire, each participant was informed that they would be contacted one more time for the purpose of doing a follow-up on the present study (participants did not know that they would be re-asked the same questions). The delayed online post-tests (at t_2 to t_4) were then conducted after the respective delay. The test questionnaires at times t_2 to t_4 did not contain additional news frames. Following the delayed post-test, all participants were debriefed.

The design also included a manipulation check (see below). A between condition randomization check on age, gender and occupation performed at the outset of the analysis revealed successful randomization with no between-group differences for the overall t_1 group. An additional randomization check for each of the time groups (t_2 to t_4) did also show a successful splitting into subgroups. The treatment and control groups also did not differ with respect to our pre-intervention moderator variable ($F(2, 622) = 1.42, p = .24$).

Stimulus Material

The stimulus material comprised one news article per condition at t_1 , containing the economic consequences frame in an opportunity or a risk version. We manipulated an article about EU investment in the Bulgarian and Romanian market after the countries' EU accession in 2007. The design of this study recommended using constructed rather than actually published news material: While the economic consequences frame can be found frequently in current political news items and in EU news in particular (e.g., de Vreese, 2009; Maier & Rittberger, 2008), the use of real news coverage would have minimized the commensurability across conditions. Constructed stimulus articles ensured a high amount of control. Effort was made to adapt the presentation and writing of the articles to the structure and language of day-to-day Dutch news coverage. Following previous studies with experimental design, basic core information within the news article was kept identical between the two frame versions (e.g., de Vreese, 2004; Price et al., 1997), while one paragraph in the news story pointed out a number of opportunities or risks regarding the economic consequences of Bulgaria and Romania within the EU market (see underlined text, Appendix B).

Manipulation Check

After being exposed to the stimulus material, participants were asked to indicate on a seven-point scale (1 = "strongly disagree" to 7 = "strongly agree") to what extent the article dealt with the advantages of the issue. The manipulation check showed successful manipulation. Participants in the opportunity condition ($M = 5.94, SD = 1.63$) perceived their article to be more advantageous than participants in the risk condition ($M = 2.35, SD = 1.93$) ($t(612) = 2.75, p < .001$). This allowed the further experimental proceeding with the design and the ascribing of differences between groups in the post-test to the experimental manipulation.

Measures

Although we employed an experimental design, we included a number of *control variables* in our design. Four variables were used as *socio-demographic* control variables, namely gender (42.7% female), age ($M = 51.67, SD = 15.38$) and education ($M = 3.61, SD = 1.48, \text{range} = 1-6$; participants asked for highest completed degree). Extant studies state that political predispositions, represented by prior attitudes to an issue, play an important role when determining framing effects (e.g., Brewer, 2001; Chong & Druckman, 2007a). To measure *prior*

attitudes towards the EU, participants were presented with two scenarios, where opposing opinions were represented by a person “A” and a person “B” (Slothuus, 2008). With each scenario, participants had to indicate with which person’s opinion they agreed to a greater extent ($M = 3.27$, $SD = 1.01$) (for scenarios and scaling, see Appendix C).

The dependent variable of *opinion*— support for the perceived economic benefits of the EU membership of Bulgaria and Romania—was measured according to two items on a seven-point scale with higher scores indicating increased support for the issue ($t_1 M = 3.73$, $SD = 1.28$; $t_2 M = 3.61$, $SD = 1.25$; $t_3 M = 3.81$, $SD = 1.28$; $t_4 M = 3.76$, $SD = 1.28$; Cronbach’s alpha = .68). Levels of *political knowledge* are best measured using factual rather than perceived knowledge on an issue (Delli Carpini & Keeter, 1993). Thus, political knowledge was tapped by asking five factual multiple choice questions asking for both national and EU-related knowledge (see Appendix C). The items were chosen to ensure a sufficient amount of variation in our sample. EU-related knowledge questions often yield low threshold means, and render an adequate split of a sample difficult (e.g., Schuck & de Vreese, 2006). Extant literature on the definition and measurement of political knowledge indicates that national knowledge can also be used as an indicator in EU-related studies (e.g., Hobolt, 2007).⁵ The variable ($M = .59$; $SD = .29$) is an additive index from 0 to 1. Cronbach’s alpha for this scale was .67. In line with Zaller (1992), we divided participants into three groups: low political knowledge (0-1 correct answer, $n = 144$), moderate political knowledge (2-3 correct answers, $n = 168$), and high political knowledge (4-5 correct answers, $n = 303$).

