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Lucía Freira

DNI: 94562019

Director: Martín Rossi

Codirector: Ernesto Schargrodsky

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Abstract

El presente trabajo de doctorado cuenta de tres capítulos y cada uno de los capítulos corresponde a un experimento diferente que busca indagar sobre ciertas conductas de las personas observando sus reacciones a través de indicadores que no dependen de auto reportes como, por ejemplo, medidas relevadas por terceros o medidas psicométricas y fisiológicas. El primer trabajo estudia el impacto de la presencia de una persona en el baño sobre el comportamiento de lavarse las manos y tirar la cisterna. Las estimaciones muestran que ser expuesto a un observador aumenta la probabilidad de lavarse las manos en 13 puntos porcentuales y aumenta la probabilidad de tirar la cisterna en 15 puntos porcentuales. Dado que el beneficio individual de realizar ambas acciones es inferior al beneficio social de realizarlas, los resultados brindan apoyo a la idea de que la presión social podría actuar como un mecanismo adicional para resolver subóptimos sociales derivados de estas externalidades. El segundo trabajo sugiere un fenómeno de desensibilización o habituación de las personas que han sufrido delitos. Se realizó un experimento de laboratorio en el que se le mostraron imágenes de actos criminales a un grupo de sujetos, algunos de los cuales habían sido previamente víctimas de un delito. Se midieron marcadores biológicos de estrés e índices conductuales de control cognitivo antes y después de que los participantes vieran una serie de videos reales. Un grupo fue expuesto a videos relacionados con crimen mientras que el otro grupo fue expuesto a videos sin situaciones de violencia. Se encontró que los participantes que todavía no habían sido víctimas y fueron expuestos al primer video mostraban cambios significativos en el nivel de cortisol, la frecuencia cardíaca y las medidas de control cognitivo. En cambio, las personas que sí habían sido víctimas y fueron expuestas al mismo video mostraban marcadores biológicos y rendimiento cognitivo comparables a los medidos en las personas expuestas al video de control. Por último, el tercer trabajo muestra cómo una noticia negativa que destaca los posibles riesgos sobre un evento vital relevante genera temor a la gran mayoría de los participantes con independencia de la afinidad partidaria. Sin embargo, frente a este temor común, la afinidad partidaria actúa como un prisma que moldea el impacto del miedo de modo diverso. Frente a una noticia negativa sobre la vacuna, quienes tienen posiciones partidarias más definidas, responden reforzando sus creencias previas, sin embargo, los que se presentan con una posición política menos definida son quienes aparecen más susceptibles a modificar sus concepciones previas.

Índice

Introducción

Cuando se estudia la efectividad de una vacuna, se toma a un grupo de la población, se lo divide de manera aleatoria[1] en dos grupos, uno al cual se le aplica la vacuna y otro al cual se le aplica un placebo. Luego de un tiempo se observa de manera objetiva si el grupo que recibió la vacuna se enfermó menos, más o igual que el grupo que no la recibió.

En Ciencias Sociales estos tipos de experimentos son un poco más complicados, pero la esencia es la misma. Se toma a un grupo de individuos, los cuales son asignados aleatoriamente a dos subgrupos, luego, por ejemplo, se le presenta un "estimulo" a uno de los dos grupos y un "placebo" al otro grupo, para luego comparar las reacciones observadas. Cuando nos referimos a "estimulo" estamos hablando de una frase, una foto, un vídeo, una situación, y cuando nos referimos a reacción estamos hablando de una acción, o una respuesta a una pregunta, o a una emoción.

El arte está en encontrar el estímulo correcto para la pregunta que se quiere contestar. Una elección correcta de este estímulo requiere que la pregunta sea clara y este bien hecha. Es fundamental un diseño correcto del cuestionario y el uso adecuado de las herramientas matemáticas disponibles. La aplicación de enfoques econométricos al análisis de los resultados enriquece sustancialmente el trabajo. Cuando corremos un modelo de regresión lineal intentando medir causalidad siempre tenemos el problema de que no podemos incluir en el modelo todas las variables relevantes para explicar una reacción, ya sea porque no son observables o porque no tenemos los datos. Esto genera que muchas veces las estimaciones sufran sesgo por omisión de variables relevantes. El diseño experimental soluciona esto, ya que la asignación al tratamiento es aleatoria, y, por ende, no está relacionada con las variables omitidas, resolviendo el problema del sesgo.

