Physiological Arousal and Political Beliefs

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Abstract

It is by now well known that political attitudes can be affected by emotions. Most earlier studies have focused on emotions generated by some political event (e.g., terrorism or increased immigration). However, the methods used in previous efforts have made it difficult to untangle the various causal pathways that might link emotions to political beliefs. In contrast, we focus on emotions *incidental* (i.e., irrelevant) to the decision process, allowing us to cleanly trace and estimate the effect of experimentally-induced anxiety on political beliefs. Further, we build upon innovative new work that links physiological reactivity (Oxley et al., 2008a; Hatemi et al., 2013) to attitudes by using skin conductance reactivity as a measure of emotional arousal. We found that anxiety – generated by a video stimulus –significantly affected physiological arousal as measured by tonic skin conductance levels, and that higher physiological reactivity predicted more anti-immigration attitudes. We show that physiological reactivity mediated the relationship between anxiety and political attitudes.

A wealth of new research on the formation and change of political beliefs has begun to establish what pollsters, campaign managers and candidates have long known: emotions lie at the heart of political campaigns (Glaser and Salovey, 1998; Marmor-Lavie and Weimann, 2006). Campaigns design television (Brader, 2005) and print (Chang, 2001) ad campaigns to play upon our emotions (Ridout and Searles, 2011) and candidates' own emotions 'leak out' and affect how they are perceived (Sullivan and Masters, 1988; Glaser and Salovey, 1998). As the centrality of emotions (and emotional appeals) in politics has become more generally accepted, the focus has naturally turned to a new question: *how* do emotions affect political judgment and behavior?

We follow the path of Brader et al. (2008b), Ladd and Lenz (2008), Brader (2011), Civettini and Redlawsk (2009), Gadarian (2010) and others in focusing on anxiety and its effects on political beliefs and preferences. Anxiety is attractive to researchers both because of its strong, documented effects on the judgment and choices of the voting public, and because the manipulation of this emotion figures so prominently in modern political campaigns (Jerit, 2004). However, research on anxiety and political beliefs –whether using large panel datasets, exogenous events or experimentally varying the type of outgroup discussed in mock political coverage (respectively: Marcus and MacKuen, 1993; Huddy et al., 2005; Brader et al., 2008b) –has typically suffered from a common methodological problem: the emotions in question are *generated by political information or events.* This makes isolating the effect of emotions in these studies is difficult, since the political information that acts as the stimulus is likely to affect political attitudes in a variety of ways besides through emotion (such as through learning or ideology, see Hatemi et al., 2012). Even if the self-reported emotions used are statistically significant predictors of attitudes, it is still difficult to estimate *how much* work is being done by emotions rather than via alternative (and perhaps unobserved) causal pathways. We trigger anxiety (and measure it using physiological reactivity) using a video stimulus unrelated to politics in order to cleanly estimate the 'pure' effect of anxiety on

political beliefs about immigration.

We contribute in two critical ways to the literature on emotions and politics. Our first contribution, in the area of measurement, is built upon two complementary methodological innovations. First, we focus on experimentally-induced anxiety that is *incidental* to the political judgment being made. This allows us to cleanly identify the effects of anxiety on political beliefs without any confounding informational effects (such as might occur if the emotion induction contained politically-relevant information). This helps to provide important confirmation of the importance of anxiety for political beliefs. It also provides important verification for the notion that incidental emotions may 'carry over' to affect even political beliefs (this was established in Small and Lerner, 2008, but has not been a major focus of the literature on emotions in politics).

This is complemented by our use of skin conductance reactivity as a physiological measure of emotional arousal and/or anxiety. Skin conductance reactivity is best conceived as a generalized measure of emotional arousal (i.e., emotions other than anxiety might also trigger high levels of arousal), so we used a video stimulus commonly used in the past to trigger anxiety and conducted a separate manipulation check study to verify that other emotions were not inadvertently triggered as well. This allowed us to use physiological arousal as a measure of anxiety and bypass the more commonly-used self-reported measures of emotion, which are subject to both impression management on the part of subjects, as well as inaccuracy due to subjects basing their responses on implicit causal theories rather than 'true introspection' (Nisbett and Wilson, 1977).

Our experimental design follows naturally from –and builds upon –recent work, which has tackled the links between emotions (incidental or otherwise), physiological arousal and political beliefs, but often separately from one another. Oxley et al. (2008a) showed that trait differences in physiological reactivity to environmental threats unrelated to politics can predict political beliefs, but did so without implicating emotions as a factor in influenc-

ing *state* physiological arousal. Halperin et al. (2013) and Hatemi et al. (2013) show that emotions (and our ability to regulate and manage them) may predict political beliefs, but without using incidental emotions to further isolate their impact on attitudes. Small and Lerner (2008) did incorporate the use of incidental emotions to study their effect on political beliefs, but without the advantages in measurement that come from using physiological arousal as a proxy for anxiety.

Thus, our second contribution is to synthesize these recent developments through the use of an experimental design that incorporates and builds upon these important findings. In doing so, we further develop some of the ideas found in these earlier works and provide additional clarity on the mechanisms that may underpin those patterns. We also answer the call of Hatemi and McDermott (2012) to broaden political psychology by using novel methods and research strategies to address traditional questions ('what accounts for our political beliefs?'), keeping in mind that 'not everyone reacts to the same stimulus the same way.' This last observation suggests the importance of accounting for heterogeneous treatment effects through causal mediation. We find that our experimental manipulation induces physiological changes which in turn influence attitudes towards immigration policy. More specifically, anxiety –the effect of which was transmitted through increased physiological arousal– increased hostility toward immigrant out-groups.

1 Emotions and Politics

1.1 Incidental Emotions and 'Carry-over' Effects

We use the appraisal tendency framework (ATF) as an overarching theoretical scaffolding for our research because it focuses our attention on both the *way* that emotions enter into the decision process and the differential effects of specific, 'discrete' emotions (Lerner and Keltner, 2000). The latter observation is now commonplace, as a focus on 'mood' or valence'

can be misleading given that similarly-valenced emotions can have diverging behavioral consequences (Lerner and Keltner, 2001; Lerner et al., 2003; Litvak et al., 2010).

On the former issue, current research has suggested a division between emotions that are *integral* (i.e., normatively related) to the decision process, and emotions that are *incidental*, or unrelated, to the decision at hand (Loewenstein and Lerner, 2003). Most research on emotions and politics has focused on integral emotions, which include both predicted emotional reactions to certain events ('expected' emotions') or the actual emotional reactions that are experienced during a decision process ('immediate' emotions).

In stark contrast, *incidental* emotions are those that are unrelated to the decision at hand, but often 'carry-over' to unrelated domains and affect the judgments and decision-making of individuals in critical and often unappreciated ways (Lerner and Keltner, 2000; Lerner et al., 2004). We use these 'carry-over' effects as leverage to cleanly measure the 'pure' effects of a particular emotion (anxiety) on political beliefs. 'Carry-over' effects describe what occurs when emotions influence subsequent judgments by giving rise to an instinctual predisposition to appraise future events in line with the key themes associated with the original emotion. As an illustration, selling one's stock in a company because the CEO's reckless spending makes you angry illustrates an *integral* emotion; anger is in this case relevant to the decision at hand (buying or selling that company's stock). However, if you sell your stock in that same company because a driver cut you off on your morning commute, then the emotion that is affecting your financial decision-making is irrelevant, and is probably best thought of as a form of 'mental contamination' (Lerner et al., 1998).

1.2 Anxiety, Politics & Prejudice

We focus in this paper on anxiety, which has occupied a prominent place in the literature on both emotions and decision-making as well as its relation to political judgment and behavior (e.g. Huddy et al., 2005; Brader et al., 2008b,a; Gadarian, 2010; Gadarian and Albertson,

2012). Anxiety, under the Appraisal Tendency Framework, is characterized by high uncertainty and lack of control (Smith and Ellsworth, 1985). In response to environmental signals of a potential threat, individuals act to reduce feelings of uncertainty and lack of control that were generated by anxiety (Frijda et al., 1989; Raghunathan et al., 1999). However, because the ATF doesn't necessarily suggest useful hypotheses in the domain of *political* preferences regarding immigration and feelings toward out groups, we turn to the empirical literature to help generate hypotheses.

