Psychophysiological Reactions to Video and Photo Stimuli
Methodological Appendix

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This is the methodological appendix for ongoing work on the project entitled "Attention to Negative News: Evolutionary and Cultural Accounts," funded through an Insight Grant from the Social Sciences and Humanities Research Council of Canada with additional funding from the University of Michigan and the Halbert Center at the Hebrew University. The bulk of the Appendix pertains only to that project, although Section D provides information relevant to other ongoing psychophysiological experiments (cited below).

As of August 2017 we have fielded the ""Attention to Negative News" study across fourteen countries; in addition, in both Canada and Israel, we collected separate English/French and Jewish/Palestinian samples. We used an identical protocol in all countries, and all studies were fielded personally by the authors, alongside local research assistants (with local language skills) where necessary.

There are four sections that follow. Section A describes the three stages of our protocol. Section B includes the script used to introduce participants to the experiment. Section C discusses both sampling and location in each country. Section D describes the processing of physiological data.

A: The Experimental Protocol

Our protocol involves three stages, focused on (1) physiological reactions to news content, (2) physiological reactions to photos, and (3) survey responses.

Stage 1: Physiology & News Content

Our primary goal is to examine negativity biases in individuals' reactions to real network news content. The experiment we use for this purpose is based on one already fielded with some success in Canada (Soroka and McAdams 2015; Daignault, Soroka and Giasson, 2013). Participants watch a news program on their own, on a computer monitor in a quiet room, wearing noise-canceling headphones. They are connected to three biosensors, on the first to third fingers of their non-dominant hand. Sensors capture heart rate and skin conductance; where variations in skin conductance are intended to indicate arousal (Simons et al. 1999; Lang et al. 1999, 2000; Bolls et al. 2001; see review in Ravaja 2004), and heart rate (or HRV, discussed further in Section D) indicates some combination of arousal and attentiveness (Lang 1990, 1995; Mulder and Mulder 1981; see also review in Ravaja 2004).

The news content experiment lasts roughly 25 minutes, during which participants view seven randomly-ordered news stories, selected on a variety of topics, political as well as general news, and across a range of tone, from very positive to very negative. Stories are preceded by a two-minute gray screen, and then separated by 40 seconds of grey screen thereafter. Of the seven stories presented to each participant, one is domestic and negative, and one is domestic and positive – all US respondents see the same two US stories, all Japanese participants see the same two Japanese stories, and so on. The remaining five stories are drawn from a sample of eight stories, four positive and four negative, all international. The domestic stories obviously vary across countries; the international stories do not.

Our objective in this instance is to reap the benefits of both using identical stimuli across countries, and also test for the potential importance of cultural/geographic proximity in participant reactions to news content.

Regarding the latter, we are concerned about the possibility that respondents care more about stories that are more proximate, even local. Our design allows us to test for this possibility. At the same time, the bulk of our stimuli are used across all countries.

News stories are a carefully selected (non-random) sample of real news stories from BBC World News. The advantage of this news source is that it is aimed at a worldwide audience; stories accordingly focus on themes that are of relevance across the countries we examine. BBC World News is regularly aired in many the countries we study — it is as close as we can come to "regular" news across a wide range of countries.

One complication arising from using BBC World News across all countries is that the news source is in English. Our participants must thus understand English, or we must translate the content. (Note that BBC broadcasts news in other languages, but the stories are not the same.) We address this issue using a two-pronged approach. First, we gather data from multiple countries where we can conduct the entire experiment in English – not just multiple Anglo-American countries, but multiple Scandinavian countries as well. Second, we use subtitles in countries where most participants do not speak English. This requires that we explore directly the impact that subtitles have on physiological and attitudinal reactions to news content, and we accordingly run experiments in both Israel and Canada (Quebec) in which we randomize the use of subtitles. Translations may serve to decrease, or increase, the impact of videos — there is to our knowledge no existing work on this matter to date. We do not report our findings in detail here, but note that while subtitles may dampen physiological responses slightly, they thus far do not appear to have a marked effect on our results.

Subtitles are used in the following countries: Brazil, Canada (with French sample, randomized), Chile, France, India, Israel (with Jewish sample, randomized, and with Palestinian sample), Italy, Japan, and Russia. Hebrew and French subtitles were translated by the authors; Russian translations were done by research assistants. All other subtitles were translated by an academic translation service in Chicago, with Hindi subtitles edited by local research assistants to avoid uncommon words. All subtitles are embedded in videos by the authors, and available as plain-text (.srt) files upon request.