Aprender a hacer todo este proceso fue el objetivo principal del presente trabajo. Mi trabajo de doctorado cuenta de tres capítulos y cada uno de los capítulos corresponde a un experimento diferente que busca indagar sobre ciertas conductas de las personas observando sus reacciones a través de indicadores que no dependen de auto reportes, sino que intentan medir las reacciones a través de variables objetivas como, por ejemplo, medidas relevadas por terceros o medidas psicométricas y fisiológicas.

En el trabajo que se presenta en el primer capítulo se estudió el impacto de la presencia de una persona en el baño sobre el comportamiento de lavarse las manos y tirar la cisterna. Las estimaciones muestran que ser expuesto a un observador aumenta la probabilidad de lavarse las manos en 13 puntos porcentuales y aumenta la probabilidad de tirar la cisterna en 15 puntos

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[1] De manera aleatoria significa que todos los individuos tienen la misma probabilidad de estar en cualquiera de los dos grupos.

porcentuales. Dado que el beneficio individual de realizar ambas acciones es inferior al beneficio social de realizarlas, los resultados brindan apoyo a la idea de que la presión social podría actuar como un mecanismo adicional para resolver subóptimos sociales derivados de estas externalidades.

El trabajo que se presenta en el capítulo 2 sugiere un fenómeno de desensibilización o habituación de las personas que han sufrido delitos. Se realizó un experimento de laboratorio en el que se le mostraron imágenes de actos criminales a un grupo de sujetos, algunos de los cuales habían sido previamente víctimas de un delito. Se midieron marcadores biológicos de estrés e índices conductuales de control cognitivo antes y después de que los participantes vieran una serie de videos reales. Un grupo fue expuesto a videos relacionados con crimen mientras que el otro grupo fue expuesto a videos sin situaciones de violencia. Se encontró que los participantes que todavía no habían sido víctimas y fueron expuestos al primer video mostraban cambios significativos en el nivel de cortisol, la frecuencia cardíaca y las medidas de control cognitivo. En cambio, las personas que sí habían sido víctimas y fueron expuestas al mismo video mostraban marcadores biológicos y rendimiento cognitivo comparables a los medidos en las personas expuestas al video de control.

Por último, en el capítulo 3 se presenta un trabajo que muestra cómo una noticia negativa que destaca los posibles riesgos sobre un evento vital relevante genera temor a la gran mayoría de los participantes con independencia de la afinidad partidaria. Sin embargo, frente a este temor común, la afinidad partidaria actúa como un prisma que moldea el impacto del miedo de modo diverso. Frente a una noticia negativa sobre la vacuna, quienes tienen posiciones partidarias más definidas, responden reforzando sus creencias previas, sin embargo, los que se presentan con una posición política menos definida son quienes aparecen más susceptibles a modificar sus concepciones previas.

Capítulo 1

Peer Pressure:

Experimental Evidence from Restroom Behavior[2]

I.   INTRODUCTION

We perform a randomized field experiment to empirically assess the effect of peer pressure on individual behavior. Specifically, we study whether exposure to an observer in a public restroom influences the probability that a male individual washes his hands. Handwashing is typically taught since childhood and not washing hands after using the restroom is generally perceived by peers as a negative trait, so being exposed to an observer has the potential to generate peer pressure.

Since handwashing is desirable, several authors on public health literature have carried out different experiments in order to increase its compliance. Johnson et al. (2003) found that the presence of signs reminding one to wash their hands in public restrooms increased women handwashing, but not men handwashing. Sharir et al. (2001) mentioned that certain interventions such as constant handwashing education (e.g., total sanitation campaigns) are necessary in order to maintain significant handwashing compliance. Pattanayak et al. (2009) found that through shaming mechanisms (e.g., walk of shame) sanitation worldwide could be increased.[3]

Previous studies of social influence on handwashing behavior present methodological problems such as low statistical power (Nalbone et al. 2005), self-reporting behavior, and contaminated control groups (Drankiewicz and Dundes 2003). More importantly, previous literature identifies in the presence of nonrandom assignment of peer pressure (Drankiewicz and Dundes 2003; Munger and Harris 1989; Nalbone et al. 2005), which could lead to biased estimates of the treatment effect because of omitted variables. For instance, differences in treatment assignment across different times of day may bias estimates if people are more prone to wash their hands at a specific time of the day (e.g., after lunch). Our paper consistently estimates the impact of peer pressure on handwashing by randomly allocating peer pressure. We randomly assign treatment using a biased coin design (BCD, as described in Canay 2013). The BCD guarantees a consistent estimation through randomization while maximizing power through balanced group sizes. In addition, our experiment relies on direct observation, avoiding any bias associated with self-reporting.[4]

Our estimates show that the presence of an observer increases the probability of handwashing by around 13 percentage points. The results are statistically significant and robust to an array of

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[3] Some other experiments tried to identify whether the effort required to wash hands is the main reason for low compliance. The implementation of alcoholic hand rubs (Whitby et al. 2006) and the accessibility of sink location (M. Whitby et al. 2004) do not improve handwashing compliance. In this sense, the improvement of compliance is not simply related to effort (e.g., hand sanitizers or proximity to sink) but is highly dependent on altering behavioral perception (e.g., social influence).