Broadly, there is strong support for the impact of emotions on policy preferences related to outgroups (Halperin, 2008; Halperin et al., 2009; Reifen Tagar et al., 2011). When there is anxiety that is directed at particular outgroups, that emotion is a strong predictor of prejudicial beliefs (Voci and Hewstone, 2003; Stephan et al., 2006; though situational factors may reverse this relationship, see Spanovic et al., 2010). There is also some preliminary evidence that specific emotional states may lead to automatic prejudice toward outgroup members even when the emotional state is incidental to the judgments being made. Along these lines, DeSteno et al. (2004a) found that incidental anger induced in the lab created automatic prejudice toward an outgroup, while sadness and neutrality resulted in no automatic bias. Similarly, Dasgupta et al. (2009) and Inbar et al. (2012) found that incidental disgust (e.g., a disgusting smell) increased bias against disgust-relevant groups (such as homosexuals) while incidental anger increased bias against anger-relevant groups (such as Arabs). Finally and perhaps most relevantly, Butz and Yogeeswaran (2011) found that economic threats led to more prejudice against Asian Americans, mediated by heightened anxiety.

Based on the appraisal tendency framework and accumulating empirical evidence on the effects of anxiety and intergroup relations, we hypothesize that incidental anxiety should intervene in the appraisal process, triggering prejudice toward outgroup members (i.e., immigrants). More specifically, we predict that physiological (electrodermal) reactivity, as a biological proxy for anxiety, should mediate the relationship between induced anxiety and

the attitudes toward immigrants. Such an outcome would also be consistent with work on negative selective retrieval bias and mood-dependent memory, which suggest that subjects who experience heightened anxiety will be likely to recall more negative experiences with immigrations and interpret ambiguous information in a more negative and threatening manner (Bower, 1981; Broadbent and Broadbent, 1988; Burke and Mathews, 1992).

2 Methods

2.1 Participants and Procedure

We recruited 138 male[1] adults (Mage=22.8, SD=4.6) from the Cambridge, Massachusetts area for a study that took place at the Harvard Decision Science Laboratory. After completing the consent process, research assistants applied sensors to subjects individually to measure physiological reactivity. To measure electrodermal reactivity, two electrodes were attached to the palm of the non-dominant hand (Blascovich et al., 2011) and tonic skin conductance level (SCL) was recorded continuously throughout the study.

Following the application of sensors and verbal instructions, subjects completed the study at individual computer terminals. Participants were told that they would answer two unrelated surveys. Each survey appeared first approximately 50% of the time, and there were no order effects on any of our outcome variables. At the beginning of each survey, subjects watched a video (2m49s) featuring relaxing images of beaches and palm trees with calm music in the background to measure physiological responses at baseline.[2] The entire survey was conducted using the Qualtrics online survey platform.

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[1]There are important sex differences in how females respond on physiological dimensions to emotionally-arousing stimuli (Kring and Gordon, 1998) and so we focus on males only to reduce the influence of such differences on our statistical analysis. Focusing on only males eliminates the potential confounding effect of gender that –even with a control variable –would reduce the efficiency of our estimates. The strategy of focusing on one gender in psychophysiology studies is common. See, for example, McDermott et al. (2009); Dindo and Fowles (2011), which use male-only samples, and Giuliani et al. (2008), which uses a female-only sample.

[2]All videos used in the project may be viewed online at `http://jonathanrenshon.net`.

One common issue in psycho-physiological studies is knowing exactly what a subject is seeing or doing at any given moment in order to integrate physiological recordings with survey responses and experimental treatments. In other words, researchers want to use convenient online survey platforms, such as Qualtrics, but there was no (existing) efficient way to link these to the proprietary software (sometimes located on a different computer) that typically captures physiological signals. To address this issue, we designed a program which allowed the survey software on the subject's computer to send 'event-markers' via the computer's parallel port to the computers recording the physiological signals. Each event-marker was unique and contained information about what was happening in the study, allowing us to integrate physiological analysis with a more traditional survey platform (Qualtrics).

The first part of the survey recorded several demographic variables and some pre-treatment ideology markers (e.g. party identification). Each subject was randomly assigned to read one of two stories about immigration. This does not figure centrally in our analysis, but represents an effort to expose subjects to at least two different immigration 'frames.' The frames are reproduced in Appendix B. In our analysis we show that these frames did not differentially impact the physiological or preference measures.

Following this, subjects were randomly assigned into one of three potential treatment conditions, each of which watched a different video.[3] Thus, the overall design was 2 (story: Jose/Niko) X 3 (video: Relax/Neutral/Anxiety) between-subjects. In the *Relax* condition, subjects watched a video (3m46s) entitled 'Crystal Chakra Meditation' in which soothing music is played over visuals of abstract shapes and colors. In the *Neutral* condition, subjects watched a video (2m41s) of a screensaver of abstract shapes (no sound).[4] Finally, in the

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[3]This design was used in order to also pilot the application of the parallel encouragement design discussed in Imai et al. (2012). As stated above, however, the story frames did not have a measurable impact on our outcome or mediator measures, perhaps because of changing attitudes towards the immigration groups in question in the time elapsed since they were used successfully in Brader et al. (2008b).

[4]In theory, the additional length of the *Relax* video might have had some unintended impact on the subjects. In practice, this condition was dropped in order to more cleanly compare *Anxiety* to *Neutral*, which are of roughly equal length.

Anxiety condition, subjects watched a clip (2m32s) from the film 'Cliffhanger.' The film depicts a character played by Sylvester Stallone attempting to rescue a female mountain climber who is dangling over a precipice attached only by a metal carabiner to a single rope (though in the film the woman does fall to her death, the clip shown to subjects ends before that occurs). This specific film clip has been demonstrated to be a reliable way of inducing anxiety (Fredrickson and Branigan, 2003; for more on the general use of film clips to induce emotional states, see Hubert and de Jong-Meyer, 1990 and for the use of other, related emotion inductions, such as music, see Zentner et al., 2008). We also conducted a separate manipulation check for the film clip, the results of which are described in Section 2.2.

It is worthwhile to reiterate briefly here the advantage attendant in using *incidental* emotions to study the impact of emotions on political beliefs. One approach we might take would be to induce anxiety by asking participants to think about the terrorist attacks of 9/11. The problem with such an approach is that –while it is likely to generate anxiety –the emotions it triggered would be related to political beliefs and perceptions about outgroups. A similar problem would occur if we induced anxiety by asking participants to read a document about globalization and the economy: any anxiety we measured would be impossible to disentangle from the informational effects of the stimulus. We bypass this problem by using a stimulus (the 'Cliffhanger' video) that is unrelated in any way to the outcome of interest (immigration preferences/political beliefs), but which nevertheless has been demonstrated to be a reliable way of inducing anxiety in subjects.

