



# Biased but moderate voters

How information depolarizes political attitudes

**Davide Morisi**

Center for Valg og Partier  
Institut for Statskundskab  
Københavns Universitet

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**Abstract**

Common predictions of motivated political reasoning assume that biased voters should polarize after exposure to mixed arguments. However, despite extensive evidence of biased information processing, evidence of attitude polarization is surprisingly rare. This study contributes to explaining this apparent puzzle by showing that Bayesian voters can simultaneously evaluate information in line with predictions of motivated reasoning and moderate pre-existing attitudes. Experimental evidence from two studies conducted during high-stake referendum campaigns in the UK confirms that exposure to a balanced set of arguments leads to depolarization of attitudes, despite the presence of a confirmation bias in the evaluation of evidence. In addition, both studies reveal that moderation of attitudes occurs especially among those with strong prior attitudes. By showing that even motivated voters can moderate their attitudes in response to evidence, this study invites to reconsider negative evaluations of motivated reasoning, and indicates that information can actually smooth the extreme fringes of the electorate during intense political campaigns.

**Keywords**

Motivated reasoning; Attitude polarization; Confirmation bias; Bayesian learning; Referendum campaigns

## **Introduction**

In political campaigns, using the simple “force of the best argument” (Habermas 1984, 100) to change voters’ attitudes proves an extremely difficult task. As seminal studies have highlighted, not only do voters tend to avoid information that challenges their own predispositions (Lazarsfeld, Berelson, and Gaudet 1968), but attitudes are also generally stable (Converse 1962) and resistant to change (Petty and Cacioppo 1981). According to recent theories of motivated political reasoning (Lodge and Taber 2013; Kahan 2015), attitude change can be hardly reached through mere exposure to evidence, since the individual processing of political information is often biased by motivations that go beyond accuracy reasons, such as the motivation to preserve pre-existing beliefs (see Jost, Hennes, and Lavine 2013). As a consequence, motivated reasoning predicts that exposure to counter-attitudinal messages – at least in the short term (see Redlawsk, Civettini, and Emmerson 2010) – should lead voters to reinforce instead of moderate their prior attitudes, leading to the phenomenon of attitude polarization.

However, despite widespread evidence of biased processing of information evidence of attitude polarization is surprisingly rare. Widely quoted findings of polarization draw mostly on a popular experiment by Lord, Ross and Lepper (1979), in addition to a study by Taber and Lodge (2006; see also Taber, Cann, and Kucsova 2009). The former study, however, suffers from clear methodological limitations – such as the use of self-reported measures of attitude change (see Miller et al. 1993) – while the latter relies on a particular within-subject experiment that might constrain the process of attitude updating (see further discussion below). Attempts to replicate polarization findings in social psychology have provided mixed results (Miller et al. 1993; Munro and Ditto 1997), and a recent extension of the study by Lord and colleagues has failed to document polarization (Guess and Coppock 2015).

Research in political science has shown that attitude polarization in response to new evidence might occur only under certain conditions, depending for example on the strength of individuals’ priors (Leeper 2014), a context in which parties themselves are polarized (Druckman, Peterson, and Slothuus 2013), or a particular type of corrective information (Nyhan and Reifler 2010). On the other hand, recent investigations have documented that partisan information can actually moderate attitudes (Conroy-Krutz and Moehler 2015), while other studies have surprisingly found no evidence of attitude polarization (Trilling, van Klingerren, and Tsfati 2016; Hill n.d.) or even evidence of moderation of attitudes (Druckman and Bolsen 2011; Knobloch-Westerwick et al.

2015), despite all documenting biased processing of information. It seems, therefore, that we are facing a puzzling question: how can biased individuals not follow the prediction of attitude polarization in response to new information? In a political domain in which “we find bias, bias everywhere” (Taber and Lodge 2016, 82), why does evidence of polarization seem so elusive?

This article argues that one of the main explanations of this puzzle is the fact that biased processing of information – and in particular a confirmation bias in the evaluation of evidence – constitutes a necessary, but *not sufficient* prerequisite for attitude polarization. Drawing on common models of belief updating based on Bayesian learning (e.g. Bartels 2002; Bullock 2009; Gerber and Green 1999; Redlawsk 2002), the analysis reveals that voters can simultaneously evaluate information in line with predictions of motivated reasoning and either polarize or depolarize depending on the *magnitude* of their bias. Experimental evidence from two studies supports this theoretical assumption, by showing that in two highly-salient referendum campaigns in the UK – the 2014 Scottish independence referendum (Study 1) and the 2016 EU referendum (Study 2) – exposure to a balanced set of arguments led to depolarization of attitudes (especially in Study 2), despite the presence of a confirmation bias in the evaluation of evidence. In addition, both studies reveal that moderation of attitudes occurs especially among those with strong priors, thus indicating that information can reduce attitude extremity even among highly engaged voters.

By investigating the causal link between confirmation bias and attitude polarization, this article provides a theoretical contribution to research on motivated reasoning and the foundations of polarization dynamics. While contributing to explaining apparent contradictions in the literature on attitude polarization and information processing, this study shows that motivated voters can actually moderate their attitudes in response to evidence, thus casting a positive light on the possibility of information to smooth the extreme fringes of the electorate during intense political campaigns.

In the following sections I will develop theoretical predictions for how voters’ attitudes should change in response to new evidence using Bayesian learning models. Next I will describe the design and the results of two experimental studies that aim to test some of the predictions of the theoretical framework. In the final section I will discuss some of the implications of these findings for research on motivated reasoning and public opinion in general.

## **The loose link between motivated reasoning and polarization**

A growing number of studies has applied the theory of motivated reasoning to interpret how individuals evaluate information in political contexts. As summarized by Leeper and Slothuus (2014 p. 136), the premise of motivated reasoning is that “all reasoning is motivated in the sense that when individuals attend to and process information, they are driven by specific motives or goals”. According to Kunda’s original theorization (1990), two goals play a fundamental role: accuracy goals, defined as the desire to maintain a correct belief, and directional goals, which refer to the need to reach a desirable conclusion (Nir 2011, 506). While accuracy goals lead to careful evaluation and selection of information, in a political domain in which issues and beliefs are affectively charged (Lodge and Taber 2000; Redlawsk 2002) the processing of information is often driven by directional goals, such as the desire to defend prior beliefs.

A common consequence of “directionally” driven processing of political information (Flynn, Nyhan, and Reifler 2017) is the individual disposition to evaluate the evidence consistent with prior beliefs as stronger. This disposition has been documented in different domains and has been labelled as a prior attitude effect (Taber and Lodge 2006), an attitude congruency bias (Druckman and Bolsen 2011; Rudolph 2006; Taber, Cann, and Kucsova 2009), or more generally as a confirmation bias (Kahan 2015; Knobloch-Westerwick et al. 2015; Nickerson 1998). As specified by Nickerson (1998, 178), an important implication of confirmation biases is “the tendency to give greater weight to information that is supportive of existing beliefs or opinions than to information that runs counter to them”. Importantly, however, “this does not necessarily mean *completely ignoring* the counterindicative information but means being less receptive to it than to supportive information” (ibidem., emphasis added). As we will see in the analysis below, the fact that voters might not be totally blind to counter-attitudinal information proves a crucial discriminating factor in the process of opinion formation.

The pervasiveness of confirmation biases across different political domains leads us to the first expectation that voters will display a similar bias also in the evaluation of arguments in a referendum campaign. After reading messages supporting both sides of a referendum issue, voters should find the arguments that are in line with their pre-existing attitudes on the issue as more convincing than the opposite ones. Although this tendency might not necessarily correspond to a bias, as argued in the discussion, for consistency with the literature a first hypothesis can be advanced:

Hypothesis 1: Voters will evaluate evidence consistent with prior attitudes on a referendum issue as stronger than inconsistent evidence.

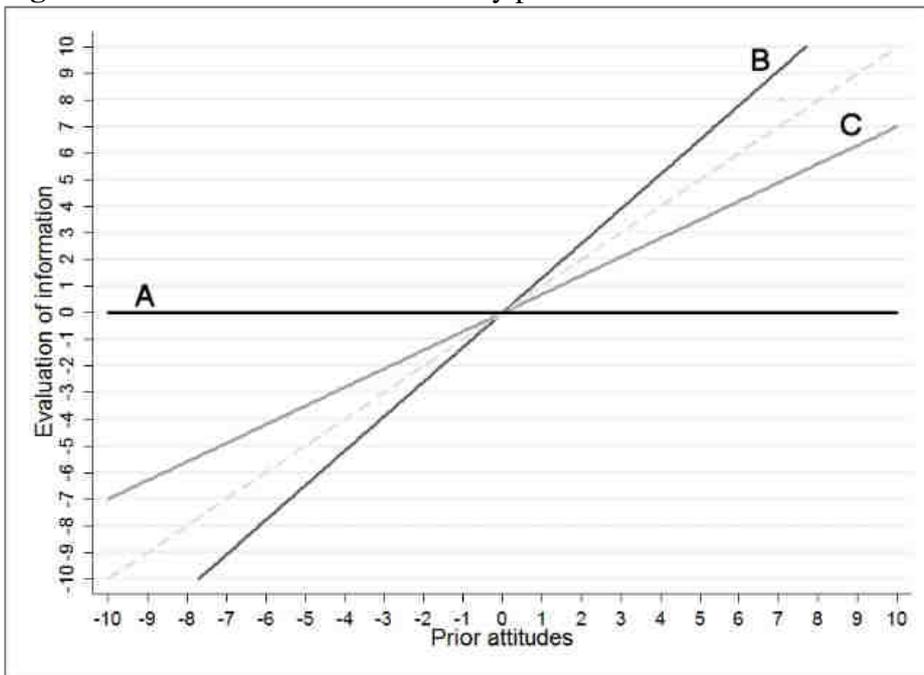
Despite extensive research on confirmation biases, there is surprisingly little evidence of the *consequences* of these biases on the formation of political attitudes. According to a common assumption of motivated reasoning (Druckman and Bolsen 2011; Kahan 2015; Levendusky 2013; Taber and Lodge 2006), confirmation biases and other mechanisms of biased information processing should lead to attitude polarization, “because each of these mechanisms deposits more supporting than repudiating evidence in mind” (Taber and Lodge 2006, 757). Yet, despite being widely accepted, the causal link between confirmation biases and polarization has received little empirical support. As the analysis in the next section shows, a possible reason for this lack of evidence is the fact that common ideas of confirmation biases do not fully consider that different degrees of bias can lead to substantially different outcomes.

#### *Evaluation of information as a function of prior attitudes*

To understand why biased evaluation of information does not necessarily lead to polarization of attitudes we can consider a few examples. Figure 1 illustrates three possible cases of how voters could evaluate two-sided information on a hypothetical referendum proposal. Values on the X-axis correspond to attitudes in favor (positive values) or against (negative values) the proposal, while values on the Y-axis correspond to the evaluation gap between pro and con arguments – the higher the positive values, the stronger the evaluation of pro arguments versus con arguments (and vice versa for negative values).

In the case of Line A, all voters consider pro and con arguments as equally convincing. This case corresponds to common prescriptions of belief updating, which assume that individuals should evaluate evidence independently from their priors (Fischle 2000; Taber and Lodge 2006). Thus, if voters receive two equally strong arguments in favor and against a referendum proposal, they should assign information a value of 0, because the two arguments cancel each other out.

**Figure 1.** Evaluation of information by prior attitudes



Line B and C, on the contrary, violate the assumption of independent evaluation, since voters' assessment of information is a *function* of their priors, meaning that the more a voter is in favor of a referendum proposal, the more convincing she would find the arguments supporting the proposal (and vice versa if the voter is against it). In this sense, they both illustrate a type of confirmation bias, since voters assign a higher value to the evidence that confirms their priors. The only difference concerns the weight attributed to the evidence relative to voters' priors, which is captured by the slope of regression lines: in Line B the slope corresponds to a value of 1.3, while in Line C the value is 0.7<sup>1</sup>.