The international stories used in our experiments are as follows:

International Negative: Peru: The small town of Chimbote burns down; *May Day*: Describes May Day protests following economic downturn; *Niger*: Describes current food shortages in Niger; *Sri Lanka*: Describes UN investigations in war crimes in Sri Lanka

International Positive: Gorillas: Gorillas from a zoo are released into the wild; *Folding Car*: Discussing of a new electric, folding car intended to reduce congestion; *Young Director*: An 11-yr old makes stop-motion films; *Cured Liver Disease*: A young child recovers from liver disease

The local stories are as follows:

Local Negative: Brazil, a fire in a nightclub; Canada, the arrest of a serial killer; Chile, protestors in Santiago; Denmark, a shooting in a café holding a meeting about free expression; France, a woman is killed and her daughter hides under her; India, conflict between India and Pakistan in Kashmir; Israel, ultra-orthodox Jews prevent girls from walking to school; Italy, a shipwreck in Genova; Japan, ongoing problems from nuclear fallout; New Zealand, a hot air balloon accident; Sweden, riots in Stockholm; Russia, a plane crashes in to the Black Sea; UK, a story about foreigners sold into slavery; US, a story about homelessness in the US.

Local Positive: Brazil, a ballet company for impaired dancers; Canada, a group of factory workers win the lottery; Chile, fossils discovered in northern Chile; Denmark, about the Copenhagen little mermaid statue; France, a very old man participates in bike race; Israel, a television station that keeps dogs company when owners are out; India, a company makes useful items from recycled goods; Italy, a mayor declares that no one in town can die since the graveyard is full; Japan, an island full of cats; New Zealand, a group that teaches dogs to drive cars ; Sweden, the ongoing popularity of ABBA; Russia, exploring for pieces of a recently-fallen meteorite; UK, a story about a fancy suit store; US, a man who makes bagpipes.