Following the video manipulation, we asked two sets of questions.[5] The first set of questions related to emotions, and asked: 'Now, moving on, we would like to know how you feel about increased immigration. The following questions will ask how you feel when you

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[5]The 'separate task' paradigm is extremely common in the experimental sciences and subjects rarely guess the true relationship between the manipulation (video) and the surveys that generally follow (see, e.g. Bodenhausen et al., 1994; Tiedens and Linton, 2001). This is especially true in cases such as this one when the manipulation has no substantive relevance for the surveys that follow.

think about the high levels of immigration to this country.' Subjects were then asked to rate their feelings on a 4 point scale (Not at all, A little, Somewhat, Very) for the following emotions: anxious, proud, angry, hopeful, worried and excited. We also asked several questions in which subjects recorded their level of agreement/disagreement (on a five point scale from Strongly Agree to Strongly Disagree) with statements relating to immigration (sample statement: 'Immigrants should only be allowed to take jobs that cannot be filled by American workers'). All immigration questions are borrowed from Brader et al. (2008b, $\alpha = .67$, see Appendix A for all items) to maximize comparability. The experimental procedure is depicted in Figure 1.
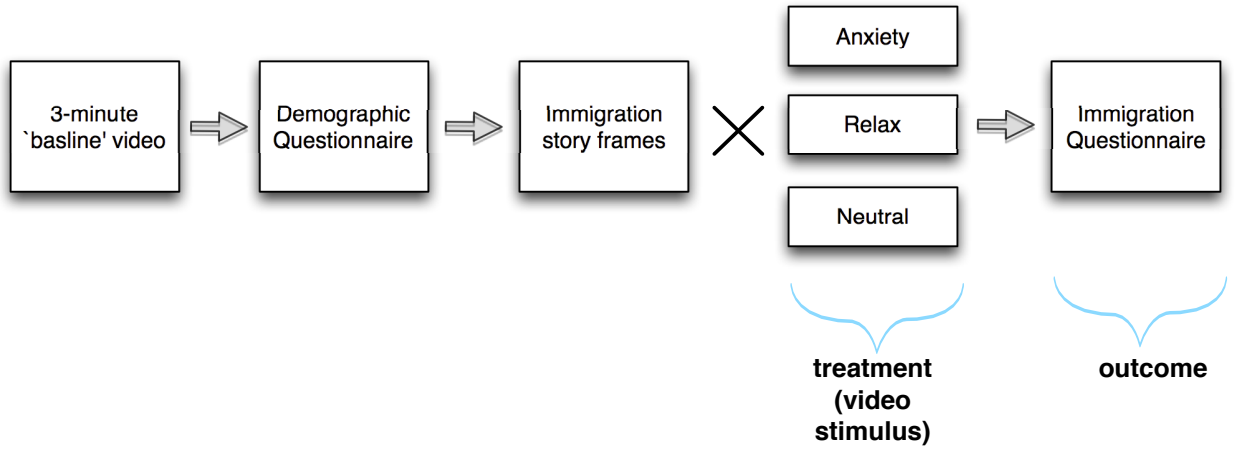

Figure 1: **Experimental Design**

While SCL was recorded continuously, we use physiological reactivity *during the immigration questionnaire* as our mediator. More detail on our rationale for this is contained in Section 3.3.

2.2 Physiological Data Collection & Analysis

Emotions, once triggered, are accompanied by physiological changes that occur without our control, and sometimes without our awareness (Safta et al., 2011). In particular, emotional arousal can trigger both the sympathetic (SNS) and parasympathetic (PNS) nervous system

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(Blascovich et al., 2011). This property of emotions allows us to measure them directly (as opposed to self-report measures) using physiological signals. The principal advantage of using physiological signals is that they are free from demand characteristics or impression management, and more easily interpreted than facial expressions or speech analysis (van den et al., 2009).

One common measure, employed here, is tonic skin conductance level (SCL; distinct from another common measure, skin conductance responses, SCR, which measure changes within a short period of time, in response to a particular stimulus).[6] In particular we focus on *reactivity* (relative to baseline). SCL variations are determined by the quantity of sweat secreted by the eccrine sweat glands (Sequeira et al., 2009), and have been used as measures of attention and arousal for over a century (for reviews, see Christie, 1981; Sequeira and Roy, 1997).

In linking the anxiety generated by the film clip to patterns of physiological arousal, there are two questions to disentangle: (1) what specific emotions, if any, are triggered by the stimulus and (2) how fine a measure of emotions is skin conductance? On the former question, we rely on previous research which has used film clips to induce specific emotions (Gross and Levenson, 1995) and has used this particular film clip to stimulate anxiety (Fredrickson and Branigan, 2003). We conceptualize anxiety as 'undirected aversive arousal' which is distinguished from similar emotions (such as fear) by lacking a clear object (Ohman, 2000).[7]

On the latter question, we recognize that skin conductance and broader patterns of physiological reactivity are best conceptualized as generalized[8] measures of emotional arousal,

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[6]While common throughout psychology, this is a somewhat novel method for political science, but recent examples can be found. See, for example, Mutz and Reeves (2005) and Mutz (2007), which use it as a general measure of arousal, and do not link it to a specific emotion.

[7]For an excellent review of the differences between fear and anxiety –and the typical conflation of the two in both clinical work and research –see Sylvers et al. (2011).

[8]One potential issue is that emotional arousal is one of several physiological processes that can affect SCL. In addition to its association with heightened arousal and anxiety, increased skin conductance may

rather than as indicators for specific emotions (Hubert and de Jong-Meyer, 1991).[9] Thus, while our measure of physiological arousal is unlikely to allow us to distinguish between different discrete emotions, the targeted nature of the (previously validated) stimulus gives us confidence that we are truly measuring the physiological arousal associated with elevated anxiety.

In addition, we conducted a short online experiment in order to serve as an additional manipulation check. The results (pictured in Figure 5, Appendix E) further buttress our claim that (1) the Cliffhanger video stimulus induced anxiety (and not other emotions) and (2) the physiological reactivity that we measured in the main study can be attributed to anxiety in particular, and not other emotions that (in theory, at least) would also increase physiological arousal. Addressing these potential pitfalls allows us to use a measure of arousal that has significant advantages over traditional self-report measures, most notably by rendering ineffective any impression management strategies used by subject in answering questions about how the video made them feel.

All physiological data was collected using two disposable Biopac (Santa Barbara, CA) electrodes (Model: EL507) filled with Biopac Skin Conductance Electrode Paste placed on the palms of the participant's nondominant hand (the thenar and hypothenar eminences). Data were amplified using a gain of $25\mu\Omega$ and a low-pass filter of 5Hz. The tonic skin conductance data were then calculated in microsiemens values using Mindware software EDA module 3.0 (Mindware Technologies, Gahanna, OH) by research assistants who were blind to both the study hypothesis and conditions.[10] Once output into a time series, SCLs were

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also signal increased cognitive effort and attention (Frith and Allen, 1983; Pecchinenda and Smith, 1996). It is for this reason that we use a previously-validated video stimulus.

[9]There is an ongoing debate as to whether certain physiological patterns distinguish discrete emotions. For more, see Cacioppo et al. (2000).

[10]We failed to collect physiological data for 7 participants due to the computer software malfunction. Several participants showed zero reactivity (i.e., no variation at all throughout the study) in their skin conductance levels and were thus excluded from analysis. About 10% of the population have been found to be non-responders (Dawson et al., 2007).

standardized within each participant to address potential differences in variability across participants (see Ben-Shakhar, 1985; Bush et al., 1993).[11] This was done by calculating the following for each subject: (1) average SCL during the first baseline video that a subject watched ('baseline SCL') (2) a measure ('diff SCL') that recorded the difference between SCL at any given moment in the study and the average baseline SCL, then transformed into z-scores (3) after excluding outlier observations that were $> \pm 3$ SD (following generally-accepted practice of detecting outliers, see Hein et al., 2011), we recalculated the mean, SD and z-scores based only on the non-outlier observations. This process ensures that SCL levels are not pulled toward extreme values caused by anomalous spikes in SCL, though our results hold even if we include these rare instances. This process was repeated for each individual. It's important to note that this process merely smoothes outlying SCL readings for a given time interval, but does not drop subjects from the analysis. All analysis thus uses physiological data in which an observation at t_i is equal to the standardized difference, excluding outlier signals, of SCL at $t_{baseline}$ and t_i. In essence, this allows us to ask: how much did a treatment affect SCLs across different conditions, controlling for heterogeneous baseline and reactivity levels across individuals?