As an example, imagine Voter 1 who is mildly in favor of EU membership (value 3 on the X-axis) and who evaluates information following the equation in line B (value 3.9 on the Y-axis), and Voter 2 who is strongly in favor of EU membership (value 8) but evaluates information following line C (value 5.6). Despite evaluating information as less supportive of EU membership than Voter 2, Voter 1 displays a stronger confirmation bias *relative to her priors*, since she believes that the information signal is more strongly in favor of EU membership than her original position. On the other hand, Voter 2 believes that the arguments definitely point towards support for EU

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<sup>1</sup> Lines B and C illustrate basic linear correlations. However, non-linear functions are also perfectly plausible (see Figure 5).

membership, but the strength of this support is somewhat weaker than his original stance on the issue. In this sense, the slope of regression lines in Figure 1 captures the magnitude of the bias, with higher positive<sup>2</sup> values corresponding to stronger biases.

How would voters update their priors if they evaluated information as displayed in Figure 1? To address this question we can develop different simulations of attitude change by relying on Bayesian learning, which represents not only a common benchmark for belief and attitude updating<sup>3</sup> (Bartels 2002; Gerber and Green 1999; Redlawsk 2002; Tetlock 2005), but also a valid proxy for how individuals actually update their priors, as recent investigations reveal (Guess and Coppock 2015; Hill n.d.).

### *Polarizing or depolarizing voters?*

In its essence, Bayes' theorem provides a model of how an individual should revise a belief after receiving evidence and subjectively estimating its likelihood. The most common model of Bayesian learning draws on the assumption that both prior beliefs and new information are normally distributed (e.g. Bartels 1993; Gerber and Green 1999; Husted, Kenny, and Morton 1995). Drawing on Bullock's (2009, 1111) analysis, we can assume that the fact that a referendum proposal would be either favorable or unfavorable for a country (along a continuum from totally unfavorable to totally favorable) can be expressed with an unknown parameter  $\theta$ . In line with the normality assumption, a voter's initial belief about the referendum proposal will be normally distributed, so that  $\theta \sim N(\hat{\theta}_0, \sigma_0^2)$ , where  $\hat{\theta}_0$  indicates the voter's belief about the referendum proposal at time 0, while the variance  $\sigma_0^2$  measures the uncertainty (or the precision) of this belief: as the value of  $\sigma_0^2$  decreases, the uncertainty of the voter also decreases.

In line with the normality assumption, when the voter receives a new message, she assigns the message a value  $x_1$  and she assumes that this message is also drawn from a normal distribution  $x_1 \sim N(\theta, \sigma_x^2)$  with mean  $\theta$  corresponding to the belief of interest and variance  $\sigma_x^2$ . In this case, the

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<sup>2</sup> A negative value would correspond to the unlikely case of voters giving more values to counter-attitudinal than pro-attitudinal arguments.

<sup>3</sup> Although Bayesian learning is generally discussed in relation to belief updating, it can be applied also to attitude change (see for example Redlawsk 2002; Taber and Lodge 2006). The distinction between beliefs and attitudes falls outside the scope of this article.

variance indicates how certain the voter is about the reliability of the message: as variance decreases, the reliability of the message increases.

After receiving the message, if the voter updates her prior belief in line with Bayesian updating, according to common calculations (see Lee 2004, 34-36) it follows that her posterior belief will correspond to  $\theta|x_1 \sim N(\hat{\theta}_1, \sigma_1^2)$ , where

$$1a) \quad \hat{\theta}_1 = \hat{\theta}_0 \left( \frac{\phi_0}{\phi_0 + \phi_x} \right) + x_1 \left( \frac{\phi_x}{\phi_0 + \phi_x} \right), \text{ and}$$

$$1b) \quad \sigma_1^2 = \frac{1}{\phi_0 + \phi_x}$$

The parameters  $\phi_0 = 1/\sigma_0^2$  and  $\phi_x = 1/\sigma_x^2$  correspond respectively to the precisions of the prior belief and the new message.

In a two-sided information environment in which the voter encounters at the same time one message in favor of the referendum proposal ( $x_{pro}$ ) and one message against the referendum proposal ( $x_{con}$ ), the value of the evidence  $x_1$  can be defined as

$$2) \quad x_1 = \alpha x_{pro} + \beta x_{con}, \text{ where } \alpha > 0 \text{ and } \beta > 0.$$

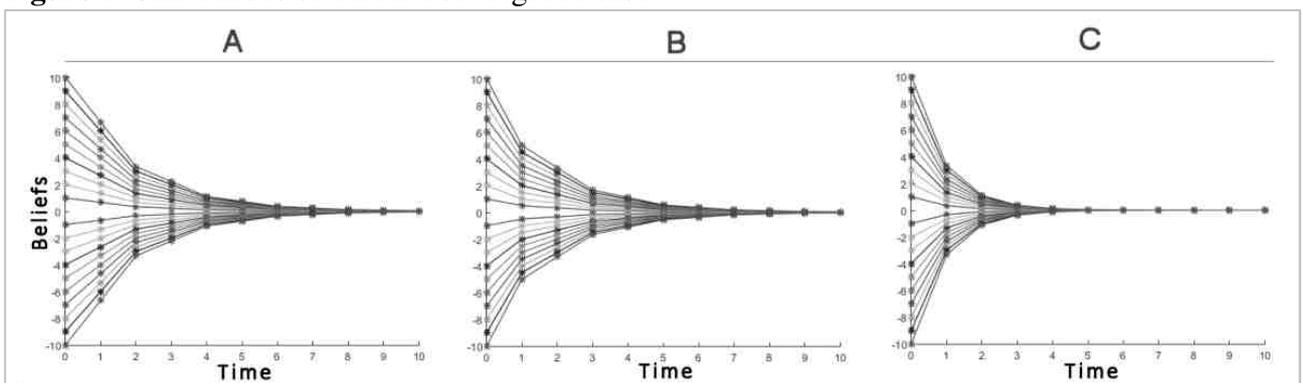
Let us define  $n$  as a positive number and assign the voter's prior belief a value ranging from  $-n$  (if she believes that the referendum proposal would be totally unfavorable for her country) to  $n$  (for the opposite belief), with value 0 along a continuum from  $-n$  to  $n$  indicating a completely neutral position. Equally, the value of the messages will fall within the same interval, with  $0 < \alpha x_{pro} \leq n$  for the message supporting the referendum proposal, and  $-n \leq \beta x_{con} < 0$  for the message against the proposal. If we assume that a) the two messages are *equally* strongly against and in favor of the proposal (thus  $\alpha x_{pro} = |\beta x_{con}|$ ); b) the voter evaluates evidence independently from prior beliefs, and; c) the voter updates her prior beliefs in line with Bayes' theorem, it follows that  $x_1 = 0$  (the case illustrated with Line A in Figure 1), thus the voter's posterior belief will be equal to:

$$3) \quad \hat{\theta}_1 = \hat{\theta}_0 \left( \frac{\phi_0}{\phi_0 + \phi_x} \right)$$

For simplicity purposes, we can ignore the precision  $\sigma_1^2$  of the posterior belief<sup>4</sup> and consider only the value  $\hat{\theta}_1$ . Assuming that both  $\phi_0 > 0$  and  $\phi_x > 0$  (i.e. assuming that there will always be an infinitesimal degree of variance in the precision of both voter’s belief and the message), by definition the term  $(\frac{\phi_0}{\phi_0 + \phi_x})$  will always be smaller than 1. Thus, it is clear from Equation 3 that after repeated exposure to equally strong pro and con messages, the voters’ posterior beliefs will converge to a completely neutral belief having value equal to 0. The “speed” of this convergence process will depend only on the reliability of the message compared to the precision of the voter’s prior, as captured respectively by the parameters  $\phi_x$  and  $\phi_0$ : the higher the variance of  $\phi_x$  compared to  $\phi_0$  (i.e. the more unreliable the message compared to the precision of the voter’s prior), the slower the convergence rate.

We can represent this process with a simulation of a group of 20 voters with initial beliefs corresponding to integer numbers distributed from -10 to 10 (excluding the value 0), as represented in Figure 2. As graphs show, if the voters assign the same weight to pro and con messages (Line A in Figure 1) and if they update their priors in line with Bayes’ theorem, they will quickly converge to the mid-point of the scale, *regardless* of their initial positions. The simulations in Figure 2, therefore, represents a case of “truth-convergence” (Kahan 2015, 2), in which “truly unbiased processors of the same political information ... ultimately *converge* in their judgments” (Mutz 2006, 231).

**Figure 2.** Simulations of a truth-convergence case



Note. Simulations based on Equation 3: Graph A:  $\sigma_x^2 = 2\sigma_0^2$ ; Graph B:  $\sigma_x^2 = \sigma_0^2$ ; Graph C:  $\sigma_0^2 = 2\sigma_x^2$ .

<sup>4</sup> Despite being an important parameter, the precision of the posterior beliefs affects the voter’s certainty about the “location” of this belief, but not the location itself.

The different “speed” of the convergence rate in the three graphs depends on the precision attributed to both information and prior beliefs: as the precision of the information increases, voters will reach more quickly the point of convergence. Graph A illustrates the case in which the reliability of the message is lower than the precision of voters’ beliefs, thus  $\sigma_x^2 > \sigma_0^2$  (recall that  $\phi_0 = 1/\sigma_0^2$  and  $\phi_x = 1/\sigma_x^2$ ). More specifically, Graph A displays the case in which the uncertainty about the information signal is double than the precision of voter’s prior:  $\sigma_x^2 = 2\sigma_0^2$ , from which it follows that  $\hat{\theta}_1 = \frac{2}{3}\hat{\theta}_0$ .

In Graph B voters are equally certain about the precision of their beliefs and the reliability of the messages, thus  $\sigma_x^2 = \sigma_0^2$ , and  $\hat{\theta}_1 = \frac{1}{2}\hat{\theta}_0$ . In this case, voters will converge more quickly to the value of 0, compared to the case in Graph A, because they are more certain about the information source. Finally, the convergence rate will be even faster if voters think that the message is more “precise” than their initial positions. This case is shown in Graph C, in which  $\sigma_0^2 = 2\sigma_x^2$ , thus  $\hat{\theta}_1 = \frac{1}{3}\hat{\theta}_0$ .

In the next step, we can consider the case in which voters assess information through the lens of their priors, instead of evaluating it independently from what they originally believed (Line B and Line C in Figure 1). In this case, the evaluation of information can be conceived as a function of voters’ priors, thus  $x_1 = b\hat{\theta}_0$  (in the case of a linear function), in which  $b$  corresponds to a generic coefficient assigned to the value of voters’ prior. If the relation between priors and evaluation is positive, thus if  $b > 0$ , this function can be interpreted as a confirmation bias, since voters believe that the messages that are in line with their priors are more convincing than the messages from the others side. Following this reasoning, if the value of the evidence  $x_1$  is a function of voters’ initial belief  $\hat{\theta}_0$  about the referendum proposal, we can re-write equation 1a as follows:

$$4) \quad \hat{\theta}_1 = \hat{\theta}_0 \left( \frac{\phi_0}{\phi_0 + \phi_x} \right) + b\hat{\theta}_0 \left( \frac{\phi_x}{\phi_0 + \phi_x} \right).$$

In addition, since we assumed that both  $\phi_0 > 0$  and  $\phi_x > 0$ , this leads to  $\frac{\phi_0}{\phi_0 + \phi_x} + \frac{\phi_x}{\phi_0 + \phi_x} = 1$ .