Figure 1. The Tone of International Stories used in Video Experiments

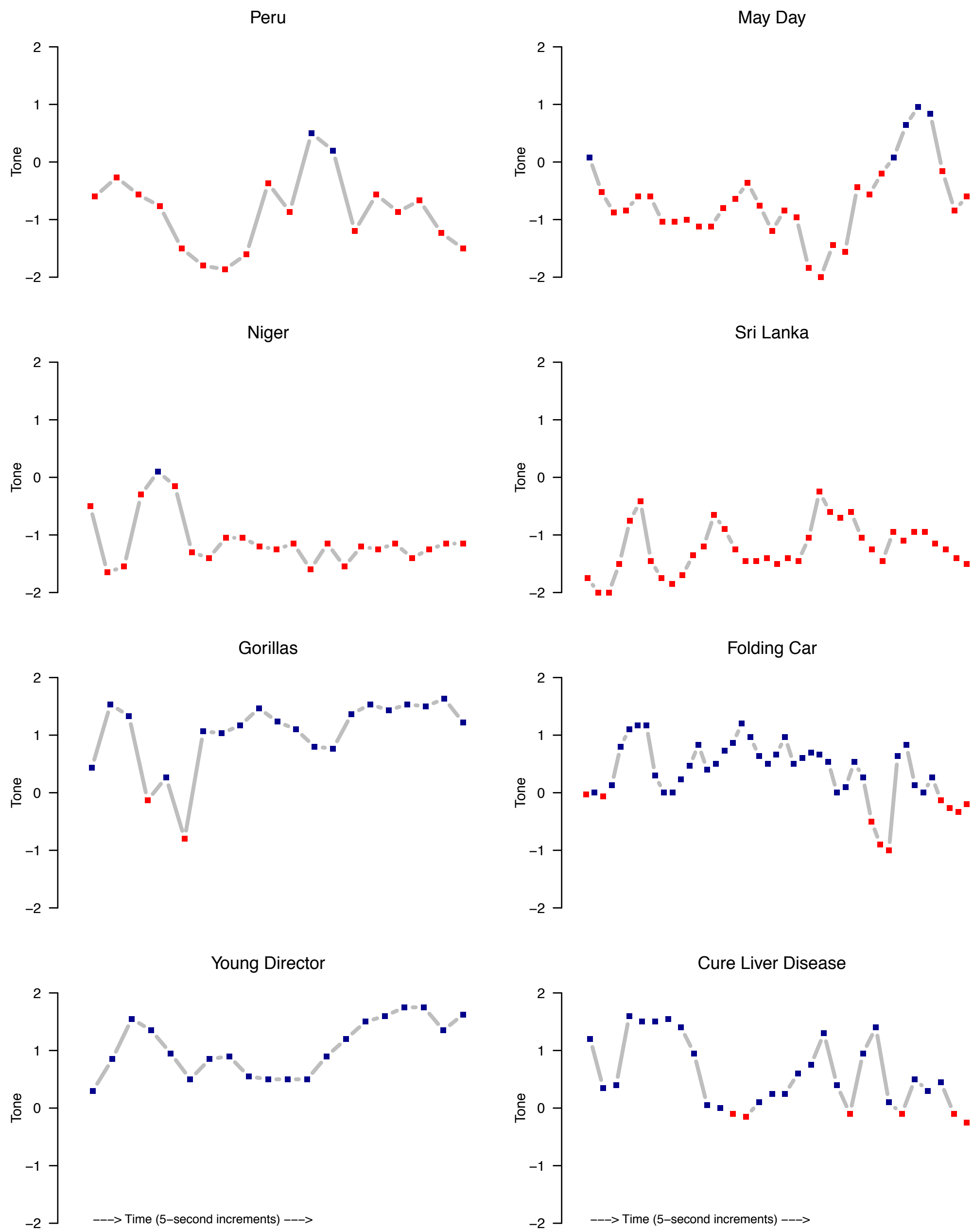


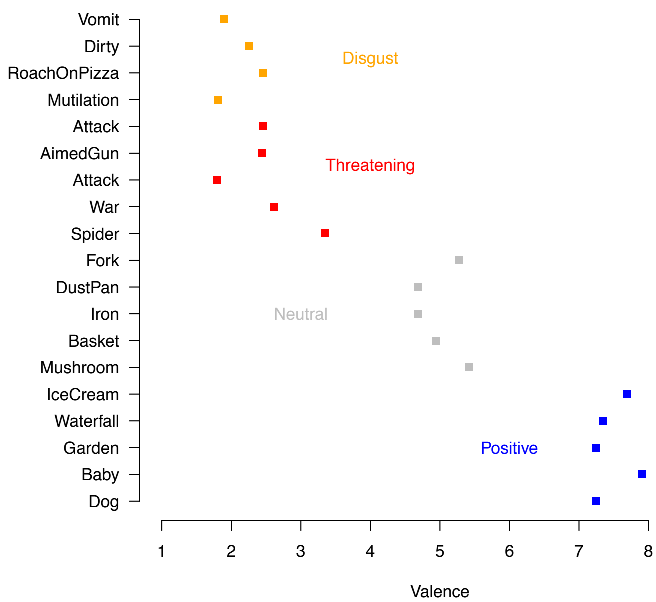
Figure 1 shows average tone, coded second-by-second but aggregated here in five-second intervals, by expert coders. Any value below 0 is negative, and shown in red; values above 0 are positive, and shown in blue. Note then that tone varies within as well as across videos, and it is for this reason that we sometimes focus on responses at 5-second intervals, rather than overall news stories. Even so, there are clear differences in tone across the positive and negative stories – positive stories are positive most of the time, just as negative stories are negative most of the time. We expect results to be similar across different levels of aggregation.

Stage 2: Physiology & Photos

We are attracted to the use of actual news coverage because it is a realistic, "real-world" stimulus; we regard video-experimental results as having especially high external validity as a result. At the same time, the use of real news stories is complicating: there are linguistic differences across countries; there are many differences in the content of real news videos, so we cannot easily vary only one variable while holding all others constant; and there are second-to-second changes in video as well. It thus is possible that our video stimuli are just too complex to produce intelligible results. This is just one reason to run a parallel study focusing on photos from the International Affective Picture System (IAPS). Distributed by the Center for the Study of Emotion and Attention at the University of Florida (http://csea.phhp.ufl.edu/index.html), the IAPS is a large battery of still photos coded on several dimensions by expert coders, and used in a wide range of psychological and psychophysiological experiments (see, e.g., Ribiero et al. 2005; Codispoti et al. 2001; Lang et al. 1993; Mikels et al. 2005).

There are additional reasons for a photo-based experiment. In particular, we are motivated by a growing body of work in political science on the link between threat sensitivity and/or disgust sensitivity – as measured using physiological responses to IAPS photos – and political ideology/partisanship (e.g., Ahn et al. 2014; Hibbing et al. 2014). We have an interest, eventually, in speaking directly to this literature. For this reason, too, then, we include a second physiological study.

Figure 2. Description, Category and Valence of IAPS Photos



This second stage was run using the same equipment and purpose-built software as the video experiment. Transitioning from Stage 1 to Stage 2 of our protocol requires no more than the push of a button. Participants, sitting in the same chair, watching the same screen, and wearing the same sensors, are exposed to a 1-minute gray screen, followed by a randomly-ordered set of photos. Each photo is shown for 10 seconds, then there is a 10-second gray screen, and the process is repeated until they have seen all 25 photos. This is in line with recent work (see citations above).