3   Results

3.1   Effects of Video Manipulations

We first tested whether our video manipulation impacted subjects' level of physiological arousal. Figure 2 shows skin conductance reactivity during the video playback, by video condition. The *Anxiety* ('Cliffhanger') video manipulation clearly increased physiological arousal relative to both the *Relax* ($t(86) = -6.95, p < .00001$) and *Neutral* ($t(79) = -4.40, p < .00001$) conditions. The *Relax* manipulation appeared to depress physiological

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[11]Sometimes SCL observations are log-transformed if the distribution is significantly skewed. Baseline (raw SCL) observations from this study had skewness values < 0.5, so this step was unnecessary.

arousal relative to the *Neutral* condition, though this difference was only marginally significant ($t(87) = -2.65, p < .10$). This same pattern ($Anxiety > Neutral > Relax$) persists if we measure only reactivity during the time frame when subjects answered questions, but the differences are no longer statistically significant.

Though the 'Cliffhanger' video has been reliably shown to induce anxiety, one potential concern is that –at least for some participants –it may be also priming identification with the ingroup (all the characters in the clip are white). However, the magnitude and direction of the video $\rightarrow$ SCL effect was very similar for the three ethnicities from which most of the subjects were drawn (Caucasian, Asian and African-American). An additional issue concerns what *type* of anxiety is being primed and whether it is a specific and directed anxiety or a more general, abstract anxiety (such as that caused by mortality salience, à la the 'terror management' research program, Schimel et al., 1999). Either of these interpretations is consistent with the argument advanced in this paper, though this observation (there is more than one type of anxiety) should impel researchers to be cautious even when focusing on a single emotion.

The results in Figure 2 show levels of physiological arousal/reactivity by video condition, thus pooling results across story conditions. The story manipulation (in effect, differing primes about immigration) had no obvious effect on physiological arousal, and the patterns depicted in Figure 2 for the video manipulation are consistent across story conditions.[12]

Following the video induction, we asked participants their feelings with respect to immigration. Neither the video manipulation nor the differing information primes (Jose/Niko stories) had any effect on self-reported feeling about immigration.[13] This is interesting in its own right, but is also suggestive of some potential problems that accompany reliance only on self-reported feelings: self-reported feelings with respect to immigration did not seem to

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[12]See Appendix C for physiological arousal across all six conditions.

[13]The video manipulation did increase self-reported anxiety, but the effect did not come close to achieving statistical significance. Full text of these questions is contained in Appendix D
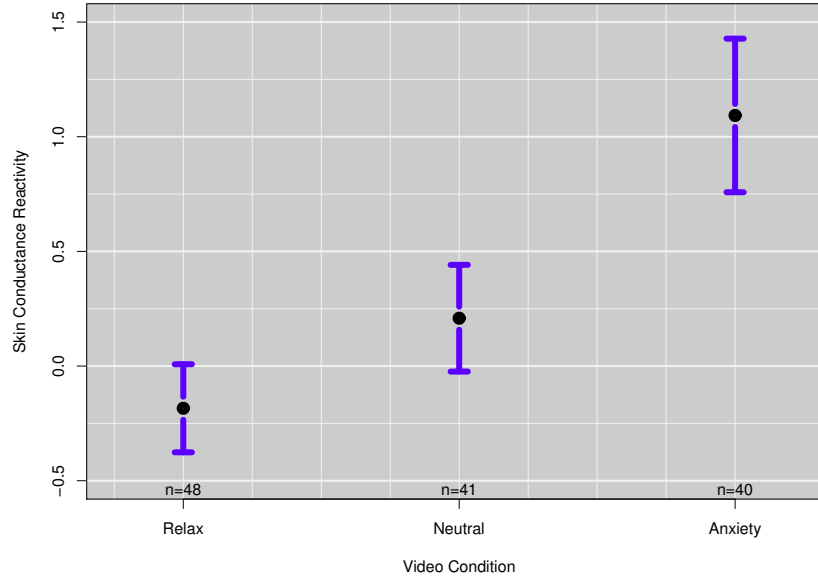
Figure 2: **Means of Skin Conductance Reactivity by Video Condition**. 95% confidence intervals are in blue.

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be impacted by experimentally-induced anxiety, and yet immigration *preferences* (as shown below), were. This is consistent with earlier research on the difficulties of relying upon self-reports if in fact subjects do not actually rely upon 'true introspection' in answering questions, but rather on the basis of implicit causal theories, such as whether their immigration beliefs *should* be affected by reading the Jose/Niko stories (see Nisbett and Wilson, 1977).

3.2   Effects of Physiological Arousal on Immigration Preferences

Table 1 displays two linear regression models that comprise the two 'stages' of a causal mediation model. In Model 1, our measure of skin conductivity is regressed on an indicator variable for the treatment status ('Anxiety Manipulation'). This model conveys the same information displayed in the difference in means analysis, but will be used in Section 3.3 when we conduct a causal mediation analysis. In the second model, immigration prefer-

ences are regressed on skin conductance reactivity and the experimental manipulations.[14] Skin conductance readings for this analysis were taken during the time frame when subjects answered the questions relating to their immigration preferences. Although the analyses described here 'smooth' outlier SCL readings in the manner described earlier, including outlier SCL readings does not alter any of the results described in this paper. In this table, the *Anxiety* condition is compared exclusively to the *Neutral* (control) condition, and the *Relax* condition is dropped.[15] As shown, elevated skin conductance reactivity is a significant predictor of immigration preferences. As the coefficient is positive and statistically significant, the implication is that elevated skin conductance levels predict more anti-immigrant preferences. Unsurprisingly, self-reported beliefs about immigration (focusing only on negatively-valenced emotions like anxiety) predicted preferences related to immigration in every condition (Table 4 in Appendix H). This, by itself is not novel. Yet, in the *Anxiety* condition, physiological arousal remained significant even when controlling for self-reported feeling about immigration. As shown in Model 2 (Table 1), these results hold controlling for the story condition. Here, the story coefficient is positive and significant, but *only* after controlling for the post-story emotion manipulation and SCL.[16]

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[14]The questions related to immigration were averaged to create a composite variable which served as our outcome measure. Higher values indicate greater hostility toward, and suspicion of, immigrants. Principal component analysis revealed a 1 factor solution that explained a substantial amount of the variance (51%; the central factor had an eigenvalue of 2.52 while a possible second factor had a value of 0.82), but results are unchanged using the factor as an outcome measure instead of the mean.

[15]An alternate way of estimating this is to include all observations and estimate effects of dummy variables for *Anxiety* and *Relax* conditions. These results, as well as models that control for demographic differences (e.g. age, ideology, income, etc.) are shown in Figure 2 in Appendix F. The results we discuss here remain unchanged by different estimation strategies.

[16]Within each video condition the story condition did not significantly influence SCL. The story condition only influenced immigration preferences in the anxiety video condition. This may be seen more clearly in Table 3 in Appendix G, which demonstrates clearly that the story frames do not impact either the results themselves or the substantive interpretation.

DV:	(1) SC Reactivity	(2) Immigration Preferences
Anxiety Manipulation	0.339+	-0.277
	(0.195)	(0.178)
Story Condition		0.386*
		(0.176)
SC Reactivity while answering questions		0.232*
		(0.100)
Constant	0.115	1.983**
	(0.137)	(0.138)
N	81	81
r2	0.0368	0.120

Standard errors in brackets

$+p < 0.10, *p < 0.05, **p < 0.01$

Table 1: **Main Results:** Model (1) shows the effect of the treatment (anxiety) on physiological reactivity while Model (2) shows the effects of physiological reactivity on immigration preferences, controlling for the story condition. Both models includes only *Neutral* & *Anxiety* conditions (*Relax* condition is excluded).

3.3   Causal Mediation

Next, we must turn to causal mediation analysis. This allows for estimation of an *average causal mediation effect* (ACME), which can be interpreted as the expected difference in the outcome when the mediator took the value it would realize under the treatment condition as opposed to the control condition, while the treatment status itself is held constant. Of course, we never observe the outcome in both states, but as long as the assumption of sequential ignorability is satisfied, we are still able to estimate this effect, which is termed the 'indirect effect' of the treatment upon the outcome (through the mediator).[17] The 'direct effect' of the treatment upon the outcome (average direct effect, or ADE) is the expected difference in the potential outcome when the treatment is changed but the mediator is held constant.