Thus, equation 4 can be transformed as:

$$5) \quad \hat{\theta}_1 = \hat{\theta}_0 \left( \frac{\phi_0}{\phi_0 + \phi_x} \right) + b\hat{\theta}_0 \left( 1 - \frac{\phi_0}{\phi_0 + \phi_x} \right), \text{ and}$$

$$6) \quad \frac{\hat{\theta}_1}{\hat{\theta}_0} = \left( \frac{\phi_0}{\phi_0 + \phi_x} \right) + b \left( 1 - \frac{\phi_0}{\phi_0 + \phi_x} \right).$$

If voters assign information the same value as their priors (thus  $b = 1$ ) from equation 6 it follows that  $\frac{\hat{\theta}_1}{\hat{\theta}_0} = 1$ , thus  $\hat{\theta}_1 = \hat{\theta}_0$ . Therefore, if voters believe that information has exactly the same value as their initial belief, they will simply confirm what they originally believed, and will not change their mind.

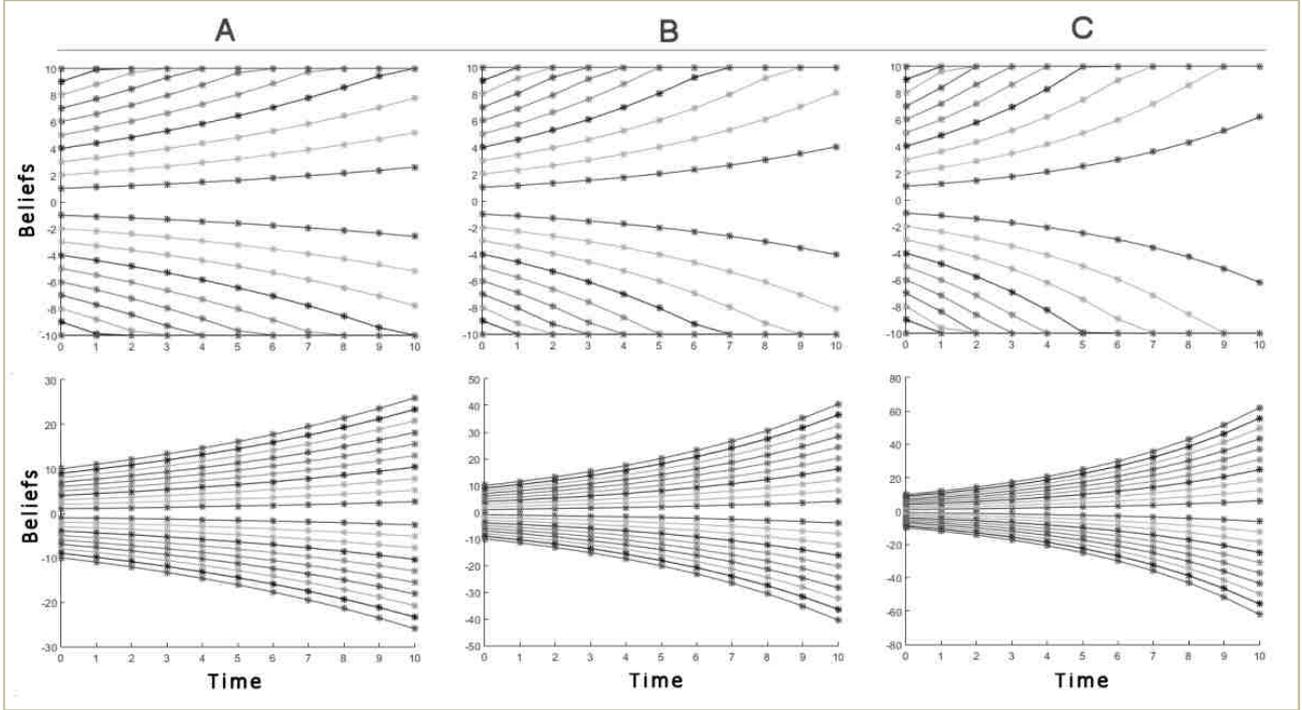
On the contrary, we can consider the case in which  $b > 1$ , meaning that a voter believes that the information signal is more strongly in favor or against a referendum proposal than what she originally believed. From equation 6, we can demonstrate that  $\frac{\hat{\theta}_1}{\hat{\theta}_0} > 1$ , thus  $\hat{\theta}_1 > \hat{\theta}_0$ , because if

$$7) \quad \left( \left( \frac{\phi_0}{\phi_0 + \phi_x} \right) + b \left( 1 - \frac{\phi_0}{\phi_0 + \phi_x} \right) \right) < 1, \text{ then}$$

$$8) \quad b < \left( 1 - \frac{\phi_0}{\phi_0 + \phi_x} \right) / \left( 1 - \frac{\phi_0}{\phi_0 + \phi_x} \right), \text{ which is not possible.}$$

Therefore, if a) voters attribute to information a value that is higher than the value of their priors ( $b > 1$ ), and if b) they update their priors according to Bayes' theorem, it follows that voter's posterior belief  $\hat{\theta}_1$  will always be more extreme than their prior belief  $\hat{\theta}_0$ . Figure 3 represents different cases based on Line B in Figure 1, in which  $b = 1.3$ . In line with Figure 2, the difference in the convergence rate depends on voters' certainty about the reliability of the information compared to their priors: in Column A, they are more certain about the precision of their priors than the reliability of information, in Column B they are equally certain about their priors and the information signal, while in Column C they believe that the information signal is even more reliable than their original positions. The difference between the graphs in the first row and the second row is that in the first row we have introduced an upper bound and a lower bound respectively at value of 10 and -10, corresponding to the maximum limit of attitude extremity that a society can reach. In the second row, this limit is removed, thus allowing for virtually endless polarization. As the simulations show, if voters assign disproportionately more value to confirmatory evidence relative to their priors, they would increasingly polarize over-time.

**Figure 3.** Simulations of polarization of beliefs

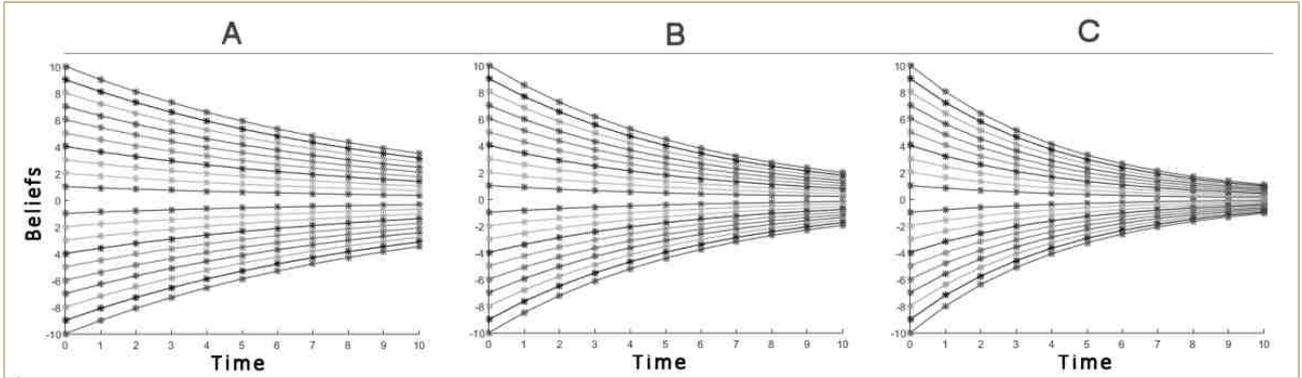


Note. Simulations based on Equation 4: Column A:  $\sigma_x^2 = 2\sigma_0^2$ ; Column B:  $\sigma_x^2 = \sigma_0^2$ ; Column C:  $\sigma_0^2 = 2\sigma_x^2$ .

Let us consider an additional example of a confirmation bias based on Line C in Figure 1. In this case voters find confirmatory arguments as stronger than counter-attitudinal arguments (thus  $b > 0$ ), but they believe that the information signal points to a weaker support (or opposition) for the referendum proposal compared to their initial belief on the issue (thus  $b < 1$ ).

Following previous demonstrations, if  $0 < b > 1$ , it follows that  $\frac{\hat{\theta}_1}{\hat{\theta}_0} < 1$ , thus voters' posterior belief  $\hat{\theta}_1$  will always have a lower value than prior belief  $\hat{\theta}_0$ . For this reason, if a) voters attribute a higher value to confirmatory than counter-attitudinal messages, but if this value is lower than the value of their priors ( $0 < b > 1$ ), and if b) they update their priors according to Bayes' theorem, it follows that voter's posterior belief  $\hat{\theta}_1$  will always be more moderate than their prior belief  $\hat{\theta}_0$ . Figure 4 illustrate the case based on Line C in Figure 1, in which  $b = 0.7$ . The different graphs correspond to different levels of certainty attributed to the information source, in line with previous simulations.

**Figure 4.** Simulations of depolarization of beliefs



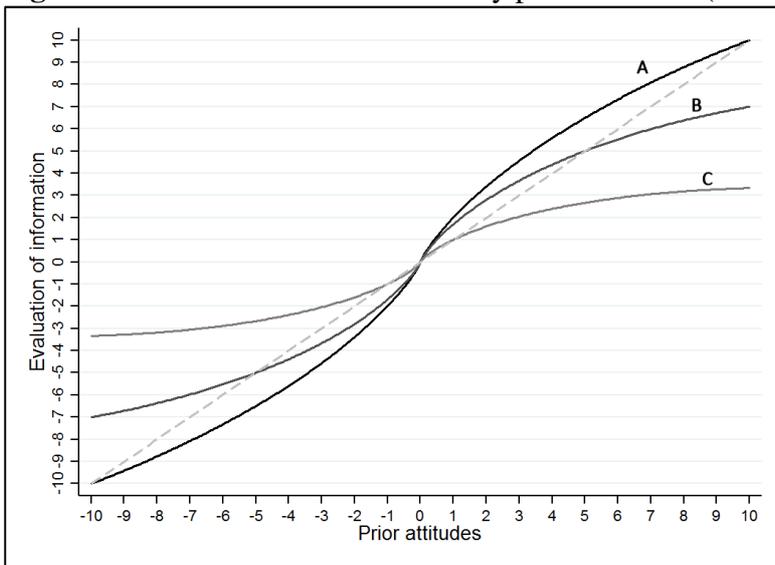
Note. Simulations based on Equation 4: Graph A:  $\sigma_x^2 = 2\sigma_0^2$ ; Graph B:  $\sigma_x^2 = \sigma_0^2$ ; Graph C:  $\sigma_0^2 = 2\sigma_x^2$ .