19 of those photos are drawn from the IAPS database. We select these 19 with the following objectives

in mind: (a) we needed photos that were paradigmatic examples of each of four categories, threatening, disgusting, positive, and neutral, and (b) we needed photos that were not deeply violent, or potentially offensive, given that we are running our experiments across wildly different cultures. Figure 2 offers a brief description of the IAPS photos we used, alongside the IAPS categories, and ratings of valence.

Alongside these 19 IAPS photos, we include 6 photos of local politicians. These are selected with the aim of including well-known national political leaders, roughly evenly divided across the left and right of the political-ideology scale. This is not always straightforward, of course. In some countries, we use a combination of current and past politicians, in order to balance out those on the left and right. The inclusion of politicians is, again, in line with past work (Dodd et al. 2012); we included them as part of an investigation into reactions to politicians that respondents agree or disagree with. A list of politicians used in each country is as follows:

Brazil: 1. Luiz Inácio Lula da Silva (Workers' Party), 2. Dilma Rousseff (Workers' Party), 3. Aecio Neves (Social Democracy Party), 4. Marina Silva (Sustainability Network), 5. Eduardo Cunha (Democratic Movement Party), 6. Fernando Henrique Cardoso (Social Democracy Party).

Canada: 1. Justin Trudeau (Liberal Party), 2. Stephen Harper (Conservative Party), 3. Thomas Mulcair (New Democratic Party), 4. Elizabeth May (Green Party), 5. Gilles Duceppe (Bloc Québécois), 6. Brian Mulroney (Conservative Party).

Chile: 1. Michelle Bachelet (Socialist Party), 2. Evelyn Matthei (Independent Democratic Union), 3. Sebastián Piñera (independent, right), 4. Marco Enríquez-Ominami (Progressive Party), 5. Ricardo Lagos (Party for Democracy), 6. Joaquín Lavín (Independent Democratic Union).

Denmark: 1. Helle Thorning-Schmidt (Social Democrats), 2. Lars Løkke Rasmussen (Venstre), 3. Pia Kjærsgaard (People's Party), 4. Anders Samuelsen (Liberal Alliance), 5. Johanne Schmidt-Nielsen (Red-Green Alliance), 6. Uffe Elbaek (Alternative).

France: 1. François Hollande (Socialist Party), 2. Manuel Valls (Socialist Party), 3. Nicolas Sarkozy (Union for a Popular Movement, 2015) or François Fillon (Republican, 2017), 4. Marine Le Pen (National Front), 5. François Bayrou (Democratic Movement, 2015) or Emmanuel Macron (En Marche!, 2017), 6. Jean-Luc Mélenchon (Left Party).

India: 1. Rahul Gandhi (Congress), 2. Manmohan Singh (Congress), 3. Yogi Adityanath (BJP), 4. Narendra Modi (BJP), 5. Sonia Gandhi (Congress), 6. Bal Thakre (Shiv Sena).

Israel: 1. Zehava Galon (Meretz), 2. Ayman Odeh (Joint Arab List and Hadash), 3. Stav Shaffir (Labor "Zionist Camp" Party), 4. Benymain Netanyahu (Likud), 5. Avigdor Lieberman (Yisrael Beiteinu), 6. Ayeled Shaked (The Jewish Home).

Italy: 1. Giorgio Napolitano (Democratic Party), 2. Pier Luigi Bersani (Democratic Party), 3. Beppe Grillo (Five Star Movement), 4. Oscar Luigi Scalfaro (Democratic Party), 5. Silvio Berlusconi (Forza Italia), 6. Mario Monti (Independent).

Japan: 1. Kazuo Shii (Communist Party), 2. Banri Kaieda (Democratic Party), 3. Natsuo Yamaguchi (Kōmeitō), 4. Shinzō Abe (Liberal Democratic Party), 5. Kenji Eda (Innovation Party), 6. Ichiro Ozawa (People's Life Party).

New Zealand: 1. John Key (National Party), 2. Andrew Little (Labour Party), 3. Winston Peters (NZ First), 4. Russell Norman (Green Party), 5. Helen Clark (Labour Party), 6. Jim Bolger (National Party).

Sweden: 1. Jimmie Akesson (Swedish Democrats), 2. Anna Kinberg Batra (Moderate Party), 3. Jan Arne Bjorklund (Liberals), 4. Stefan Lofven (Social Democrats), 5. Goran Persson (Social Democrats), 6. Åsa Romson (Green Party).