Results

In this study, we present a test of the duration of framing effects over time, and analyze how this duration depends on differing levels of political knowledge. We examined duration in four steps. First, we established whether a classic experimental survey design results in a significant initial news framing effect. Second, we traced this effect across three delayed time points. Third, we determined the immediate moderating effect of political knowledge. Finally, we looked at the conditionality of the decay, depending on differing levels of political knowledge.

Immediate Framing Effect

We predicted that, if an individual is exposed to a news frame, this would initially affect the dependent variable opinion. The results support our expectations. We find that participants in the opportunity economic consequences frame condition supported Bulgaria and Romania more ($M = 4.37$, $SD = 1.12$) than those in the risk condition ($M = 3.27$, $SD = 1.20$). Participants in the control condition were, on average, found to fall between these two values ($M = 3.54$, $SD = 1.25$, $F(2,614) = 47.23$; $p < .001$). Thus, the frame had a strong immediate effect on our chosen

dependent variable, and *HI* can be supported. This enables our further analysis of the dissipation of this effect across time.⁶

Framing Effects over Time

Our study traces effects across multiple delayed time points, and can therefore produce stronger claims on the short- or long-term persistence of framing effects. We incorporated three additional delayed time points: after one day (t_2), one week (t_3), and two weeks (t_4). Table 3.1 shows mean differences and significances between the opportunity, risk, and control condition immediately and at all delayed time points. We cautiously suggested a quick dissolution of the effects. However, surprisingly, we find that the difference between the opportunity and risk condition remain significant until t_4 , which is a full two weeks after initial exposure. This indicates that experimental framing effects have the chance to persist over time. However, the means also demonstrate that the effect had weakened considerably during the time period.

Table 3.1: Framing Effects Over Time

	Opportunity (n = 211)	Risk (n = 206)	Control (n = 208)
immediate (t_1)	4.37 ^{ax} (1.12)	3.27 ^{bx} (1.20)	3.54 ^{bx} (1.25)
after one day (t_2)	4.19 ^{ax} (1.14)	3.26 ^{bx} (1.16)	3.37 ^{bx} (1.23)
after one week (t_3)	4.07 ^{ay} (1.57)	2.72 ^{bx} (1.24)	3.42 ^{bx} (1.35)
after two weeks (t_4)	3.97 ^{ay} (1.02)	3.16 ^{bx} (1.49)	3.64 ^{bx} (1.36)

Note. Different *abc* superscripts indicate a significant difference ($p < .05$) between conditions within one time group; different *xyz* superscripts indicate a significant difference ($p < .05$) within a condition between t_1 and one other time point (t_2, t_3, t_4); higher mean values indicate increased support for the economic benefits of Bulgaria and Romania within the EU.

A closer comparison shows an interesting dynamic in the dissipation of the framing effects. After one day, the means differed only very slightly. However, one week after exposure (t_3), participants in the t_3 risk condition displayed even less support for Bulgaria and Romania within the EU than the overall t_1 group immediately after frame exposure – even though the shifts were not significant. Participants in the t_3 opportunity condition, however, showed opposite effects, i.e. were significantly less positive than the t_1 opportunity condition mean ($t(40) = 3.79, p < .001$). T_4 results solidify this trend of a relatively consistent risk framing effect, whereas the opportunity framing effect continued to fade significantly ($t(34) = 2.22, p < .05$). These findings indicate a difference in the decay of effects of opportunity and risk news frames, in that opportunity frames (which were initially more effective) dissipated quicker than the risk framing effects. Possible explanations for this dynamic will be discussed below.