Lastly, we can consider the case in which evaluation of information is not a linear function of voters' priors. Figure 5 illustrates three possibilities in which the evaluation is a combination of a logarithmic function. If we focus on the positive side of the X-axis, in Line A the coefficient  $b$  is always higher than 1 (apart from when prior attitudes reach the upper bound of 10), in Line B, the coefficient is partially higher and partially lower than 1, while in Line C the coefficient is always lower than 1 if prior attitudes are equal or larger than 1.<sup>5</sup>

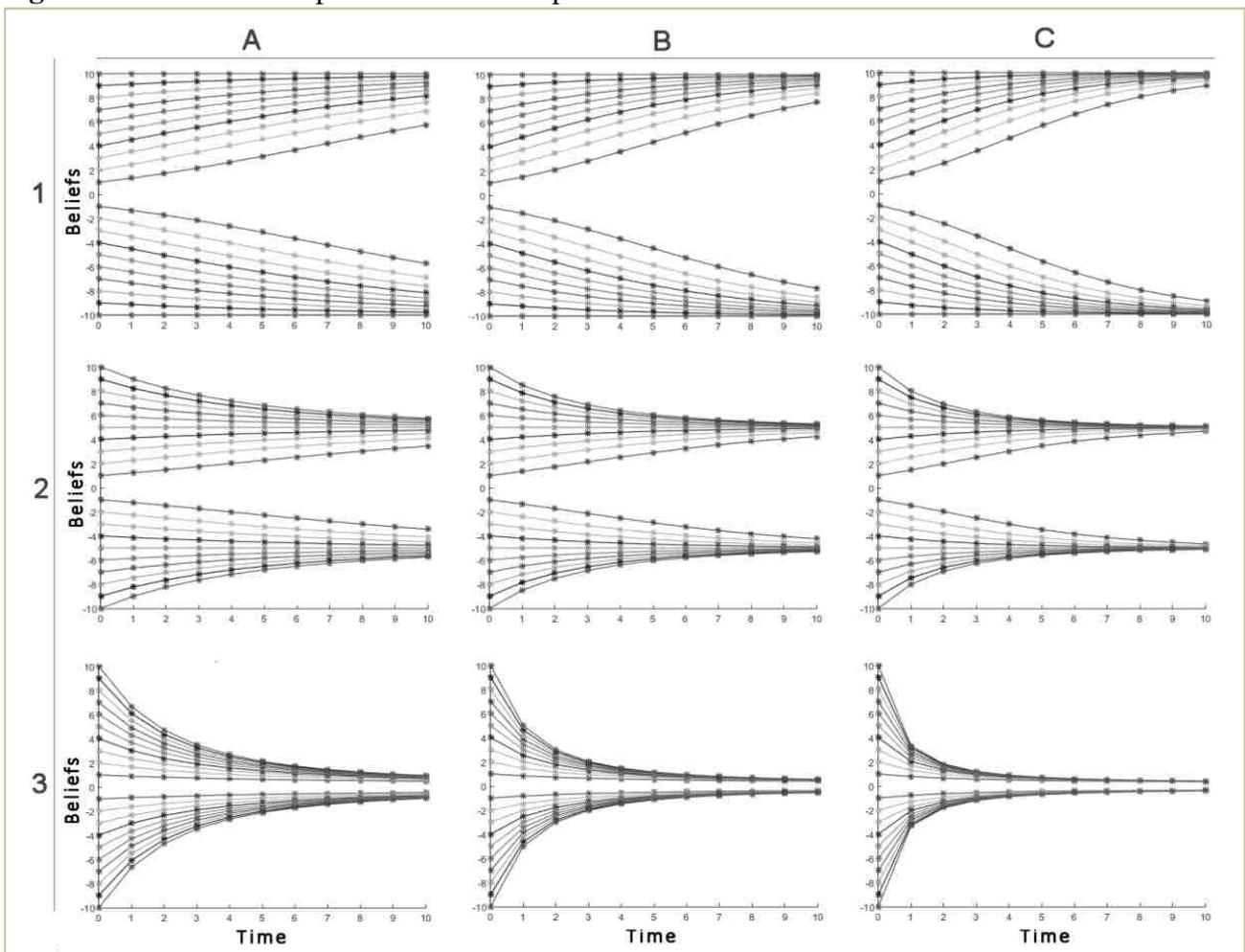
Figure 6 illustrates different simulations of belief updating in which the value of information corresponds to the functions included in Figure 5. In line with previous demonstrations, if voters attribute information a value that is higher than their priors (Line A), they will ultimately converge towards the extremes of the attitude spectrum, thus displaying a typical pattern of polarization. However, if some voters attribute more value to information, while other attribute more value to their priors (Line B), this will lead voters to converge at a more moderate point of the attitude spectrum (in this case, at the values of 5 and -5). Thus, while those with weak priors will become more extreme, those with strong priors will become more moderate. This case represents a mix case of both polarization and depolarization, in which voters will ultimately converge at two different points of the attitude spectrum. Finally, if all voters attribute more value to their priors than the information received, they will ultimately converge at the mid-point of the spectrum, similarly to the case described in Figure 4.

<sup>5</sup> More precisely, the functions in Figure 5 correspond to the following equations, in which  $x_1$  corresponds to the evaluation of information (the values on the Y-axis) and  $\hat{\theta}_0$  corresponds to voters' priors: Line A:  $x_1 = (2 - \log_{10} |\hat{\theta}_0|)\hat{\theta}_0$ ; Line B:  $x_1 = (1.7 - \log_{10} |\hat{\theta}_0|)\hat{\theta}_0$ ; Line C:  $x_1 = ((1 - \log_{10} |\hat{\theta}_0|)/1.5)\hat{\theta}_0$ .

**Figure 5.** Evaluation of information by prior attitudes (non-linear functions)



**Figure 6.** Simulations of polarization and depolarization of attitudes



Note. Simulations based on Equation 4. The value of  $b$  is given by the functions in Figure 5: Line A (first row), Line B (second row), Line C (third row). Column A:  $\sigma_x^2 = 2\sigma_0^2$ ; Column B:  $\sigma_x^2 = \sigma_0^2$ ; Column C:  $\sigma_0^2 = 2\sigma_x^2$ .

### *Hypotheses and moderating factors*

These simulations reveal that voters can either polarize or depolarize in response to information depending on the *magnitude* of their bias. Although voters' certainty about their priors and the reliability of the information signal would affect the speed of the attitude formation process, it will not affect, however, the ultimate outcome of either polarization (Figure 3) or depolarization (Figure 4). Following this reasoning, therefore, we can advance two alternative hypotheses:

Hypothesis 2A: Provision of a mixed set of arguments will lead to polarization of attitudes if voters assign disproportionately more value to confirmatory evidence compared to their priors.

Hypothesis 2B: Provision of a mixed set of arguments will lead to depolarization of attitudes if voters assign disproportionately more value to their priors compared to the evidence.

With regard to the experimental designs presented in this article, these hypotheses imply that the distribution of attitudes in the information condition (treatment group) will be either more polarized (H2A) or less polarized (H2B) than the distribution of attitudes in the condition of no information (control group).

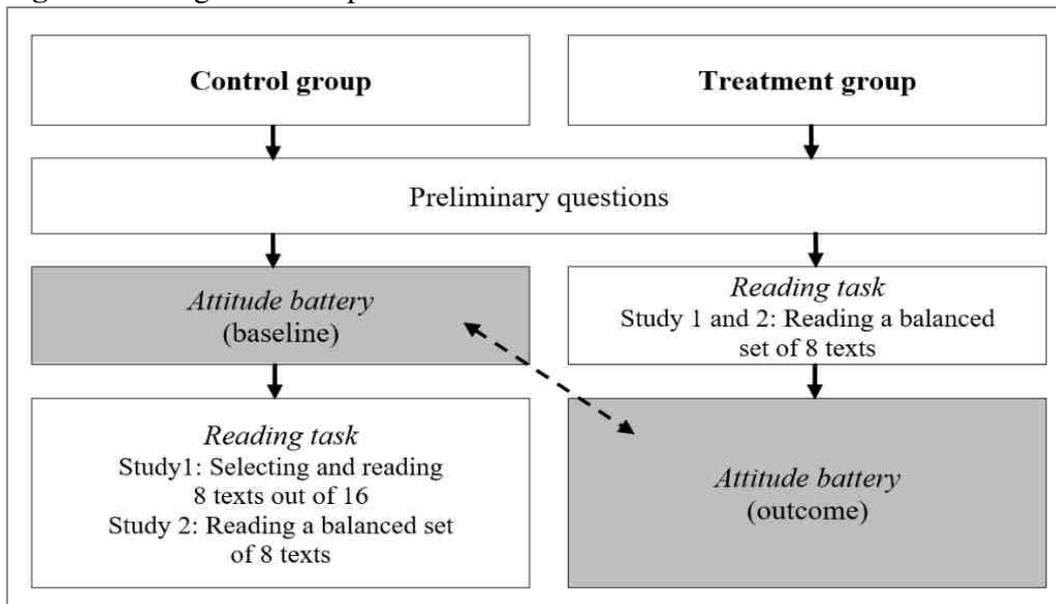
Recent studies have identified several elements that affect evaluation of political information at the individual level, including, for example, partisanship (Bisgaard 2015; Bolsen, Druckman, and Cook 2014; Mullinix 2016; Slothuus and de Vreese 2010), ideology (Rogowski and Sutherland 2016), and anxiety (Groenendyk 2016; Redlawsk, Civettini, and Emmerson 2010). In the context of a referendum, in which voters are required to cast a vote on a specific issue instead of a party or a candidate, we can expect both the strength of prior attitudes on the referendum issue and the level of political knowledge to crucially moderate response to information. With regard to prior attitudes, evidence shows that individuals with strong priors are more likely to discount counter-attitudinal messages and polarize in response to mixed evidence than those with weak priors (Leeper 2014; Taber and Lodge 2006; see also Mullinix 2016). Thus, if exposure to information leads to attitude polarization, we should expect this outcome to occur especially among those with more extreme positions on the referendum issue:

Hypothesis 3: Voters with strong priors will be more likely to polarize than those with weak priors due to a stronger confirmation bias in the evaluation of evidence.

## Design

The analysis draws on two experimental studies conducted during high-stake referendum campaigns in the UK: the campaign for the 2014 Scottish independence referendum<sup>6</sup> (Study 1), and the campaign for the 2016 EU-membership referendum<sup>7</sup> (Study 2). The choice of these consultations draws on two elements that arguably make information an essential element for opinion formation: the extreme salience of the referendum issues and the crucial consequences of the vote – such as becoming an independent state or breaking the long-lasting bond with the European Union.

**Figure 7.** Design of the experiments



Both studies rely on a between-subject design, in which those assigned to control reported their attitudes *before* reading a set of arguments, while those assigned to treatment reported their attitudes *after* reading. As illustrated in Figure 7, this particular design allows to identify a) the influence of prior attitudes on information processing, by analyzing how the participants in the control groups

<sup>6</sup> The referendum was held on 18 September 2014 (No votes to independence: 55.3%).

<sup>7</sup> The referendum was held on 23 June 2016 ( “Leave votes”: 51.9%).

evaluated the arguments; and b) the effect of information on attitudes, by comparing the aggregate distribution of pre-reading attitudes in the control groups with the distribution of post-reading attitudes in the treatment groups. The adoption of such a between-subject design aims to rule out learning issues and confounding factors that are typically associated with within-subject designs (see Morton and Williams 2010: 92; Druckman et al. 2011: 18), especially when participants are asked to report their attitudes twice in a very short period of time<sup>8</sup>.

### *Study 1: the Scottish independence referendum*<sup>9</sup>

Study 1 was conducted at BLUE Lab, University of Edinburgh, from 28 April to 2 May 2014. The pool consisted of 118 participants – mostly university students (95 percent of the participants, median age = 22) and females (69 percent). The participants were all resident in Scotland (median number of years living in Scotland = 4) and eligible to vote in the referendum. Randomization was carried out within sessions<sup>10</sup>.

As illustrated in Figure 7, in the first stage all the participants replied to a preliminary set of questions including a political-knowledge battery<sup>11</sup> and an 11-point attitude relevance scale,<sup>12</sup> which was introduced as a proxy for measuring participants' strength of priors.<sup>13</sup> In the second stage, those

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<sup>8</sup> Stating one's own attitude immediately before exposure to information stimuli can prove problematic, because "prior beliefs serve as a cognitive anchor that impedes appropriate and efficient updating based on new information" (Levy 2013: 310).

<sup>9</sup> The experiment was designed and conducted in collaboration with Céline Colombo. List of questions and information stimuli available in Appendix B.

<sup>10</sup> For randomization checks, see Appendix A.