Russia: 1. Vladimir Putin (United Russia), 2. Gennady Zyuganov (Communist Party), 3. Mikhail Prokhorov (Independent), 4. Vladimir Zhirinovsky (Liberal Democratic Party), 5. Sergey Mironov (A Just Russia), 6. Alexei Navalny (Progress Party).

UK: 1. David Cameron (Conservative Party, 2015) or Theresa May (Conservative Party, 2017), 2. Ed Miliband (Labour Party, 2015) or Jeremy Corbyn (Labour Party, 2017), 3. Nick Clegg (Liberal Democrats, 2015) or Tim Farron (Liberal Democrats, 2017), 4. Nicola Sturgeon (Scottish National

Party), 5. Margaret Thatcher (Conservative Party), 6. Tony Blair (Labour Party).
US: 1. Bill Clinton (Democrats), 2. George W. Bush (Republicans), 3. Hillary Clinton (Democrats), 4. John McCain (Republicans), Barack Obama (Democrats), Ronald Reagan (Republicans).

Stage 3: The Survey

Immediately after the experiments are concluded, participants complete a roughly 10- to 15-minute survey on the premises. The survey captured basic sociodemographic information, media use, interest in politics, political participation, vote choice, party identification, political ideology, and risk preferences. Ideological questions included items from the Wilson-Patterson ideological scale, which has been used in the context of biopolitical studies (Alford et al. 2005; Oxley et al. 2008; Hatemi et al. 2009; Dodd et al. 2012). The survey also asks respondents whether they remember seeing each video (including questions about the videos they did not see), and asks for ratings for the videos on several dimensions.

The survey was designed in English, but fielded in the local language in Brazil, Canada (with French sample), Chile, France, Israel, Italy, Japan, and Russia. In India, the survey and subtitles are in Hindi rather than Marathi; this meant that some respondents had difficulties, but research assistants aided respondents when necessary. Survey translations were handled in the same as subtitles, by a combination of the investigators, research assistants and a paid translation firm, as discussed above. The entire survey, in all languages, is available upon request.

B. Script

All participants are guided through the protocol using a relatively simple script. There are of course small variations, based on language, and on questions from participants. But the script which we use, and with which we train local research assistants (where necessary), is as follows:

> Hello, you must be NAME. I'm NAME. It is a pleasure to meet you. First, thank you very much for participating in our study. We really appreciate your help. This is where everything will happen. You will be seated at this computer for the next 45 minutes.
>
> Before we begin, I would like you to read this document that describes the study [hand over the consent form]. Let me know if you have questions. [Note that we can describe the general goal of the study (understanding reactions to news content), but we do not talk about the hypothesis we are examining before the experiment (comparing reactions to positive and negative stimuli).]
>
> If everything is clear and you don't have any question, then I would like you to sign this consent form, which is typical for university studies. Here is your payment [hand over the money]. Can you please sign this document to confirm that you received the payment [hand over the confirmation sheet]?
>
> Can you please mute your phone so you will not be disturbed? Please have a seat. Are you right-handed or left-handed? Ok, we will put the equipment on your non-dominant hand. First, this sensor will measure your heart rate. It goes on your middle finger. The velcro should be loose, but it should not be too tight, let me know if this is not comfortable. The next two sensors will measure your skin conductance. One goes on your index finger, the other goes on your ring finger. Are they too tight? We can check whether the sensors are working well by starting the software. The top line is heart rate. The bottom line is skin conductance.
>
> If you move too much, the sensors are affected, so please find a position where you can stay immobile during the experiment. Some people prefer to put their hand on the chair's armrest, some prefer to put it on their leg, some prefer to put it on the table. Chose the position you like best. Is the computer screen correctly inclined?
>
> The first experiment will show television news reports. You simply need to watch them. There will be seven stories altogether. The stories are separated by a long blank screen. The first blank screen is really long. Two minutes! It will look like the longest two minutes of your life! It will look like the system is not working,

but it is. It simply needs to calibrate for a while before beginning.

When the screen says thank you it is over, just let me know because I won't see what is happening. You can now put on the headphones. You can adjust their volume by clicking on these two buttons.

[After the video experiment is over.] The second experiment will show images. The images are again separated by a blank screen. The first blank screen will be longer, but less than two minutes. Again, when the screen says thank you it is over, just let me know. The headphones are noise cancelling, so it is best to put them on again to avoid distractions.

[After the photo experiment is over.] We can now take off the headphones and the sensors. All that remains is a survey. It is done on the same computer. You can use the mouse, the trackpad and the keyboard. Simply let me know when it is over. It will return to the start screen.

[After the survey is complete.] Thank you once again for your participation. We are very grateful. Do you have any questions?