Immediate Effect of Political Knowledge as a Moderator

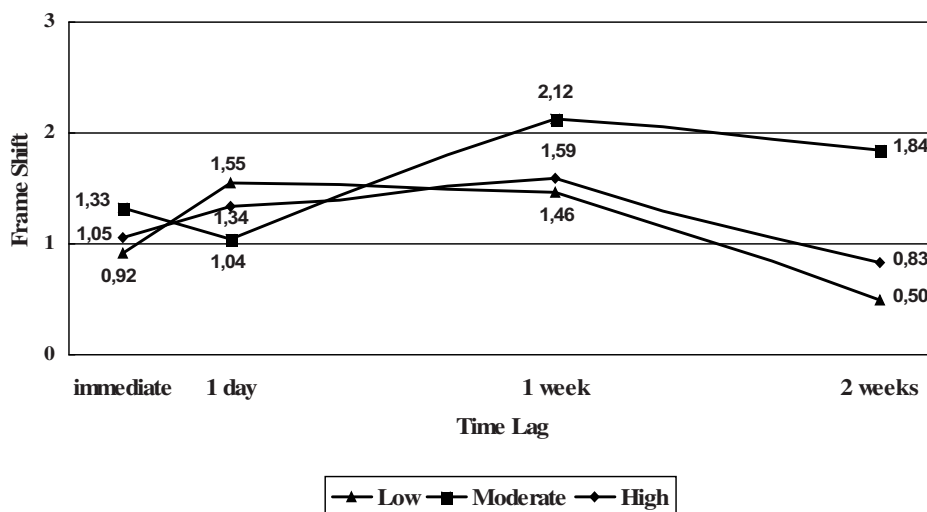
We also examined the influence of differing levels of political knowledge on the decay of framing effects. Based on extant studies, we predicted that *immediate* framing effects are stronger among individuals with lower levels of political knowledge, because these individuals are less able to resist a framed argument (e.g., Lecheler & de Vreese, 2010; Schuck & de Vreese, 2006). We compare the “frame shift” of these two groups, that is, the absolute difference between opportunity and risk condition in level of support (e.g., Chong & Druckman, 2008). As our study does not investigate within-subject change across all time points (see experimental design), we use this measure to illustrate the magnitude of the framing effect over time.

Contrary to our prediction, the overall frame shift mean comparison immediately after exposure (t_1) does not show a significant difference between high, moderate and low knowledge groups. To solidify these initial findings, we regressed our dependent variable of opinion on a dummy variable of frame exposure (1 = opportunity frame exposure), and added our control variables to the model.⁷ We also added a measure of prior attitudes towards the EU to the model, and therefore controlled for events that had shaped participants’ opinions prior to our framing experiment (see Brewer, 2001; Chong & Druckman, 2008; Shen & Edwards, 2005). A comparison of main effect coefficients across the three knowledge groups shows strong influences of the frame on opinion across the board. The frame had thus more or less equally strong effects on all three knowledge groups at t_1 , and the results of both the mean comparison and the regression analysis do not lend support for *H2*.

Effect of Political Knowledge as a Moderator over Time

Political knowledge did not function as a moderator at t_1 . Looking at the role this variable plays across the delayed measurement points in Figure 3.1 shows that, over time, political knowledge emerges as an important moderator of framing effects.

Figure 3.1: Framing Effects over Time – Three Different Levels of Political Knowledge



Given the scarcity of relevant research, we did not formulate a hypothesis concerning political knowledge as a moderator over time, but a directional research question (*RQ2*). Based on Zaller's work (1992), we asked whether moderately politically knowledgeable individuals would display the most durable framing effects, due to their susceptibility to being framed, and their capability of actively integrating the frame into their inventory. The analysis demonstrates that this is indeed the case in our study. Figure 3.1 shows that, as time progresses, both effects on individuals with low and high knowledge levels dissipate to a substantial extent, while the moderately knowledgeable continue to be affected by t_1 frame exposure. A closer look at the progression line shows that this mechanism only surfaces, after some days had passed: After one day, we do not find substantial difference between high (frame shift = 1.34), moderate (frame shift = 1.04), and low knowledge individuals (frame shift = 1.55). However, one week after exposure, the mean comparison shows strong framing effects for the moderately knowledgeable participant group (frame shift = 2.12), while high (frame shift = 1.59) and low knowledge individuals (frame shift = 1.46) show lower shifts. Two weeks after exposure, moderately knowledgeable participants still displayed a surprisingly strong frame shift (= 1.84, $t(24) = 3.23$, $p < .01$). Effects on individuals in the low (frame shift = .50, $t(10) = 0.53$, $p > .05$) and high group (frame shift = .83, $t(61) = 2.42$, $p < .05$), however, had diluted more substantially.⁸