<sup>11</sup> The battery included four true/false questions on British and Scottish politics and eight questions of factual knowledge related to the referendum (such as stating the eligibility criteria for the vote). For the complete list of questions, see Appendix B.

<sup>12</sup> The question was worded as follows: "How much do you personally care about the issue of Scottish independence?" Answers ranged from 0 ("do not care at all") to 10 ("absolutely care"), Mean = 7.25, SD = 2.13.

<sup>13</sup> Attitude relevance constitutes one of the key dimensions that have been frequently associated with attitude strength (see for example Krosnick and Petty 1995, 5-7). Results from Study 1 show that in the control group (in which prior attitudes could be measured) attitude relevance is significantly correlated with strength of priors (Cronbach's alpha = 0.74).

assigned to treatment read and evaluated four texts supporting independence and four texts against independence presented sequentially in random order. Evaluation of the arguments has been measured by asking the participants to rate the strength of each arguments on a 0–10 scale after reading the texts.<sup>14</sup> Values have been combined in a single evaluation index ranging from -10 to 10, with positive values indicating higher rating of pro versus con arguments (and vice versa for negative values).

All the texts had been created on the basis of a content analysis of British media, and policy reports published between September 2013 and April 2014. The information material was pre-tested in a pilot survey with a convenient sample (N=50) and with expert interviews in order to present only the strongest arguments from both sides of the campaign. Each text contained around 200 words with no mention of media sources, political candidates or political parties, in order to remove possible “cueing” effects. Crucially, during the experiments the participants were clearly instructed that the reading material they were provided contained no fictional information, but only arguments taken from publicly available sources.

Immediately after reading the information material, those assigned to the treatment group replied to an attitude battery of six 11-point-scales, which aimed to measure how “extreme” participants were in either supporting or rejecting independence<sup>15</sup>. In line with previous studies (Taber and Lodge 2006, 758), these scales have been combined into an additive index of attitude extremity rescaled from -10 to 10, with values below 0 corresponding to con attitudes and values above 0 corresponding to pro attitudes.

Those assigned to the control group firstly replied to the same attitude-battery presented in the treatment group, and subsequently chose, read and evaluated eight texts based on a list of 16 headlines presented in a random order. This list corresponded to eight texts in favor of independence and eight texts against independence, and included the same texts presented in the treatment group. The participants carried out the task sequentially, meaning that they selected one headline, read the corresponding text, and then repeated the same task for eight times. The task

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<sup>14</sup> Following Taber and Lodge (2006, 759), the participants had been explicitly encouraged to keep their opinions separated from the evaluation of the arguments. The question was worded as follows: “How weak or strong do you believe the argument contained in this text is? Please note: we want to know how weak or strong you believe the argument is, not whether you agree or disagree with the argument.”

<sup>15</sup> List of questions available in Appendix B.

aimed to test whether the participants displayed a confirmation bias when selection of evidence was possible.

### *Study 2: the EU-membership referendum*<sup>16</sup>

Study 2 replicated and extended the design adopted in Study 1. The study was conducted online with a pool of participants recruited by CESS Lab at Nuffield College, University of Oxford. In this case, the experiment was conducted in two waves. In Wave 1 (27 May - 5 June 2016), the participants replied to a brief survey, which included a political-knowledge battery<sup>17</sup> and a measure of prior attitudes on Britain's EU membership.<sup>18</sup> The actual experiment was carried out in Wave 2 just a few weeks before the referendum, in the period between 9 and 13 June 2016. A total of 172 participants who were all resident in Britain and eligible to vote took part in both waves. Contrary to Study 1, the pool included a mixed set of respondents in terms of age (median age = 34, SD = 15.1; female = 63%), with only a third being students. The choice of a mixed pool of participants aimed to increase variation in the attitudes toward Britain's EU membership, since opinion polls indicated that young and highly educated voters were predominantly in favor of the EU.

The information material included eight texts of 100 words each, with four texts supporting Britain's EU membership, and four texts opposing it. The texts had been selected after pilot testing 16 pro and anti-EU arguments with a convenient sample of 80 participants, and did not include any mention of media sources, politicians or political parties. The entire information material had been created after a content analysis of the articles published between January and April 2016 in major British newspapers.

As in Study 1, after reading and evaluating<sup>19</sup> the information material, the participants in the treatment group replied to an attitude battery of six 11-point-scales that were combined in a single attitude

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<sup>16</sup> List of questions and information stimuli available in Appendix C.

<sup>17</sup> The battery included six knowledge questions of British politics and four questions of factual knowledge related to the European Union (see Appendix C).

<sup>18</sup> The question was worded as follows: "On a scale from 0 to 10, how do you feel about Britain's membership of the European Union?" Answers ranged from 0 ("Britain should definitely Leave the European Union") to 10 ("Britain should definitely Remain in the European Union").

<sup>19</sup> The evaluation question in Study 2 replicated the question included in Study 1.

extremity index<sup>20</sup>. On the other hand, those assigned to control firstly reported their attitudes, and secondly read and evaluated the same set of eight texts presented in the treatment condition. By “forcing” all the participants to read the same texts, Study 2 aimed to test whether they displayed a confirmation bias in the evaluation of the evidence even in the absence of selection.

Due to the similarities between Study 1 and Study 2, in the next section I will present the results from both studies side-by-side.

## **Results**

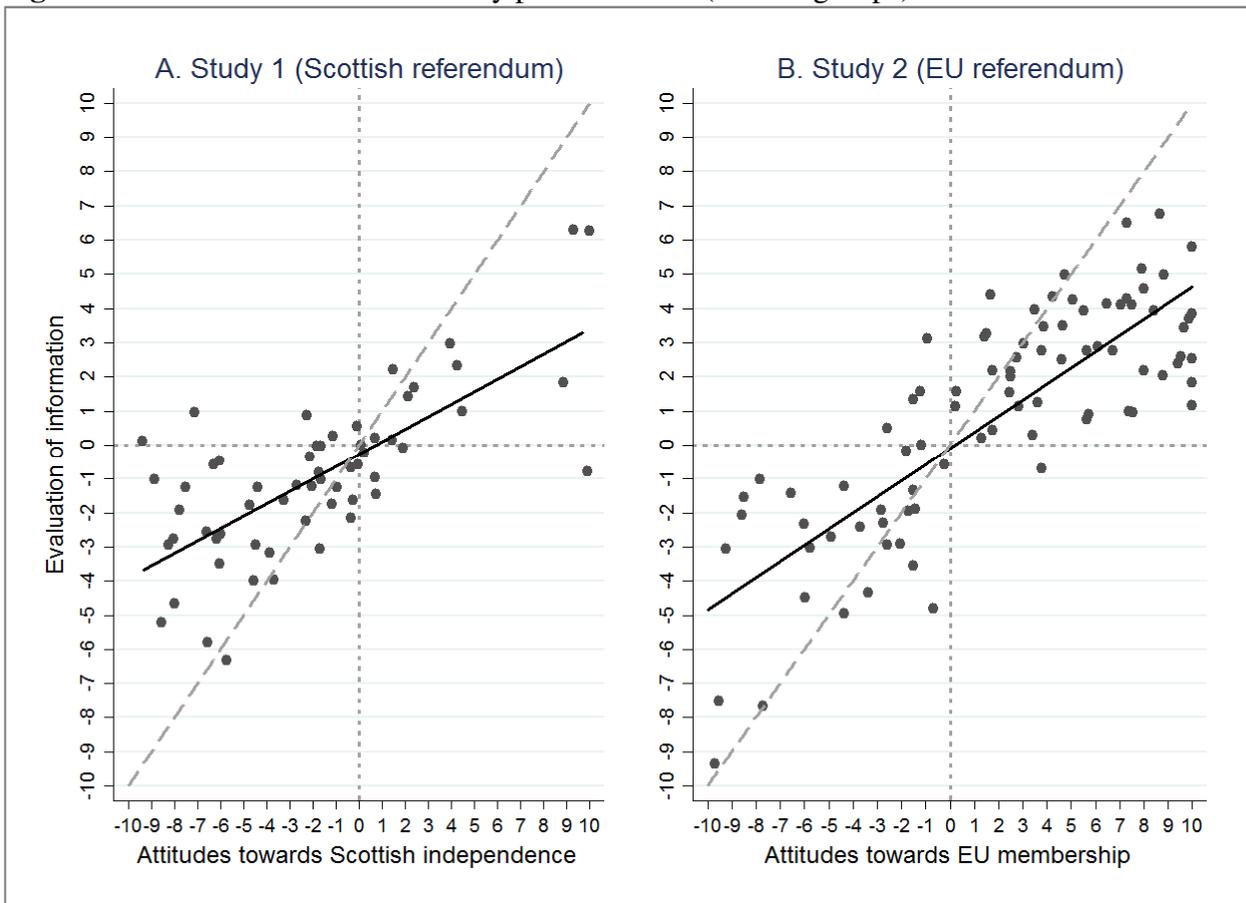
### *Information processing*

The first step of the analysis takes into consideration only on the participants from control groups. Figure 8 illustrates how these voters evaluated the information material depending on their attitudes. The plots reveal a strong correlation in both studies between participants’ priors – as measured on the attitude-extremity index described above – and evaluation of information (Study 1,  $R^2=.523$ ; Study 2,  $R^2=.654$ ). As the linear regression lines show, the more participants are in favor of either Scottish independence or EU membership, the higher they value the arguments supporting these issues (and vice versa for those who oppose them). In this sense, evaluation of information represents a clear function of participants’ priors, even when all participants read exactly the same material (Study 2). Further analysis from Study 1 confirms that the participants displayed a confirmation bias also in the selection of the arguments, since both pro- and anti-independence participants tended to select more reinforcing than challenging texts (see Table 4 in Appendix A). These results support Hypothesis 1 and show that also in referendum campaigns and even in the absence of explicit party cues, voters display a clear confirmation bias in the evaluation of evidence.

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<sup>20</sup> List of questions available in Appendix C.

**Figure 8.** Evaluation of information by prior attitudes (control groups)



Note: participants from control groups only (Graph A: N=59; Graph B: N=86). X-axis: values from -10 (strongly against Scottish independence/EU membership) to 10 (strongly in favor of Scottish independence/EU membership). Y-axis: positive values indicate higher rating of pro-independence/pro-EU membership than anti-independence/anti-EU membership arguments (and vice versa for negative values). For regression models, see Table 4 in Appendix A.

Regression lines in Figure 8, however, indicate that, despite giving more weight to confirmatory evidence, participants evaluated the information material as less convincing than their priors, since in both studies the slope is positive but smaller than 1 (Study 1,  $b=0.37$ ; Study 2,  $b=0.47$ ). Following theoretical predictions (H2B), therefore, we would expect the attitudes in the information condition (treatment) to be *less* polarized than the attitudes in the control condition of no information.

Furthermore, analysis of attitude strength indicates that, contrary to expectations, those with strong priors do not display a larger confirmation bias compared to those with weak priors, as measured by the steepness of the slope in Figure 8. Although the differences between those with strong and weak priors are not statistically significant, data in Table 1 suggest that those with strong priors

(especially in Study 2) give less value to confirmatory information relative to their priors than those with weak priors.

**Table 1.** Correlations between attitude extremity and evaluation of information by strength of priors

<i>Attitude relevance</i> (Study 1)		<i>Attitude strength</i> (Study 2)	
Low	High	Low	High
0.38 (0.087)	0.36 (0.057)	0.51 (0.068)	0.45 (0.049)

Note: Average marginal effects based on OLS regressions of evaluation of information on the interactions between attitude extremity and attitude relevance. Participants from control groups only. All coefficients are significant at the 0.01 level ( $p < 0.01$ ). Standard errors in parentheses.