C. Sampling & Location

Just as there are concerns about US-only samples in most psychological research, there are serious questions about the generalizability of student-based samples. We consequently sought access to non-student samples whenever possible. That said, there are several countries for which only student samples were available to us. Sample differences across countries raise some difficulties, since we want to be sure that cross-national differences are not fueled by simple differences in sampling. We deal with this by having some countries in which we have both student and non-student samples (esp. the US), and by running analyses that assess country differences controlling for differences in age and education.

Our objective in each country is to find a sample of 40+ participants, evenly divided by gender, and roughly representative of the population at large. This is difficult with a sample of only 40, of course; often, our aim was simply to seek variation in age, education, income and partisanship. In some cases, this was straightforward; in others, we had no information about respondents until they arrived for the experiment.

Experiments were typically conducted in a room – often but not necessarily a purpose-built lab – at a local university. In Brazil and Russia, we used a hotel room; in India, some experiments were run in a shed in a nearby construction compound. In every instance, we sought out quiet locations, in rooms where nothing was happening except for our experiment. We always place respondents towards a wall or blank space, so that there are no distractions during the experiment. We also always use noise-cancelling headphones to reduce the impact of noise outside the lab. We provide details on the fielding of each experiment below (with the PI(s) responsible in parentheses).

Brazil: A diverse sample was recruited by local research assistants among their acquaintances, aiming for diversity in terms of age, education, and partisanship. Experiments were run in a hotel meeting room in Brasilia in 2016. (Fournier)

Canada: Our primarily English-language sample, students recruited through posters and emails at McGill University, was collected in 2013, in a purpose-built lab at the Centre for the Study of Democratic Citizenship at McGill University in Montréal. Our primarily French-language sample, recruited among participants in two non-student online studies, was collected in 2015, in a faculty office at the Université de Montréal. (Fournier and Soroka)

Chile: A representative (non-student) sample was provided by the Centre for Experimental Social Science (CESS) Santiago, and conducted in their purpose-built lab in Santiago in 2016. (Soroka)

Denmark: A diverse sample was recruited by local research assistants among their acquaintances, aiming for diversity in terms of age, education, and partisanship. Experiments were run in faculty offices at Aarhus University in 2016. (Fournier)

France: We rely on a student sample, built through posters and snowball sampling, at the Sciences Po in Paris. Experiments were run in faculty offices at that university in 2015. A second round of experiments was completed in 2017. (Fournier and Soroka)

France: We rely on a sample built through posters and snowball sampling, at the Sciences Po in Paris. Experiments were run in faculty offices at that university in 2015. A second round of experiments was completed in 2017 to diversify the sample – in particular, we sought to recruit participants from the right side of the political spectrum, and from a more diversified age range and educational background. (Fournier and Soroka, 2015; Fournier, 2017)

India: A representative (non-student) sample was provided by the Centre for Experimental Social Science (CESS) at FLAME University, and conducted in their purpose-built lab in Pune in 2017. (Soroka)

Israel: Our primarily Jewish sample relies on a student participant pool at the Hebrew University in Jerusalem. Experiments were run in a purpose-built lab at that university in 2013. Our primarily Palestinian sample relies on a student participant pool, supplemented with snowball sampling, at the University of Haifa. Experiments were run in a purpose-built lab at that university in 2016. (Nir, Fournier and Soroka)

Italy: We rely on a student sample, built through posters and emails at the University of Milan. Experiments were run in a small quiet room at that university in 2016. (Soroka)

Japan: We rely on a student sample, built through an existing participant pool as well as emails at Waseda University in Tokyo. Experiments were run in two small quiet rooms at that university in 2016. (Soroka)

New Zealand: A representative (non-student) sample was provided by the Vote Compass. Experiments were run in a quiet conference room at the Victoria University of Wellington in 2016. (Fournier)

Russia: A diverse sample was recruited by a local research assistant among acquaintances, aiming for diversity in terms of age, education, and partisanship. Experiments were run in a hotel meeting room in St-Petersburg in 2017. (Fournier)

Sweden: A representative (non-student) sample was provided by the Citizen Panel. Experiments were run in a quiet conference room at the University of Gothenburg in 2015. (Fournier and Soroka)

UK: A representative (non-student) sample was provided by the Centre for Experimental Social Science (CESS) at Nuffield College, and conducted in their purpose-built lab in Oxford. Experiments occurred in two rounds, first in 2015 and then in 2017. (Soroka, 2015; Fournier, 2017)