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[17]Sequential ignorability has two parts. First, we assume that the treatment (here, a video induction) is 'ignorable' or statistically independent of potential outcomes or mediators. As in most experimental studies where treatments are randomly assigned, this is not a problem. Second, we assume that that the mediator (here, physiological reactivity) is also 'ignorable,' and can be treated *as if* it were randomly assigned. This is a much stronger assumption, and not guaranteed to hold even in experimental studies. As suggested by Imai et al. (2010a), we ran sensitivity analyses and our results are relatively robust to potentially confounding pre-treatment covariates. Results for the sensitivity analyses are depicted in Appendix J.

The average treatment effect (ATE) is the sum of the direct and indirect effects. Causal mediation analysis was implemented via the `mediation` package in **R** (Imai et al., 2010b).[18]

The results analysis are depicted in Figure 3.[19] The ACME, or indirect effect of physiological reactivity is positive and marginally significant ($p = .08$), implying that to the extent that the video induction increased anxiety, it led to more anti-immigrant preferences. The causal pathway through physiological reactivity is estimated to account for 41% of the total effect. The direct and total effects are both negative but the confidence intervals overlap with 0.[20] It is worth noting here that while we are confident that anxiety was generated by the video stimulus and led to physiological arousal (which in turn impacted immigration preferences), we cannot say for sure whether other discrete emotions (such as disgust or excitement), or even physical activity (such as running) which generate physiological arousal might not have had similar effects.

Here, we use physiological reactivity measured during the time when participants answered the questions related to immigration. We do this to illustrate how emotions generated by the video outlast the stimulus and bleed over on to –what should be –unrelated judgments about immigration. In fact, classic research on the related subject of emotion and risk has shown that even mundane newspaper accounts of events may trigger significant changes in perceptions of unrelated risks (Johnson and Tversky, 1983). However, one concern might be that it is in fact the immigration questions themselves that are the cause of the physiological arousal (i.e., our mediator is endogenous to the treatment). In fact, using physiological reactivity *during the video stimulus* as our mediator, the results are strengthened even further.

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[18]The literature on mediation analysis is voluminous. For a background on causal mediation analysis using the framework of *potential outcomes*, see Imai et al. (2010a,c, 2011). Because the model is *linear* regression, causal mediation analysis as implemented by `mediation` gives identical results to the product of coefficients methods used throughout linear structural equation modeling (LSEM) (MacKinnon et al., 2002).

[19]Results are even stronger when controls (ideology, age, income, race, education) are included. These results are depicted in Figure 6, Appendix I.

[20]Models that allow for an interaction between the video condition and mediator indicate that the ACME was slightly larger under the 'Cliffhanger' condition.
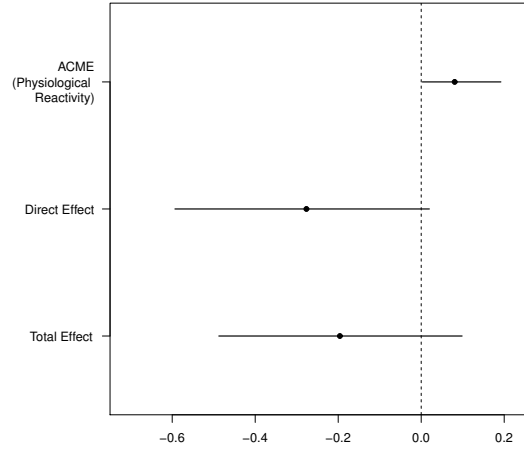
Figure 3: **Causal Mediation Plot**: *Treatment* is anxiety video manipulation (compared to neutral condition), *Mediator* is skin conductance reactivity when answering immigration questions, *Outcome* is composite variable of immigration preferences. Horizontal lines represent 90% confidence intervals for estimates.

In that analysis, the mediator is statistically significant and positive ($p = .07$) and is estimated to account for 80% of the total effect. This is wholly consistent with earlier works on carry-over effects, which show a slight decay over time (DeSteno et al., 2004b). However, we do not emphasize these results because we believe the strength of the research design relies to a great extent on showing the carry over of emotions on to unrelated judgements, which requires empirical demonstration that the physiological effects outlast the original stimulus.

An additional potential concern with our study is that an omitted variable might account for both physiological arousal and immigration preferences. This would violate the 'sequential ignorability' assumption necessary for mediation analysis (Imai et al., 2010c). It could be that people who are anti-immigration just tend to have higher average skin conductance levels. If this were true, this would be unlikely to bias our results, since our SC measure relies on *changes* from baseline, and thus account for differences in baselines SC levels across participants. If, however, the omitted confounder causes both physiological *reactivity* (changes from baseline) and immigration preferences, then the mediation analysis

will be suspect, since it relies on controlling for confounding variables that cause both the mediator and outcome variables.

We address this concern in three ways. First, Figure 6 (Appendix I) presents our mediation analysis controlling for several pre-treatment covariates, including ideology, age, income, race, and education. The results do not change. Second, we included baseline SC as a control in the mediation analysis. If the omitted variable is also related to baseline differences then this helps us control for confounding. Including the baseline SC control variable did not change the mediation results presented above. This corroborates similar patterns of findings by others (e.g. Oxley et al., 2008b) in suggesting that subjects' beliefs about politics (and here, immigration) don't translate to stable physiological differences that we would observe when taking baseline measurements.

Finally, we conducted a sensitivity analysis. While the mathematical details are dealt with elsewhere (Imai et al., 2010c), the basic intuition is that the mediation effect can be calculated for different magnitudes of a potentially omitted variable's impact on the mediator and outcome variables. We present the results in Figure 7 in Appendix J, which uses a model with pre-treatment covariates. The sensitivity analysis is presented in two ways, one (a) where the omitted variable (for example, genetically influenced variation in baseline levels of anxiety, see Hatemi et al., 2013) influences SCL and anti-immigration preferences in the same direction and one (b) where the omitted variable influences these variables but in opposite directions. Under the assumption that the confounder influences SCL and anti-immigration preferences in the same direction, our analysis suggests that for the positive mediation effect to instead be negative, then the confounder must explain 40 percent of the remaining variation in SCL and 20 percent of remaining variation in anti-immigration preferences.[21]

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[21]If, however, we assume that the unobserved confounder is influencing SCL and anti-immigration preferences in opposite directions, as in Figure 7(b), then the sensitivity analysis suggests that the confounder only strengthens our results as we increase the magnitude of variance in SCL and preferences that it explains.

4 Discussion

In support of our hypotheses, the results of the present study indicate that heightened physiological reactivity, measured by SCL, mediated the relationship between anxiety and anti-immigration attitudes. This provides critical evidence that emotions incidental to the decision process can have important effects on our political beliefs. Our evidence for the role of emotions in political beliefs is consistent with previous research on how anxiety/fear could lead to negative selective retrieval bias, which makes anxious individuals more likely to interpret ambiguous information in a negative, threatening manner (Broadbent and Broadbent, 1988; Burke and Mathews, 1992; MacLeod and Cohen, 1993). This is also consistent with earlier work on mood-dependent memory, such Bower (1981) who found that people recalled experiences and information that was 'affectively congruent' with the mood they were in during recall (see also Lord et al., 1979, on 'biased assimilation'). This might have led participants who felt anxious and aroused due to the video induction to have subconsciously interpreted the information on increased immigration as threatening, or recalled more threatening facts about immigration, thus triggering anti-immigration attitudes.

We did not find evidence for a total or direct effect of anxiety on immigration attitudes. The former implies a role for other causal processes operating in opposite directions. The presence of alternative mechanisms that run in different directions to the mechanism of primary interest, which get folded into the ADE, means that it is always possible to get a total effect equal to zero but non-zero mediation effects. MacKinnon et al. (2002, 2007), Zhao et al. (2010), Rucker et al. (2011) and others point this out, and is commonly known as competitive mediation. Future research should explore the role of alternative mechanisms.