### *Effects of information on distribution of attitudes*

In the second step of the analysis, I compared control and treatment groups with the aim of identifying the effect of information on the aggregate distribution of attitudes. Preliminary analysis in Table 2 indicates that in both studies the distribution of attitudes in the control group differs significantly from a normal distribution, while the same cannot be said for the distribution of attitudes in treatment groups.<sup>21</sup> In addition, in Study 2 the variance in the treatment group is significantly lower than in the control group, meaning that the participants in the information condition are less spread out along the attitude spectrum. These comparisons suggest that in the information conditions, attitudes are more clustered around the mean and less spread out (Study 2) than in the conditions of no information, thus suggesting a lack of polarization in the treatment groups.

**Table 2.** Distribution of attitudes across groups

	<b>No information (control)</b>			<b>Information (treatment)</b>		
	Mean	SD	Normality test <sup>†</sup>	Mean	SD	Normality test <sup>†</sup>
<b>Study 1</b> (N)	-1.98 (59)	4.72	0.011	0.11 (59)	4.83	0.550
<b>Study 2</b> (N)	1.99 (86)	5.58	0.031	1.50 (86)	4.70	0.107

<sup>21</sup> If polarization occurred in the information conditions, we would expect attitudes at least not to be normally distributed.

*Note.* Attitudes measured on the attitude extremity index (values from -10 to 10). Levene’s test for equality of variance between control and treatment conditions: Study 1:  $p=0.445$ ; Study 2:  $p=0.018$ .

† P values for Shapiro-Wilk test for normality (the lower the p value, the less likely the distribution is normally distributed).

To test whether information moderated participants’ attitudes, in the next step I folded the extremity index at the zero point, thus creating a one-sided attitude-extremity measure, with values ranging from 0 (maximum moderation) to 10 (maximum extremity either in favor or against a referendum issue). Table 3 presents the results from regression analysis in which one-sided attitude extremity is the dependent variable. The key independent variable “Information” corresponds to a dummy with value 1 for those assigned to treatment, and value 0 for the control group. The models estimate whether being in the treatment conditions is associated with an increase in attitude extremity, controlling also for a series of key covariates that are linked to extremity, such as Scottish identity (Study 1), EU identity (Study 2), and support for the main parties supporting the referendums, i.e. the Scottish National Party (SNP) in Study 1 and the United Kingdom Independence Party (UKIP) in Study 2.

**Table 3.** Effects of information on attitude extremity

	Study 1 (Scottish referendum)			Study 2 (EU referendum)		
	(1)	(2)	(3)	(1)	(2)	(3)
<b>Information</b> (treatment group)	-0.12 (0.526)	-0.36 (0.509)	-0.74* (0.451)	-1.10** (0.461)	-0.99** (0.438)	-0.69* (0.388)
Scottish identity (Study 1) / EU identity (Study 2)		0.80 (0.706)	-0.43 (0.653)		1.42*** (0.472)	0.55 (0.434)
Pro SNP (Study 1) / Pro UKIP (Study 2)		2.26** (1.047)	1.76* (0.923)		5.06*** (1.066)	3.60*** (0.962)
Medium political knowledge		0.42 (0.561)	-0.35 (0.509)		0.51 (0.548)	0.47 (0.483)
High political knowledge		1.81** (0.714)	0.46 (0.667)		0.78 (0.520)	0.46 (0.460)
Attitude relevance (Study 1) / Attitude strength (Study 2)			4.14*** (0.703)			3.37*** (0.484)
Constant	4.10*** (0.372)	3.42*** (0.491)	2.45*** (0.461)	5.03*** (0.326)	3.40*** (0.521)	2.34*** (0.484)
R <sup>2</sup>	.001	.130	.337	.033	.184	.370
N	118	118	118	172	171	171

*Note.* OLS regressions. Dependent variable: one-sided attitude extremity, ranging from 0 (maximum moderation) to 10 (maximum extremity). Political knowledge: terciles, reference category equal to low

knowledge. Attitude relevance/attitude strength: quartiles rescaled from 0 to 1. Scottish identity, EU identity, pro SNP, pro UKIP: dummy variables.  
Standard errors in parentheses. \*  $p \leq 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

In Study 1, the negative sign of regression coefficients indicates that provision of information reduced attitude extremity compared to a control condition of no information. Although in Model 1 and Model 2 the difference between the two groups is not statistically significant, when attitude relevance is introduced in Model 3, the size of the average treatment effect increases, reaching statistical significance. Regression models from Study 2 confirm that also in the case of the EU referendum information reduced attitude extremity. In Model 1 and Model 2, the coefficient indicates that exposure to information significantly reduced extremity by around 10 percentage points compared to the control group. When strength of priors are introduced in the analysis (Model 3), the difference between control and treatment condition is smaller, but still statistically significant. By controlling for participants' prior attitudes as reported in Wave 1, Model 3 provides a robust estimate of the moderating effect of information on participants' extremity of attitudes. Interestingly, the fact that the size of regression coefficients from both Models 3 in Study 1 and Study 2 is extremely similar indicates that in two different referendum campaigns provision of information led to a very similar effect in terms of moderation of attitudes.

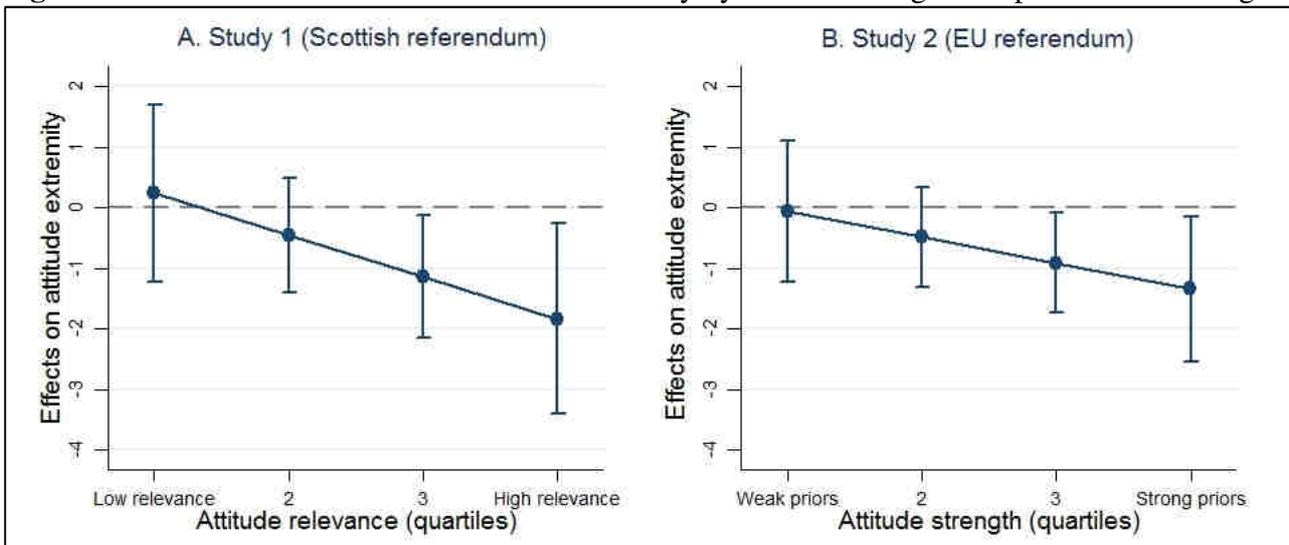
In line with Hypothesis 2B, these results confirm a depolarizing effect of information on attitudes towards referendum issues (especially in the case of the EU referendum), despite clear biased processing of campaign arguments. Drawing on the theoretical framework, the explanation for this (apparently) puzzling finding lies in the fact that the participants give more value to confirmatory than counter-attitudinal arguments, but this value is lower than the one attributed to their prior positions.

In the last step of the analysis, I tested whether treatment effects changed depending on participants' strength of priors, by introducing an interaction in the regression models in Table 3.<sup>22</sup> Figure 9 illustrates the average marginal effects calculated on these models, with 95% confidence intervals. The graphs illustrate how provision of information affected one-sided attitude extremity compared to the control group (value 0 on the Y-axis).

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<sup>22</sup> Regression models available in Table 5 in Appendix A.

**Figure 9.** Effects of information on attitude extremity by attitude strength and political knowledge



Note. Average marginal effects with 95% confidence intervals. Positive values on Y-axis correspond to increased attitude extremity, while negative values correspond to lower attitude extremity (moderation). Calculations based on OLS regressions (see Table 5 in Appendix A).

Graph A and Graph B reveal a striking similarity: in both referendum campaigns, exposure to a balanced set of arguments significantly moderated attitudes among those with stronger feelings towards Scottish independence (Study 1) and those with stronger priors on the issue of Britain’s EU membership (Study 2). Despite being in line with the first step of the analysis, these results contradict the expectation that polarization should occur especially among those with strong priors (H3).

## Discussion and conclusion

By analyzing the link between confirmation bias and attitude polarization, this study provides a theoretical and an empirical contribution to research on motivated reasoning and public opinion. In line with the idea that “moderation occurs when motivated reasoning is low” (Conroy-Krutz and Moehler 2015, 584) and with theoretical models showing that “when individuals have low bias ... the opinion formation process is depolarizing” (Dandekar, Goel, and Lee 2013, 5794), the analysis in this article demonstrates that attitude convergence can be reached even if voters filter evidence through the lens of their priors, as long as they believe that such evidence is not as strongly in favor of an issue (or against an issue) as they were in their initial positions. The key message is that biased voters can moderate their political attitudes as long as they are not completely *blind* to the

arguments from the other side. As specified by Gerber and Green (1999, 199), “we do not expect critics of new information to be altogether unmoved by it.”

The experimental evidence presented in this study extends our knowledge of motivated reasoning within a real context of political decision-making – i.e. referendum campaigns – in which previous studies have highlighted the importance of campaign arguments (e.g. Hobolt 2009; Kriesi 2005; de Vreese 2007). The fact that depolarization occurred in high-stake referendum campaigns, in which we would expect polarization of attitudes to be particularly likely to occur, sheds a positive light on the possibility of information to reduce voters’ radicalization. In addition, the fact that moderation of attitudes occurred especially among those with strong priors suggests that stimulating voters to consider both sides of a debate can reach the desired effect of smoothing extreme attitudes in the electorate. A possible explanation of this finding lies on the fact that these voters give less weight to confirmatory evidence relative to their starting positions than those with weak priors, although further research is needed to support this claim.

In light of these findings, two final points are worth mentioning. The first one concerns the definition of biased voters. According to a common assumption of Bayesian learning, “unbiased” individuals should evaluate new evidence independently from their priors (Fischle 2000; Mutz 2006; Taber and Lodge 2006). However, consider, the case of an individual who has already dedicated time to evaluate the pros and cons of a referendum proposal and has almost decided how to vote. If she received additional pro and con messages, would a perfectly balanced evaluation of these messages be an indicator of rationality or would it rather be a sign of inconsistency? Clearly, this is not to argue that the evaluation of evidence should be fully subjective. The key point, instead, is that “rational” information processing should be interpreted with regard to a trade-off between accuracy and effort, as already suggested by Stroh (1995). In this sense, it should be clear that motivated reasoning does not necessarily mean biased reasoning (Leeper and Slothuus 2014, 138). In a context of political decision-making, confirmation biases might be a legitimate occurrence of voters’ caution towards accepting counter-attitudinal arguments at face value.

A final remark concerns the external validity of these findings. It is true that in a high-choice media environment (Prior 2007), voters have numerous possibilities to filter out counter-attitudinal messages, thus reducing the potential moderating effect of information. However, in the online media environment, voters are also more likely to be “accidentally” exposed to news from different sources (Chadwick 2009; Kim, Chen, and Gil De Zúñiga 2013; Valeriani and Vaccari 2016),

despite the presence of information filtering. In line with analysis by Leeper (2014), this study suggests that it is evaluation of information – rather than choice – that plays a crucial role in the dynamics of opinion formation. By showing that even motivated voters can moderate their attitudes in response to evidence, this study invites to reconsider negative evaluations of motivated reasoning, and indicates that information can actually smooth the extreme fringes of the electorate during intense political campaigns.