A more conservative test of this effect development, a regression analysis for each delayed time point for the three knowledge groups, confirmed these findings. As in the t_1 regression analysis, we included control variables into each model. This means that we again incorporated prior attitudes towards the EU into the models, and therefore accounted for a determining predictor of opinion besides experimentally induced frame exposure. Table 3.2 shows that—after two weeks—framing effects on participants with low levels of political knowledge had dissipated substantially (Model 1). A similar trend is visible for high knowledge participants, although we still detect a significant effect of frame exposure (Model 3). However, Model 2 shows that our group of moderately politically knowledgeable was still most affected by t_1 frame exposure. Beyond the main effects, we find an interesting dynamic regarding the influence of prior attitudes towards the EU on opinion over time: While the low and moderately aware showed no significant effect of these prior attitudes on the dependent variable, this was not the case for the highly knowledgeable, and Model 3 shows prior attitudes towards the EU as a significant predictor of t_4 opinion for high knowledge participants. This further corroborates our initial suggestions of the effect of political knowledge on framing effects on opinion formation over time.

Table 3.2: Regression Models Predicting Opinion - t_4 (after 2 weeks)

	Model 1	Model 2	Model 3
	Low Knowledge	Moderate Knowledge	High Knowledge
<i>Controls</i>			
Age	-.363(.157)	-.077(.223)	.014(.107)
Gender (1=fem)	-.378(.300)	.117(.618)	.275(.287)
Education	.172(.116)	.007(.224)	.114(.105)
Prior Attitudes / EU	.015(.921)	.293(.335)	.645***(.154)
<i>Main Effects</i>			
Frame (1=opp)	.194(.309)	1.74**(.569)	.906*(.375)
Constant	4.87**(1.09)	2.13(2.08)	.522(.826)
Adjusted R ²	.380	.191	.290
N	15	20	58

Note. Ordinary least squares regression. Data are unstandardized regression coefficients and standard errors (in parentheses), * $p < .05$; ** $p < .01$; *** $p < .001$.

Overall, our results show that political knowledge has the ability to influence the magnitude (and probably process) of framing effects over time.

Discussion

Framing experiments are omnipresent in communication research, and they have established a solid empirical basis on the mechanisms that enable framing effects. But how useful are these experiments for making predictions about real-life politics? Based on recent criticism on the generalizability and robustness of framing effects results an increasing number of scholars focus on creating somewhat more “realistic” research designs (e.g., Chong & Druckman, 2008). One fundamental part of such realism is the examination of the *duration* of framing effects (Gaines et al., 2007). However, so far, only very few studies have collected data on the duration of framing effects, and existing results are tentative. This article augments a framing experiment with a number of delayed measurement points, as well as with a moderator analysis for all these points. In doing so, we aim to introduce effect duration as a standard variable for future framing research, and we view our results as an important first step.

The results of our experiment showed a strong immediate effect of a framed news article on opinion towards the economic benefits of Bulgaria and Romania in the EU. To tap rate of decay, we tested the magnitude of this effect at three additional delayed time points (respectively, after one day, one week, and two weeks). Our framing effect proved to be surprisingly resistant to dilution – but still faded considerably over the chosen time period of two weeks. Next, we analyzed whether the speed of the decay depended on differing levels of political knowledge. Contradictory to our expectations, we found no immediate moderating effect of political knowledge. However, over time, participants with moderate levels of political knowledge displayed most consistent framing effects compared to participants with low or high knowledge levels.

We believe that our findings on the general decay of framing effects add substantially to extant framing literature. We show that a framing effect can persist beyond initial exposure. In fact, the effects in our study proved to be extraordinarily robust. This contradicts both common perceptions in present literature on the duration of framing effects as fragile snapshots of opinion formation, as well as past claims of a quick dissolution of an experimentally generated news framing effect (e.g., Chong & Druckman, 2008; de Vreese, 2004; Druckman & Nelson, 2003). However, our results lend theoretical as well as methodological support to those many framing effects experiments that have based their real-life predications on one-shot experimental designs. We believe that the use of experimental (survey) designs in framing effect research should be encouraged – but under consideration of both experimental realism (e.g., the creation of a more complex exposure scenario), and the real-life persistence of the effects. Future studies could, for example, test persistence by exposing participants to multiple frames over time (see Gaines et al., 2007; Peter, 2004). We conclude that framing experiments can indeed bring something more permanent and effectual into being than had been assumed by some scholars (e.g., Kinder, 2007; Sniderman & Grob, 1996). Based on such assertions, our results also open up plenty of theoretical questions. Most importantly, we believe that future studies are obliged to explore the