One explanation for the non-significant direct effect is that within our sample there existed pre-treatment covariates that moderated the effect of the treatment (i.e., moderated

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This is indicated clearly by mediation effects attached to each contour line, which are all positive and grow more positive in magnitude as more variance is explained.

mediation). We tested for, but did not find any evidence of, moderation effects due to age or ideology. It's possible that in a more expansive sample (one not composed only of younger adult males, or one that was not limited geographically) evidence of a direct effect would be observed, but the technologically-intensive nature of physiological studies precluded us from pursuing this line of inquiry. Such an explanation would be broadly in line with other recent research suggesting the importance of the heterogeneity in how individuals respond to powerful emotional stimuli (see, e.g. Mehta et al., 2008). There is also the possibility that differences in the ability to regulate emotions explain some of the variability in responses to the stimulus (Goldin et al., 2008). This is a promising area for future research to address.

And while our study focused on a very specific question at the intersection of beliefs, emotions and psychophysiology, our results have some relevance for larger questions relating to political psychology. For example, we demonstrate the practicality of isolating the effects of specific emotions by studying 'carry-over' effects in order to minimize other confounding factors. While increasingly common in social psychology, this approach is rarely used in political science, despite its methodological advantages. We also demonstrate the utility of an integrative approach that takes into account not just how subjects *say* they feel, but measures physiological reactivity in order to better triangulate subjects' true emotional response to stimuli. Finally, in recent years scholars of international political economy have increasingly posited a role for non-economic explanations of immigration preferences (e.g., Hainmueller and Hiscox, 2010). To the extent that these arguments operate through emotional pathways, our research highlights the role of anxiety in those explanations.

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Supporting Information (Online only)

A   Immigration Questions

All questions on five point scale anchored by Strongly Agree and Strongly Disagree. Recoded during analysis so that higher values represent more anti-immigrant attitudes.

1. Immigrants should only be allowed to take jobs that cannot be filled by American workers.

2. Immigrants should be allowed to receive government benefits like Social Security and Medicaid.

3. Immigrants increase crime rates.

4. It is impossible for people who do not share American customs and traditions to become fully American.

5. Immigrants improve America by making it more open to new ideas and cultures.

B Immigration Story Frames

Jose Story

Immigration Concerns Governors

Questions Raised About Economic, Cultural Impact of Immigrants

New York (AP)– During the 1990's more immigrants entered the United States than in any previous decade, and the growing number of immigrants in the U.S. clearly has some Americans worried. At a state governors' convention in June, many governors called for the Bush Administration and Congress to step in to restrict the flow of immigrants. Several governors voiced concern that immigrants are driving down the wages of American workers, while taxpayers are forced to meet the rising costs of social services for the newcomers. Governors say these views are shared by many of their constituents.

John Baine, shift manager at a large auto parts factory in Cleveland, said he is angered that "a number of friends have been laid-off or forced to take a pay cut" because of the influx of cheap immigrant labor.

Nancy Petrey, a Boulder, Colo. nurse has seen staff let go for similar reasons. "People give twenty years of their lives to this hospital and then, boom, they're out the door because some foreigner will do their job for half the pay." Patrey said, "It just isn't right."

Governors also say constituents are worried that the country is no longer a "melting pot," because new immigrants are not adopting American values or blending into their new social world.

Mary Stowe, an Omaha-based sales associated, says she is frustrated by the fact the recent immigrants to her areas "do not learn English or make any effort to fit in."

Bob Callaway, a construction supervisor in Newark, says he sees similar problems with immigrants hired by his company. "These people are totally unwilling to adopt American values like hard work and responsibility," Callaway said. "I try not to complain, but sometimes they are so pushy and uncooperative –it's not acceptable."

When asked for his opinion, Jose Sanchez, a recent immigrant from Mexico, says he welcomes the chance for a better life in America. "Many of my cousins find work here and now it's my turn. I want a good job and benefits."

"But," Sanchez added, "that doesn't mean I have to change who I am. We love our culture. I'm proud to be from Mexico."

Jose Sanchez is one of thousand of new immigrants who arrived in the U.S. during the first half of this year.

While there was agreement at the convention that the federal government needs to do more to help states manage the rising tide of newcomers, few governors agree on exactly why immigration levels have increased. Some blame the Immigration Act passed by Congress in 1990, which loosened federal restrictions on immigration. Others point to the fact that large companies are attracting immigrants to the U.S. with the promise of prosperity, a practice that has become widespread in recent years.

Still others maintain that, in a world full of turmoil, people are attracted by the hope of a better way of life. Whatever is bringing immigrants to these shores in record numbers, everyone seems certain that the numbers will continue to grow.

Niko Story

Immigration Concerns Governors
Promise Seen in Economic, Cultural Contributions of Immigrants

New York (AP)– During the 1990's more immigrants entered the United States than in any previous decade, and the growing number of immigrants in the U.S. clearly has some Americans hopeful about the future. At a state governors' convention in June, many governors called for the Bush Administration and Congress to protect the flow of immigrants from further restrictions. Several governors said they are encouraged by how immigrants are helping to strengthen the economy, while also providing a welcome boost to tax revenue. Governors say these views are shared by many of their constituents.

John Baine, shift manager at a large auto parts factory in Cleveland, said he is enthusi-

astic about how much the influx of immigrant labor has "helped the company keep a lid on costs and remain competitive."

Nancy Petrey, a Boulder, Colo. nurse has seen similar benefits for the hospital where she works. "These people take jobs there often hard for us to fill, and they're willing to work shifts that other people don't want," Petrey said. "It's a big help."

Governors also say constituents take pride in the fact that the country is still a "melting pot," where immigrants continue to bring new experiences and ideas that enrich American culture.

Mary Stowe, an Omaha-based sales associated, says she admires what it must take to "leave home and come to a place that is so different, without knowing the language or anything about the way of life here."

Bob Callaway, a construction supervisor in Newark, says he sees similar qualities in the immigrants hired by his company. "These people are determined and persistent," Callaway said. "I've gotta give 'em credit, they'll do what it takes to get ahead. That's something I respect."

Nikolai Vandinsky is one of thousand of new immigrants who arrived in the U.S. during the first half of this year.

When asked for his opinion, Nikolai Vandinsky, a recent immigrant from Russia, says he welcomes the chance for a better life in America. "Many of my cousins find work here and now it's my turn. I want a good job and benefits."

"But," Vandinsky added, "that doesn't mean I have to change who I am. We love our culture. I'm proud to be from Russia."

While there was agreement at the convention that the federal government needs to do more to help states manage the rising tide of newcomers, few governors agree on exactly why immigration levels have increased. Some credit the Immigration Act passed by Congress in

1990, which loosened federal restrictions on immigration. Others point to the fact that large companies are attracting immigrants to the U.S. with the promise of prosperity, a practice that has become widespread in recent years.

Still others maintain that, in a world full of turmoil, people are attracted by the hope of a better way of life. Whatever is bringing immigrants to these shores in record numbers, everyone seems certain that the numbers will continue to grow.
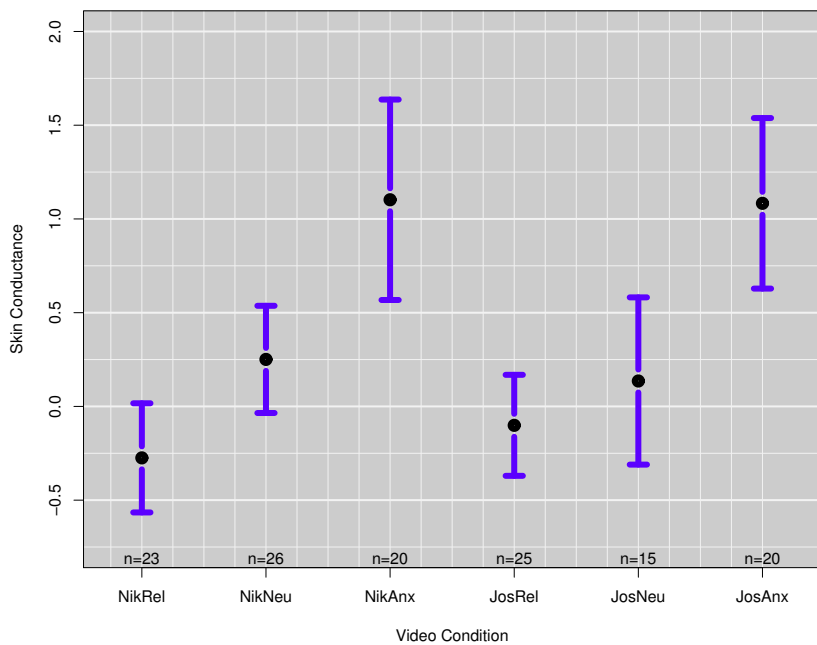
C EDA by Treatment Condition

Figure 4: **Means of Skin Conductance by Treatment Condition**. 95% confidence intervals are in blue.