US: Most US experiments were conducted in a purpose-build lab at the University of Michigan in Ann Arbor in 2015-2016. We collected three different samples: one student sample based on an existing participant pool, another student sample based on posters and snowball sampling, and a representative sample built through quota sampling from an existing medical-experimental pool. Additional US experiments were conducted in a lab at Texas A&M, in conjunction with ongoing work with Johanna Dunaway. (Soroka)

Figure 3. Sample Characteristics

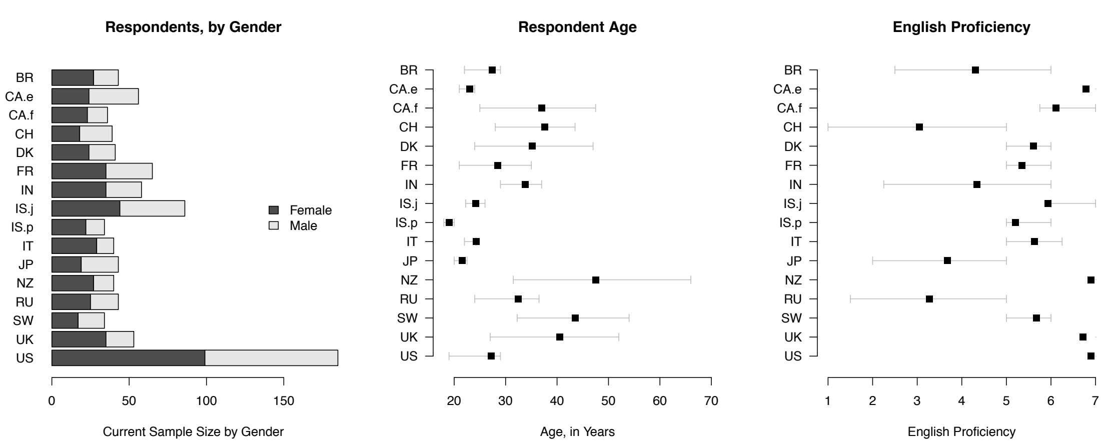


Figure 3 includes three panels: (1) the total number of respondents, by country and gender, (2) the mean (squares) and interquartile range (whiskers) in age, and (3) the mean (squares) and interquartile range (whiskers) in self-described English-language proficiency. CA.e designates the Canadian English-language sample, while CA.f designates the Canadian French-language sample; IS.j designates the Israeli Jewish sample, while IS.p designates the Israeli Palestinian sample.

D. Processing of Physiological Data

Our research requires that we are able to conduct experiments in various locations, and not necessarily in a traditional lab environment. It is for this reason that we rely on a portable encoder from Thought Technologies (http://thoughttechnology.com); specifically, we rely on either a FlexComp or ProComp5 Infiniti system, alongside a Skin Conductance Sensor and a BVP (Blood Volume Pulse) Sensor. This system is connected to a computer via USB cable. Data are collected using purpose-build software, described in Soroka and McAdams (2015).

The same equipment and data-processing is used in other psychophysiological experiments in communication and political science. The process described below thus also applies to ongoing work by Arceneaux, Dunaway and Soroka (2017), Dunaway and Soroka (2016), and Orey, Baumgartner and Soroka (2017).

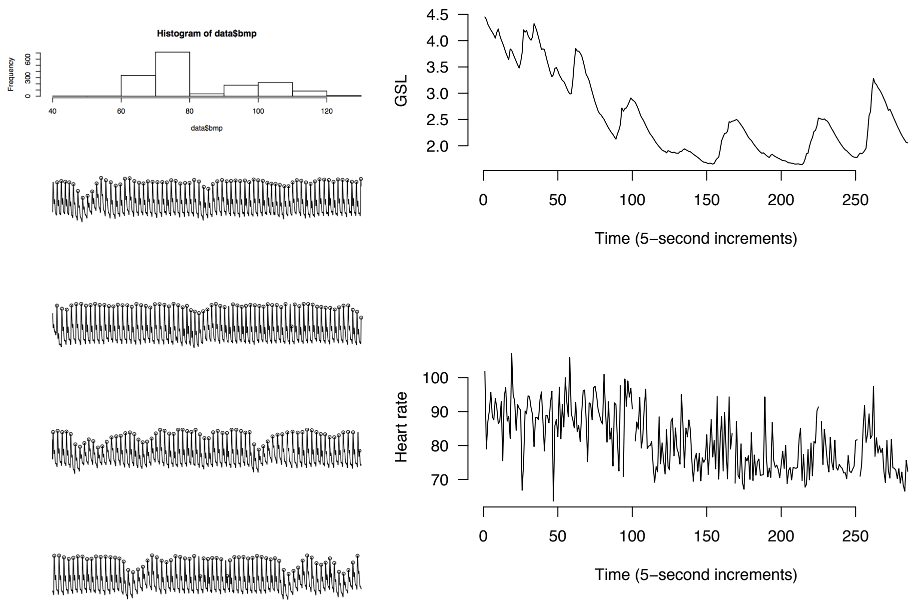
Unlike many physiological studies in political science and communication studies, our software does not produce pre-processed measures of skin conductance and heart rate. Rather, we record the raw signal (at 256/second), and process the resulting data ourselves. There is a considerable body of research on the processing of psychophysiological data. We rely on that work to develop our own pre-processors, implemented in R.