relationship between (non-)persistent framing effects and the psychological processes that enable learning effects (see Lecheler & de Vreese, 2009). The long-term acquisition of framed information *must* go hand in hand with the “learning” of considerations. Consequently, learning mechanisms, such as the named “sleeper effect”, could apply to framing also. Based on recent empirical evidence which shows that with every frame, an individual also acquires new belief content (Slothuus, 2008), framing scholars should also put more emphasis on the role of persuasive serial position effects in a dynamic over-time framing scenario (see Chong & Druckman, 2008).

We also traced the impact of one of the most important moderator variables in framing effects research over time: political knowledge. Against expectations, we did not find an immediate effect of political knowledge on the magnitude of the framing effects. Potential reasons for this non-finding are discussed below. More importantly, we note that, in a “one-shot” study, this finding would have led us to discard political knowledge as a moderator variable. Nonetheless, political knowledge played a decisive role over time, especially on a more “long-term” basis (after one and two weeks). We ascribe the fact that the moderately politically knowledgeable were affected most consistently by our frames to Zaller’s (1992) argumentation on the nonlinear effects of political knowledge on the formation of public opinion. While we still argue that low knowledge individuals are bound to be most susceptible to immediate (forced) frame exposure (see Schuck & de Vreese, 2006), these individuals are prone to not engage and process political information thoroughly after exposure (Zaller, 1992, p. 21). High knowledge individuals may have been initially affected in our study, however, these individuals are more likely to encounter other (competing) information in the interim period, and have a higher ability of rejecting a political argument after some time (p. 121). Thus, we are left with the moderately knowledgeable, a group characterized by a certain level of cognitive engagement, but without access to a plethora of possibly competing considerations on the issue.

There are a number of caveats in our study. We tested effects of a set of frames, concerning *one* particular issue, and could only acknowledge *one* moderator variable. Also, our particular interim period was characterized by an extraordinarily small amount of elite information on the framed issue (see also de Vreese, 2004). While these conditions were ideal from a methodological point of view, they rendered our design more artificial than originally intended. This leaves us with the question of how quickly our effects would have dissipated, had we chosen another, potentially more omnipresent, issue. The use of a different framing conceptualization is also likely to have affected our results (see e.g., Matthes, 2009), and we could only touch upon the plethora of processing variables which we believe will moderate the duration of framing effects. Gaines et al. (2007, p. 6) argue that “one frame’s effects [might] last longer than another’s”, and we hope that future studies will examine these variations. Lastly, given the scarcity of relevant research, we had no clear theoretical assumption about how to pick the delayed measurement points in our study. Future studies must build on our design, and determine the optimum time-lags step by step.

The slightly puzzling differences between framing effects for opportunity and risk news frames are another aspect for further discussion and research. Intuitively, and based on literature, we expected the negatively valenced risk frame to be more effective immediately after exposure (Meffert, Chung, Joiner, Waks, & Garst, 2006; Soroka, 2006). This was not the case. Explanations for this phenomenon must remain cautious. We assume that individuals exposed to the opportunity frame were somewhat “surprised” by its content, given the overall negative tone and public opinion towards the European Union and its endeavors in the Netherlands. This surprise might have left participants with a more profound impression of what they had read, while the risk condition experienced some kind of a “floor-effect”. Only further study on valenced news framing over time across issues and frames can uncover the mechanisms behind our finding in this study.

Another potential limitation of our study was that political knowledge did not emerge as a moderator of framing effects immediately after exposure. This may be connected with the personal importance many individuals attach to the chosen issue of EU enlargement. While the European Union is perceived to be important on a national level, individual attitudes connected to it are generally weak, because citizens often find them of little consequence for their personal lives. Lecheler et al. (2009) argue that, when an issue is of little personal importance, and has received only relatively little news coverage on a national agenda, framing effects are likely to be much stronger and across the board. Nevertheless, we want to stress that political knowledge emerged as an important processing variable over time. Our finding highlights the strong need to determine the relationship of knowledge with psychological variables such as attitude strength and extremity, which is a connection many political communication studies do not make. The duration of framing effects has been shamefully neglected in past framing research. Slowly but steadily, however, more and more studies pop up that do consider the generalizability and strength of their results. This article aims to contribute to this development by providing first insights into how long a one-shot framing effect can actually last. While our results are surely only a drop in the bucket, they are a drop that was long overdue: To consider the persistence or context of experimental framing research is perhaps one of the most exciting tasks of our research field. Future studies should therefore not only explore mere decay rates. They should also focus on the (theoretical) circumstances that are likely to speed up, slow down or stop the decay of framing effects, and further develop the necessary research designs to test framing effects over time.