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D   Self-Reported Feelings About Immigration

'Now, moving on, we would like to know how you feel about increased immigration. The following questions will ask you how you feel when you think about the high levels of immigration to this country.

1. How *anxious* (that is, uneasy) does it make you feel?

2. How *proud* does it make you feel?

3. How *angry* does it make you feel?

4. How *hopeful* does it make you feel?

5. How *worried* does it make you feel?

6. How *excited* does it make you feel?

All questions were scaled from (1) Not at all to (4) Very.

E   Manipulation Check

Because of concerns that including too many self-report emotion questions in the main study would reduce the effects of the video (as in Keltner et al., 1993), we ran a separate study to serve as further check on the efficacy of the video stimulus in inducing anxiety. This study was conducted using the Mechanical Turk (mTurk) online labor marketplace. The three video conditions from the main study (*Neutral, Anxiety, Relax*) were replicated, after which subjects completed a modified PANAS (Watson et al., 1988) questionnaire. All self-report emotions were scaled from 1 (very slight or not at all) to 5 (extremely). As pictured in Figure 5, the Cliffhanger video increased self reported anxiety–whether measured by itself or as a composite variable (anxious + worried + angry) –but *did not* significantly affect positive emotions (e.g. pride or hope). This result helps to buttress our claims that (1) the Cliffhanger video stimulus induced anxiety and (2) the physiological reactivity that we measured in the main study can be attributed to anxiety in particular, and not other emotions that (in theory, at least) would also increase physiological arousal.
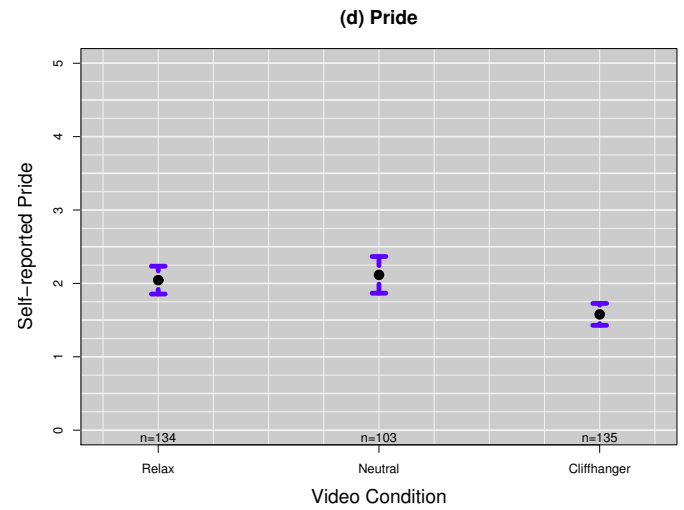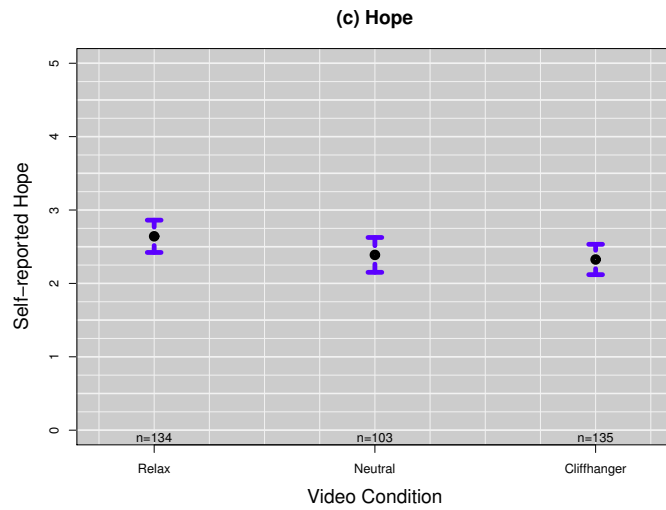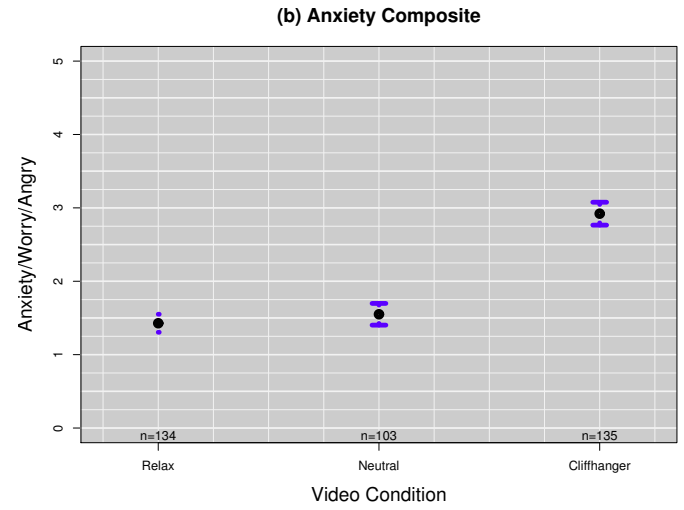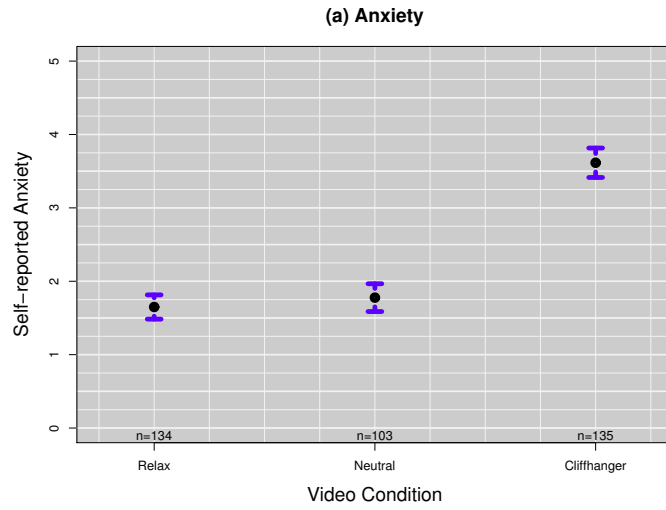
Figure 5: mTurk Manipulation Check for Anxiety Stimulus

F   Alternate Main Results Table 1

	(1) Dummy Video Conditions	(2) Treatment Only	(3) Treatment + SC Reactivity	(4) Full Model with controls
Anxiety Manipulation	0.339+	-0.171	-0.206	-0.294+
	(0.187)	(0.171)	(0.174)	(0.166)
Relax Manipulation	-0.216	-0.0677	-0.0134	-0.0566
	(0.179)	(0.160)	(0.166)	(0.157)
SC Reactivity while answering questions			0.176*	0.159*
			(0.0821)	(0.0799)
Age				0.0162
				(0.0164)
Ideology				0.200**
				(0.0469)
Race				-0.0269
				(0.0408)
Income				0.0328
				(0.0329)
Education				-0.0223
				(0.0398)
Constant	0.115	2.171**	2.131**	1.313**
	(0.131)	(0.120)	(0.121)	(0.476)
N	129	137	129	129
r2	0.0704	0.00756	0.0408	0.187

Standard errors in brackets
$+p < 0.10, *p < 0.05, **p < 0.01$

Table 2: **Alternate Results:** Model (1) shows the effects of the treatment on physiological reactivity when all observations are included and dummy variables are used to estimate the differential effects of the *anxiety* and *relax* conditions. Models 2-4 show effects of the treatment and mediator on immigration preferences, where the DV is composite variable of 5 immigration questions.