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## Appendix A. Additional analysis

**Table 4.** Regressions of prior attitudes on evaluation and selection of the arguments

	Study 1 (Scottish referendum)				Study 2 (EU referendum)	
	<i>Evaluation</i>		<i>Selection</i>		<i>Evaluation</i>	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Prior attitudes</b>	0.37*** (0.046)	0.37*** (0.046)	0.12** (0.052)	0.12** (0.052)	0.47*** (0.037)	0.47*** (0.038)
Prior knowledge of the arguments		-0.09 (0.076)		0.01 (0.086)		0.12 (0.100)
Constant	-0.03 (0.024)	-0.04 (0.025)	0.01 (0.026)	0.01 (0.028)	-0.10 (0.222)	-0.05 (0.225)
R <sup>2</sup>	.523	.534	.091	.092	.654	.660
N	59	59	59	59	86	86

*Note:* OLS regressions, participants from control groups only. Dependent variables: mean rating of pro-independence/pro-EU arguments minus mean rating of anti-independence/anti-EU arguments (columns 1, 2, 5 and 6); number of selected pro-independence arguments minus number of selected anti-independence arguments (columns 3 and 4). All values rescaled from -10 to 10.

Prior attitudes: values from -10 (strongly against independence/EU membership) to 10 (strongly in favor of independence/EU membership). Prior knowledge: from -10 (knowledge of only anti arguments) to 10 (opposite pattern).

Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Table 5.** Effects of information on attitude extremity (interactions with attitude strength)

	<i>Study 1</i>	<i>Study 2</i>
	(1)	(2)
Information (treatment group)	0.93 (1.093)	0.36 (0.850)
Attitude relevance (Study 1)	1.72 (0.309)***	1.34 (0.224)***
Attitude strength (Study 2)		
Information * attitude relevance/strength	-0.69 (0.413)*	-0.42 (0.306)
Political knowledge (ref: low knowledge)		
Medium knowledge	-0.30 (0.506)	0.48 (0.482)
High knowledge	0.65 (0.671)	0.46 (0.459)
Scottish identity (Study 1)	-0.39 (0.649)	0.54 (0.433)
EU identity (Study 2)		
Pro SNP (Study 1)	1.88 (0.918)**	3.80 (0.970)***
/ Pro UKIP (Study 2)		
Constant	0.24 (0.765)	0.642 (0.693)
R <sup>2</sup>	.354	.378
N	118	171

*Note.* OLS regressions. Dependent variable: one-sided attitude extremity, ranging from 0 (maximum moderation) to 10 (maximum extremity). Attitude relevance/attitude strength: quartiles. Political knowledge: terciles, reference category equal to low knowledge. Scottish identity, EU identity, pro SNP, and pro UKIP: dummy variables.

Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Table 6.** Summary statistics and randomization checks

<i>Study 1 (Scottish referendum)</i>			
	Control (N=59)	Treatment (N=59)	P-values
Female	71.2%	66.1%	0.552
Scottish identity	11.9%	20.3%	0.210
Pro-SNP party ID	3.4%	10.2%	0.143
Age	22.90 (4.57)	24.42 (8.74)	0.237
Attitude relevance (0-1)	0.71 (0.22)	0.75 (0.23)	0.305
<i>Study 2 (EU referendum)</i>			
	Control (N=86)	Treatment (N=86)	P-values
Female	61.6%	64.0%	0.752
European identity	65.1%	61.2%	0.283
Pro-UKIP party ID	4.65%	4.65%	1.000
Age	37.6 (16.2)	35.1 (13.9)	0.286
Prior attitudes (0-1) (Wave 1)	0.65 (0.34)	0.65 (0.31)	0.962

*Note.* P-values for the differences between treatment and control group. Female, Scottish identity/EU identity, pro-SNP/pro-UKIP party ID: p values for Pearson's Chi-squared test. Age, attitude relevance/prior attitudes: p values for two-tailed t-tests, with standard deviations in parentheses.

## **Appendix B. Questions and information stimuli used in Study 1 (Scottish independence referendum)**

### *Main variables used in the experiment*

#### **Attitude relevance**

Q: How much do you personally care about the issue of Scottish independence?

A: 0 (Do not care at all) / ... / 10 (Absolutely care) / Don't know

#### **Attitude battery (items used to create the attitude extremity index)**

Q: How strongly do you agree or disagree with the following statements? Please reply by using the scale below, where 0 means "Strongly disagree" and 10 means "Strongly agree".

[Random presentation]

1. Scotland should become independent even if this resulted in short-term economic losses for Scotland.
2. Scotland should become independent even if this meant losing research funding from UK-based sources and raising tuition fees for Scottish universities
3. Scotland should become independent even if Westminster granted Scotland the maximum level of devolution
4. Scotland should remain part of the UK even if the Westminster government decided to leave the EU
5. Scotland should remain part of the UK even if, as an independent state, it would be wealthier due to its oil reserves and natural resources
6. Scotland should remain part of the UK even if the Tories will win the 2015 election and continue to be in government

A: 11-point scale from 0 "strongly disagree" to 10 "strongly agree" / Don't know

#### **Political knowledge**

Q: For each of the following statements, please tell us if it is true or false

[items]

1. The longest time allowed between general elections in the UK is four years (false)
2. Britain has separate elections for the European Parliament and the British parliament (true)
3. The current number of Westminster constituencies for Scotland is about 30 (false)
4. The current number of members of the Scottish Parliament is about 130 (true)

A: True / False / Don't know

Q: On which day will the Scottish referendum take place?

A: 16 September 2014 (0) / 17 September 2014 (0) / 18 September 2014 (1) / 19 September 2014 (0)

Q: What is the minimum age to be eligible to vote in the Scottish independence referendum?

A: 14 years (0) / 16 years (1) / 18 years (0) / 21 years (0)

Q: If the YES-votes will have the majority in the referendum, there will be a transition period before Scotland actually becomes independent. How long will that transition period presumably be?

A: 6 months (0) / 12 months (0) / 18 months (1) / 24 months (0)

Q: Which of the following groups of citizens are eligible to vote in the Scottish independence referendum?  
[items]

1. British citizens resident in Scotland
2. Citizens of the Commonwealth countries resident in Scotland
3. Scottish citizens living in the rest of the U
4. Citizens of any country of the European Union resident in Scotland
5. Scottish citizens living outside the UK

A: Eligible / Not eligible / Don't know

### **Evaluation of the arguments**

(Note: this question was repeated after each text)

Q: How weak or strong do you believe the argument contained in this text is? Please note: we want to know how weak or strong you believe the argument is, not whether you agree or disagree with the argument.

A: 0 (Extremely weak) / ... / 10 (Extremely Strong) 10 / Don't know

### **Prior knowledge of the arguments**

(Note: this question was repeated after each text)

Q: Have you heard this argument before?

A: Yes / No

### *List of the headlines presented in the experiment*

<i>Groups</i>	<i>Pro-independence arguments</i>	<i>Anti-independence arguments</i>
Both groups	With a Yes vote Scotland's future will be in Scotland's hands	As part of the UK today Scotland has the best of both worlds
	Energy-rich Scotland would be wealthier as an independent state	Breaking the UK single market puts Scottish business at risk and may cost many jobs
	Under independence Scotland will gain a stronger role in the EU	An independent Scotland would face a mountain of problems to be part of the EU
	Independent Scotland's universities would avoid funding cuts and gain a stronger reputation	Leaving the UK would threaten Scotland's research funding and kill off free tuition fees
Control group only	Scotland's healthy public finances will make Scots better off independent	Scots worse off? Tax hikes and spending cuts will be cost of independence
	Only independence can guarantee a nuclear-weapons-free Scotland	Defence and security will be diminished by independence
	Independence will mean fairer and more equal Scotland	The only way to keep the pound is staying in the UK
	Young people have most to gain in building a future on independence	A No vote means continuing the success story of Scottish devolution

*Information stimuli (texts presented in the experiment)*

[Text 1]

**With a Yes vote Scotland's future will be in Scotland's hands**

A Yes vote will guarantee that Scotland's future will be in Scotland's hands. Decisions about Scotland will be taken by the people who care most about it – those who live and work here. This vote is a colossal opportunity given to very few in the course of history. People all over the world, dead and alive, would have loved to achieve independence for their country by doing something as straightforward - and, importantly, as peaceful – as voting in a polling booth. Independence isn't about supporting a specific political party: it's about supporting self-determination and having the right to freely elect the government the majority of Scottish actually want, whatever political color it may have. Independence, therefore, would address a profound democratic deficit in Scotland, by replacing the current Westminster system in which Scottish representatives make up just 9 per cent of the 650 MPs. At its heart independence is about a fundamental choice: the people of Scotland will have the power to build a country that reflects their priorities as a society and their values. It will no longer be possible for governments to pursue policies against the wishes of the Scottish people. Independence will put the people of Scotland in charge of their own destiny.

[Text 2]

**Energy-rich Scotland would be wealthier as an independent state**

Scotland disposes of the largest oil reserves in the EU as well as huge renewable energy potential. Investment in the oil and gas sector is at a record level of £13.5 billion this year, and planned future investment is estimated at £100 billion. Production is expected to extend beyond the middle of the century. In terms of wholesale value, North Sea reserves could be worth £1.5 trillion – a greater value than the amount extracted to date. With 25% of Europe's total tidal energy potential, 25% of its wind energy potential and 10% of its wave energy potential, Scotland has also a huge potential in renewable energy. This has the power to reindustrialise Scotland, bringing more jobs and greater prosperity. However, under successive Westminster governments this energy wealth has not been invested, instead it has gone straight to the UK Treasury. Independence gives Scotland the opportunity to harness this energy wealth for the people of Scotland. All the evidence demonstrates that an independent Scotland would be one of the wealthiest countries in the world. It would be the 14th wealthiest nation in the developed world by GDP per head of population, four places higher than the UK as a whole.

[Text 3]

**Under independence Scotland will gain a stronger role in the EU**

It is no longer possible, even if it were before, to argue that Scotland is more likely to end up outside the EU if it leaves the UK. By far the bigger threat to Scotland's membership of the EU is if it chooses to remain a part of the UK. The whole UK seems increasingly likely to leave the EU and the EU referendum, planned by the Conservatives before 2017, offers the very real prospect of Scotland being dragged out of the EU against its will. The people of Scotland are generally more outward-looking and pro-European than the electorate in other parts of the UK. Therefore, voters in Scotland who prefer to remain within the EU would be better served to vote Yes to independence. A Yes-vote will also give Scotland the capacity to participate at every level in the EU legislative and policy process. An independent Scottish Government will, for the first time, be able to promote Scottish economic interests directly at the EU level, participate fully in the Europe 2020 growth agenda, and participate on equal terms as all other member states in EU affairs. The only way to guarantee EU-membership and a stronger role for Scotland at the EU level is a Yes vote at the referendum.

[Text 4]

**Independent Scotland's universities would avoid funding cuts and gain a stronger reputation**

Scotland is home to some of the world's oldest and most prestigious universities and research at Scottish universities is among the most highly cited per capita in the world. An independent Scotland will be in a stronger position, as a sovereign nation state, to promote Scottish higher education. A dedicated overseas diplomatic and trade network for example could enhance Scotland's visibility on the international stage. With an enhanced international profile, Scottish institutions will be able to attract leading research talents from around the world. Moreover, under independence, Scotland would collect its own taxes and be completely responsible for its own funding arrangements – unlike the present situation which sees annual cuts being imposed by Westminster. With an increasingly anti-EU and anti-immigrant UK government, the principles of Scottish higher education have been under threat. The relentless reduction in public spending, the current pressures to reduce university support in England even more, and the privatisation of universities in England through fees will lead to knock-on reductions in public funding in Scotland. A Yes vote is the only way to avoid these threats, guarantee full control over higher education spending, and strengthen the international profile of Scotland's universities.