Notes

¹ The literature argues, moreover, a “negativity bias” when it comes to valenced media content. This means that the effects of negative information are likely to dominate over positive information (e.g., Meffert et al., 2006; Soroka, 2006; Vliegenthart et al., 2008). Framing studies support this finding, and indicate that negatively valenced frames are very powerful in affecting peoples’ opinion and attitudes (e.g., Cappella & Jamieson, 1997).

² Chong and Druckman (2008, p. 14) do not test for political knowledge, “because of sample size considerations, and because [they] have no theoretical expectation that over-time effects will be specified by knowledge”. Instead, the authors choose the variable “processing style” as a determinative information variable required for examining the decay of framing effects (see Hastie & Parks, 1986).

³ We coded ten major print news outlets of the Netherlands for (1) issue, (2) presence of the “economic consequences” frame, and (3) tone. The analysis only included 20 issue-relevant articles published within the data collection period. The economic consequences frame did not feature prominently in the coded articles ($M = .25$, $SD = .35$; three items: (1) “Is there a mention of the costs/degree of expense involved?”, (2) “Is there a reference to economic consequences of pursuing or not pursuing a course of action?”, and (3) “Is there a mention of financial losses or gains now or in the future?”; (yes = 1, no = 0); score built by adding items and dividing by total number of items; Cronbach’s $\alpha = .745$; see Semetko & Valkenburg, 2000). The tone of the articles was overall more negative than positive ($M = 3.86$, $SD = .37$; tone measured on 5-point scale from 1 = only positive to 5 = only negative). Intercoder reliability was $\alpha = .66$.

⁴ Due to re-testing, we expected lower response rates at the delayed time points; response rates for t_2 group: 40 percent, t_3 group: 56 percent, t_4 group 49 percent.

⁵ We also tested our moderator analysis based on two separate scales, one for national and one for EU-related knowledge. The results of this test did not differ substantially from the overall result.

⁶ We report our immediate framing effects result for all 625 participants. After t_1 , we split up participants into three delayed post-test groups. All reports of delayed framing effects are thus only based on a sub-set of the sample. To make sure, that these subsets are comparable across time (i.e., that we split up the groups in a fair manner), we analyzed whether t_1 results for each re-test group mirrored the results of the overall t_1 group which had included all participants. The analysis showed that the different time subgroups do not deviate substantially from the overall group results: t_2 group: opportunity ($M = 4.22$, $SD = 1.31$), risk ($M = 3.15$, $SD = 1.14$), control ($M = 3.49$, $SD = 1.23$) ($F(2, 195) = 15.03$, $p < .001$); t_3 group: opportunity ($M = 4.60$, $SD = 1.18$), risk ($M = 3.26$, $SD = 1.26$), control ($M = 3.58$, $SD = 1.02$), ($F(2,141) = 17.87$, $p < .001$); t_4 group : opportunity ($M = 4.19$, $SD = 1.12$), risk ($M = 3.30$, $SD = 1.30$), control ($M = 3.77$, $SD = 1.28$), ($F(2,152) = 6.44$, $p < .01$)).

⁷ Regression tables for t_1 , t_2 and t_3 can be found in Appendix F.

⁸ For t_2 group: high knowledge: frame shift = 1.34, $t(76) = 3.83$, $p < .001$; moderate knowledge: frame shift = 1.04, $t(28) = 2.22$, $p < .05$; low knowledge: frame shift = 1.558, $t(30) = 2.92$, $p < .01$. For t_3 group: high knowledge: frame shift = 1.59, $t(39) = 3.64$, $p < .01$; moderate knowledge: frame shift = 2.12, $t(22) = 3.65$, $p < .01$; low knowledge: frame shift = 1.46, $t(27) = 2.38$, $p < .015$.

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