The processing of galvanic skin levels is relatively straightforward: we smooth the raw signal using a rolling average, with slightly larger weights attributed to the middle three values. In R, the script is as follows: `gsl <- filter(gsl, filter = c(1/8, 1/4, 1/4, 1/4, 1/8), sides=2).` This serves to remove much of the noise in the series, although it does not entirely erase the impact of outlying values. This is by design; but note that a series in which we entirely remove outlying values has no significant impact on our results thus far. (We are not focusing on the millisecond-by-millisecond reactions to brief stimuli, after all, but rather on GSL over rather long intervals.) Most of our analyses really on a down-sampled version of this smoothed signal, by one- or five-second intervals, or by stimulus (video, or photo).

The processing of heart rate is more complex. We begin by applying the same filter as for GSL, in order to reduce noise in the time series. (For a useful discussion of the difficulties with noise in measuring heart rate, see Friesen et al. 1990; though note that they explore more complex approaches to noise reduction than we practice here.) We then identify peaks in the QRS complex using a script that tags any moment during which the signal is greater in amplitude than the surrounding 20 moments (10 forward, and 10 backward). Some respondents show a relatively high T wave; in order to reduce the likelihood that these are mistakenly tagged as R waves, we remove any tagged moments for which the amplitude does not exceed the 75th percentile for the entire data series. Counting the seconds (really, 256ths of seconds) between each tagged moment then produces heart rate, and inter-beat interval (IBI). Remaining outliers, due to mis-measurement, are removed by dropped moments in which measured heartrate is below 40 bpm or above 130 bpm.

The reliability of the data for every respondent is verified by hand, both by the authors and research assistants. We rely on two diagnostic figures, produced for each respondent. The first, shown in the left panel of Figure 4, shows the BVP signal with circles indicating peaks in the R wave. This is the means by which we confirm both the reliability of the BVP signal (i.e., was the sensor properly attached?), and the accuracy of the processing algorithm (i.e., do we reliably capture peaks in R waves?). This figure shows some moments during which the signal varies, perhaps due to measurement problems; but it also confirms the reliability with which our simple algorithm identifies peaks in the R wave. (This is a partial version of the figure, which has many more lines of signal.) The second diagnostic graphic, shown in the right panel of Figure 4, shows both GSL and heart rate for a respondent at 5-second intervals. Instances in which GSL or heart rate are flat, or especially stochastic, or exhibit other strange dynamics, are tagged, investigated, and typically excluded from the working datasets.

Figure 4. By-Respondent Diagnostics



Note that we focus entirely on galvanic skin levels (GSL); we do not focus on galvanic skin responses (GSR), although these can be identified using a process similar to the one used to capture peaks in the R wave in the BVP signal. Note also that while we use heart rate or inter-beat interval (IBI) in some analyses, we increasingly focus on heart rate variability (HRV). Our principle measure for this is the standard deviation of the NN intervals (SDNN), calculated over a given period of time (i.e., a single news story). The Task Force of the European Society of Cardiology and the North American Society of Pacing Electrophysiology (1996) notes that SDNN appears to be an appropriate measure over relatively brief time periods (5 minutes), but that the measure is affected by the length of monitoring time (i.e., the period over which it is calculated). We can take this into account in our analyses, of course. We also calculate the Root Mean Square of the Successive Differences (RMSSD) – more precisely, the square root of the mean squared differences of successive NN intervals – as an alternative measure of short-term variation in heart rate. To be clear:

$$\text{SDNN} = \sqrt{\frac{\sum(ibi_t - \overline{ibi})^2}{n-1}} \text{, and}$$

$$\text{RMSSD} = \sqrt{\frac{\sum(ibi_t - ibi_{t-1})^2}{n-1}},$$

where *ibi* is the inter-beat interval, measured in milliseconds, *n* is the total number of RR intervals over which *ibi* is calculated, and *t* is a count variable capturing time, measured at whatever frequency the encoder is set to operate (in our case, 256/second).

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