G   Alternate Main Results Table 2

DV:	(1) SC Reactivity	(2) Immigration Preferences
Anxiety Manipulation	0.457+	-0.591*
	(0.263)	(0.231)
Story Condition	0.0648	0.0189
	(0.287)	(0.247)
Story X Anxiety	-0.253	0.718*
	(0.401)	(0.346)
SC Reactivity while answering questions		0.247*
		(0.0982)
Constant	0.0915	2.116**
	(0.174)	(0.150)
N	81	81
r2	0.0431	0.167

Standard errors in brackets

$+p < 0.10, *p < 0.05, **p < 0.01$

Table 3: **Main Results with interaction term:** Model (1) shows the effect of the treatment (anxiety) on physiological reactivity while Model (2) shows the effects of physiological reactivity on immigration preferences controlling for the story condition. Both models includes only *Neutral & Anxiety* conditions (*Relax* condition is excluded) and both models include an interaction term to account for any potential interaction between the two experimental manipulations.

H Effects of Physiological Reactivity on Immigration Preferences, Controlling for Self-Reported Immigration Beliefs

	(1)	(2)
Neg Emotions (Self Report)	0.205**	0.175*
	(0.0510)	(0.0649)
Story Condition	0.147	0.596**
	(0.251)	(0.181)
SC Reactivity while answering questions	0.104	0.290**
	(0.156)	(0.0908)
Constant	1.134**	0.879**
	(0.288)	(0.266)
N	41	40
r2	0.326	0.479

Standard errors in brackets

$+p < 0.10, *p < 0.05, **p < 0.01$

Table 4: **Pre-Treatment Immigration Beliefs:**: Model (1) is *Neutral* condition while Model (2) is *Anxiety*. In Model (2), physiological reactivity is a significant predictor of immigration beliefs even when controlling for pre-treatment immigration beliefs.
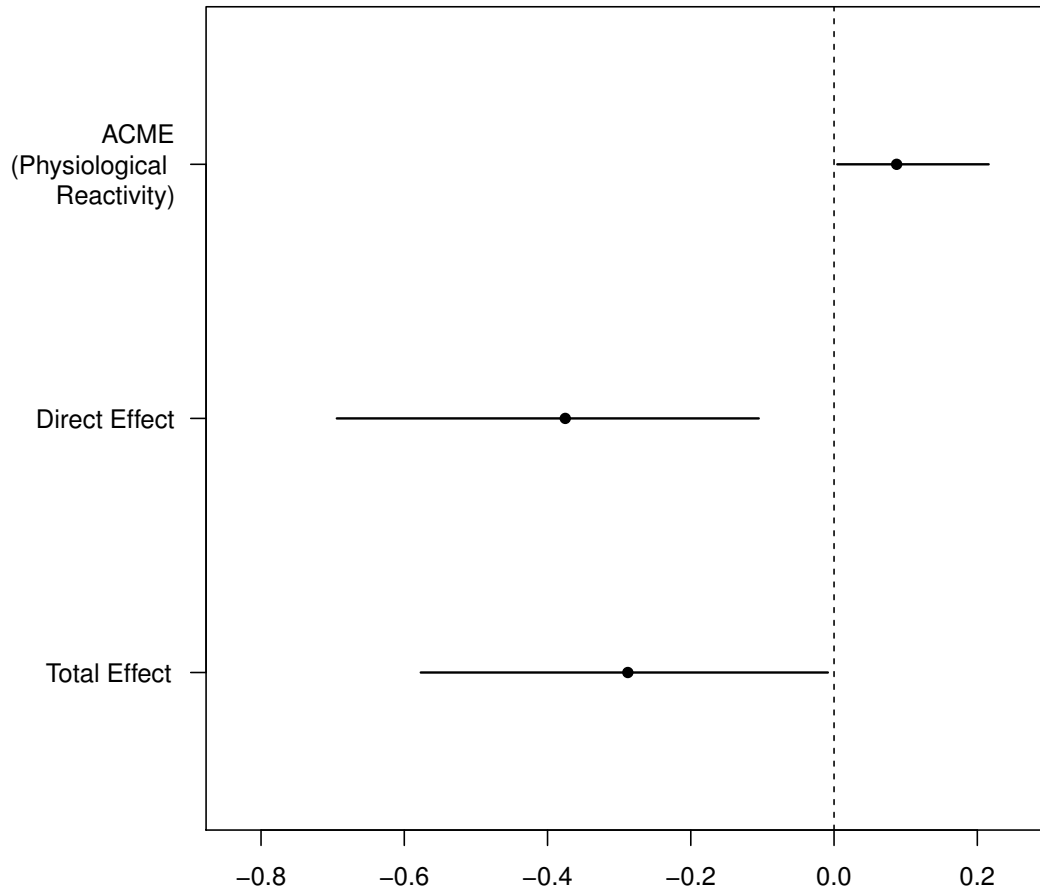
I Mediation Results with Controls

Figure 6: **Causal Mediation Plot using Pre-treatment control variables**: *Treatment* is anxiety video manipulation (compared to neutral condition), *Mediator* is skin conductance reactivity when answering immigration questions, *Outcome* is composite variable of immigration preferences. Horizontal lines represent 90% confidence intervals for estimates. Controls used include ideology, age, income, race, education. As in other analyses, the *Relax* condition is dropped.

43

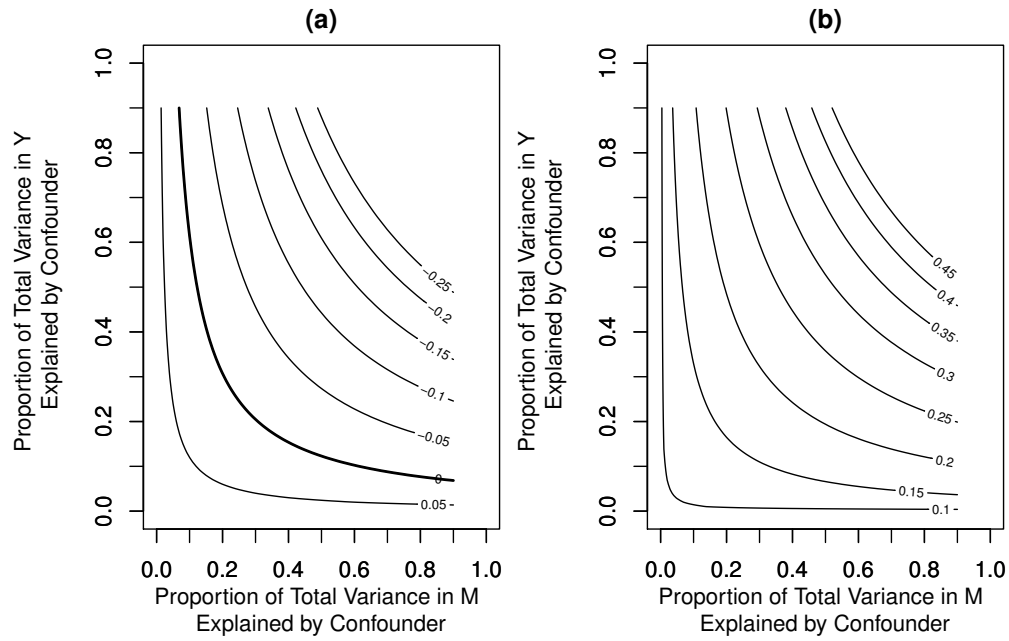# J   Sensitivity Results for Mediation with Controls

Figure 7: **Sensitivity Analysis:** Proportion of Variances in M and Y Explained by Unobserved Confounder when Counfounder affects M and Y in (a) same direction and (b) opposite direction.