[Text 5]

**As part of the UK today Scotland has the best of both worlds**

The world has grown ever closer but ever more complicated. Climate change. Extreme poverty and conflict around the world. Terrorism. Competition from new economic powers like Brazil, India and China. In this age of globalisation, countries in every corner of the world are looking at closer integration - at finding new ways to work together. Scotland, in the United Kingdom, has blazed that trail. They have knitted together the communities of these islands in a way that builds collective strength while preserving different identities. There is a sense of Scotland which is bigger than the parochialism of the nationalists. By combining all the talents so much more can be achieved than could ever be done acting alone. The UK will always be about being part of a social union that reaches across generations and borders. Where one can feel as much a part of the community in Edinburgh, as in East London, or Somerset. Rather than searching for ways to divide people who have stood shoulder to shoulder for hundreds of years throughout history, people across the UK should go united. They are stronger and safer as part of the United Kingdom and they can act as a powerful force for good in the world.

[Text 6]

**Breaking the UK single market puts Scottish business at risk and may cost many jobs**

As it stands, the UK is a true domestic single market with no internal barriers. Splitting this market, by introducing a border of whatever form, will introduce a barrier to the free flow of goods, capital and labour to the detriment of firms, workers and consumers in both states and risks making it more challenging to attract overseas investors. The unified market is viewed as a key driver for businesses in Scottish sectors such as financial services, professional services, energy, food and drink. Just a 1 per cent reduction in exports by Scotland to the rest of the UK would equate to £450 million worth of sales. Indeed, some of Scotland's largest companies have warned that a Yes vote in the independence referendum would guarantee higher costs for business. There is too much uncertainty over a number of factors, including which currency and central bank Scotland would use, the impact of EU membership talks, and the effects of two diverging markets replacing the UK's single market. Banks and insurers would face pressure to move headquarters to a stronger fiscal state with a more certain regulatory backdrop. It's clear that leaving the UK would put at risk the jobs of thousands of Scots.

[Text 7]

**An independent Scotland would face a mountain of problems to be part of the EU**

A newly independent state, breaking away from an existing EU member, Scotland would have to apply as a new member state - meaning that the accession would have to be approved by ALL the other 28 member

states. If even just one country says no, Scotland will not be in. This will be extremely difficult. Some member states may be unwilling to grant opt-outs to an independent Scottish state on measures which they have had to adopt themselves. Others have their own independence movements to consider. Spain, fuelled by a desire to stem Catalonian nationalism in its own territory, could use its veto to prevent permanently a separate Scotland joining. Croatia strictly adheres to the position that all prospective EU members have to undergo a thorough negotiating process. France would even have to hold a referendum to accept the new state. Official EU accession talks with Scotland might not be able to start until the envisaged independence date of 24 March 2016, and with such discussions potentially lasting 18 months or more, it could prolong uncertainty around the economic outlook. Tough negotiations would lie ahead on issues such as the UK's current multi-billion-pound budget opt-out, the Schengen "open borders" area, and agricultural policy.

[Text 8]

**Leaving the UK would threaten Scotland's research funding and kill off free tuition fees**

Scotland has more universities in the world top 200 per head of population than any other country in the planet, but these universities need to be properly funded. Independence threatens the survival of one of Scotland's most keenly defended and popular policies: guaranteeing free university tuition for all Scottish students. At present, English, Welsh and Northern Irish students can be charged to study in Scotland since they come from within the same EU member state – the UK. And thanks to devolution within the UK. But what if the rest of the UK becomes a different EU state, can Scotland keep discriminating against its citizens? Charging tuition fees to students from the rest of the UK in an independent Scotland would break European law against discrimination of member states' citizens. Ending that arrangement would be a disaster. It could cost Scotland £150m extra. What is more, Scotland's scientific research funding could be threatened by a break from the UK. While Scotland's population share is 8.4%, it wins 10.7% of research grant funding. An independent Scotland could lose £210 million each year in research funding from UK based sources, which would seriously hamper the research conducted by Scotland's world class universities.

## Appendix C. Questions and information stimuli used in Study 2 (EU referendum)

*Main variables used in the experiment (Wave 1)*

### **Prior attitudes**

Q: On a scale from 0 to 10, how do you feel about Britain's membership of the European Union?

A: 0 (Britain should definitely Leave the European Union) / ... / 10 (Britain should definitely Remain in the European Union) / Don't know

### **Political knowledge** (partially adapted from the British Election Study Internet Panel)<sup>23</sup>

Q: Can you match the following people to their jobs?

*People*

Tim Farron  
Nicola Sturgeon  
George Osborne  
Tom Watson  
Theresa May  
John Bercow

*Answers*

Chancellor of the Exchequer  
Leader of the Liberal Democrats  
Home secretary  
First Minister of Scotland  
Speaker of the House of Commons  
Deputy leader of Labour  
Don't know

Q: How many member states are in the European Union?

A: 26 / 27 / 28 / 29

Q: How many countries are in the Eurozone?

A: 17 / 18 / 19 / 20

Q: Who is the current president of the European Commission?

A: José Manuel Barroso / Donald Tusk / Jean-Claude Juncker / Martin Schulz

Q: Which of the following countries is NOT part of the Schengen area?

A: Luxembourg / Croatia / Switzerland / Denmark

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<sup>23</sup> Fieldhouse, E., J. Green., G. Evans., H. Schmitt, C. van der Eijk, J. Mellon & C. Prosser (2015) British Election Study Internet Panel Waves 1-6.

### **European identity**

(Note: answers recoded as a dummy: Yes (1 and 2), No (3 and 4). Adapted from Standard Eurobarometer 83, Spring 2015)

Q: Do you feel that you are a citizen of the European Union?

A: Yes, definitely (1) / Yes, to some extent (2) / No, not really (3) / No, definitely not (4) / Don't know

### *Main variables used in the experiment (Wave 2)*

#### **Attitude battery (items used to create the attitude extremity index)**

Q: On a scale from 0 to 10, how strongly do you agree or disagree with the following statements?

[Random presentation]

1. The UK should leave the EU even if it reduces UK's role as a world power
2. The UK should leave the EU even if it results in short-term economic losses
3. The UK should leave the EU even if it leads to Scotland becoming an independent country
4. The UK should remain in the EU even if the EU imposes stricter financial rules on the City of London
5. The UK should remain in the EU even if it leads to a rise in immigration from other EU countries
6. The UK should remain in the EU even if the UK has to join the Euro in ten years time

A: 11-point scale from 0 "strongly disagree" to 10 "strongly agree" / Don't know

#### **Evaluation of the arguments**

(Note: this question was repeated after each text)

Q: How weak or strong do you believe the argument contained in this text is? Please note: we want to know how weak or strong you believe the argument is, not whether you agree or disagree with the argument.

A: 0 (Extremely weak) / ... / 10 (Extremely strong) / Don't know

#### **Prior knowledge of the arguments**

(Note: this question was repeated after each text)

Q: Have you heard this argument before?

A: Yes / No

### *Information stimuli (texts presented in the experiment)*

[Text 1]

#### **Remaining in the EU would safeguard British jobs**

The EU safeguards British jobs because it provides access to a market of 500 million consumers and because EU membership attracts foreign firms keen to be part of that market. The attractiveness of Britain as a place to invest is clearly underpinned by its membership of the EU. It is estimated that over three million jobs in Britain are linked, directly or indirectly, to its exports to the European Union. Walking away from Europe's single market would be catastrophic for people's jobs, and would leave households £4,300 worse off, according to estimates. A vote to Remain would safeguard the economic benefits of the EU single market.

[Text 2]

#### **Leaving the EU would lead to massive cost savings for Britain**

Leaving the EU would result in massive cost savings, as Britain would no longer contribute to the EU budget. The UK's net contribution to the EU is the second highest of any member state, with an estimated

contribution of almost £10 billion in 2014. With the savings from leaving the EU, the UK could invest in stimulating the economy and would be able to build a new, fully staffed NHS hospital every week. Freeing the UK from the burden of the costs and regulations from Brussels would make Britain massively more productive at home and more competitive in global markets.

[Text 3]

**A Remain vote will secure Britain's right to free movement in the EU**

While the recent pace of immigration has led to some difficulties with housing and service provision, the net effect for the UK has been overwhelmingly positive. The economy relies on taxes paid by immigrants to fund public services, and limiting freedom of movement would deter the brightest and most entrepreneurial of the continent from coming to Britain. EU membership not only allows British people to live in other member states without having to apply for visas, but also opens up job opportunities for Brits seeking to work in Europe. Only by staying in the EU can Britain secure the benefits of free movement.

[Text 4]

**To control immigration, Britain must leave the EU**

Under EU law, Britain cannot prevent anyone from another member state coming to live in the UK. By leaving the EU, Britain would gain full control of its own borders, with migration in and out of the country regulated solely by British law. That means it would be possible to impose the same entry restrictions on EU citizens as those currently faced by people from outside the EU, meaning that we could select immigrants that have the most to offer to our economy. It would also create jobs for British workers and boost wages, as well as easing pressure on schools, hospitals and other public services.

[Text 5]

**EU membership is vital to Britain's national security**

Being in the EU helps keep Britain safe from terrorism and international crime. EU membership enables the UK to access vital information, such as criminal records, to allow the UK to turn away potential terrorists at the border, fast-track the extradition of criminals and simplify the deportation of prisoners. A Brexit vote could unravel Europe's stability and lead to a chain reaction of nationalism and international instability. By staying in the EU, Britain can be leader of a European foreign policy that addresses the root causes of problems such as terrorism and refugee flows. Remaining in the EU is vital to Britain's national security.

[Text 6]

**Leaving the EU would improve Britain's security**

In the EU, Britain's borders lay open to criminals and terrorists trying to enter the UK from the continent. This makes the whole of the UK vulnerable to terrorist attacks and crimes committed by those from abroad. At present, more than 700 EU migrants per week are convicted of crimes ranging from theft to rape and murder. These rates have risen as the EU has expanded further into Eastern Europe. Outside the EU, the House of Commons will regain its sovereignty and the ability to secure the country's borders and towns. Failure to leave now significantly decreases public safety and endangers the British people.

[Text 7]

**The stronger Britain is in Europe, the stronger it is in the world**

The European Union has helped to reconcile countries which were at each others' throats for centuries. Britain has a fundamental national interest in avoiding future conflict between European countries. And that requires British leadership, and furthermore for Britain to remain a member of the EU. If the UK leaves the EU, it risks becoming a maverick, isolated state, stripped of influence in Brussels, and elsewhere. Britain would find itself increasingly ignored by Washington and sidelined on major transnational issues such as the

environment, security and trade. Europe is Britain's immediate neighbourhood. The stronger Britain is in its neighbourhood, the stronger it is in the world.

[Text 8]

**Outside the EU, Britain can take control of its own destiny**

Leaving the EU will allow Britain to re-establish itself as a global leader with connections to the world outside Europe. Britain has a 'portfolio of power' in its own right, which includes membership of the G20 and G8 nations, a permanent seat on the UN Security Council, leadership of the Commonwealth of 54 nations, and a special relationship with the United States. By remaining in the EU, the UK, which is the fifth largest trading nation in the world and Europe's leading defence power, will continue to lose democratic control, autonomy over its own laws, and influence over its own destiny in the world.