[4] Surveys about hand washing behavior usually suffer from over reporting, since hand hygiene is socially desirable (Judah et al. 2009).

alternative specifications that include fixed effects for time of the day, evaluator, and restroom. These results indicate that peer pressure influences handwashing behavior in public restrooms.

To assess whether our results are restricted to handwashing, we also observe urinal flushing behavior. Our estimates show that being exposed to an observer increases the probability of urinal flushing by around 15 percentage points. The results are statistically significant and robust to an array of alternative specifications that include fixed effects for time of the day, evaluator, and restroom.

Our paper is closely related to the literature on the impact of social pressure on individual behavior. In a study that is close to our approach, Gerber et al. (2008) report evidence that social pressure increases voter turnout through an experiment on an actual election. They encourage people to turn out by showing information on previous turnout from themselves and from their neighbors. More generally, making actions observable can create incentives based on shame, peer pressure, and inference about individuals' types that influence agents' decisions about certain actions.

The rest of the paper is structured as follows. Section II describes the experimental design. Section III describes the data, introduces the econometric model, and presents the results. Section IV presents further evidence for urinal flushing behavior. Section V concludes.

II.   EXPERIMENTAL DESIGN

We study whether social pressure influences public restroom behavior in male adults. We performed an experiment in male restrooms at Universidad de San Andrés (Buenos Aires, Argentina) in order to assess the effect of social pressure on two variables of interest: handwashing and urinal flushing. The experiment took place in three restrooms at the campus.[5] Our hypothesis is that the presence of an external observer in the restroom induces a change in restroom behavior through peer pressure.

The structure and the design of the experiment are as follows. We performed a series of pilot evaluations to test that the observer was able to reliably hear the urinal flushing and handwashing from outside without incurring any abnormal behavior. Three restrooms were selected after the pilot testing. The experiment was conducted in three shifts: the morning shift from 10 a.m. to 12 p.m., the mid-day shift from 12 p.m. to 2 p.m., and the afternoon shift from 2 p.m. to 4 p.m. Before any registration, the evaluator explored the restroom in order to check that everything was clean, and that alcohol gel was not available.

Male adults that use the public restroom were previously randomized into two groups, a treatment group (exposed to an observer) and a control group (unexposed to an observer). The

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[5] Two restrooms have three urinals, and one restroom has four urinals.

full sequence of individuals assigned to treatment or control was established before the experiment began (i.e., the randomization was not done in real time). Each evaluator was provided with a worksheet to record restroom behavior. Each worksheet contains a fixed number of observations and the treated/control status predetermined for each observation. In order to avoid possible contamination caused by the presence of a third person, we discard all cases where someone else was in the restroom or entered into the restroom (either originally assigned to the control group or to the treatment group). In those cases, the evaluator continues with the sequence previously established, as if that observation never existed.

Selecting the randomization procedure to assign the participants to treatment and control groups brings up the problem of compromising between a perfectly balanced experiment and the advantages of a complete randomization (Canay 2013).[6] Complete randomization has the advantage of eliminating potential selection bias and balancing out unobserved characteristics between participants in the treatment and control groups, while having balanced group sizes allows for a greater statistical power. Standard randomization procedures used in the randomized controlled trials literature are truncated binomial design (TBD) and simple random sampling (SRS). Both TBD and SRS present inference-related problems. In TBD, participants are allocated sequentially to the treatment or control group with probability 0.5 until one of the two groups reaches a size equal to half of the sample. All subsequent participants are allocated to the remaining group. Therefore, using TBD yields a perfectly balanced experiment but a potentially significant part of the allocation will be completely determined by previous allocations. In SRS, each participant is assigned sequentially to the treatment or control group with probability 0.5. In spite of ensuring complete randomization, the two groups can be very unbalanced if the number of participants is low. Since SRS implies a positive probability of presenting serious unbalance between group sizes, some researchers are willing to rerandomize the sample in the experiment in order to increase statistical power, losing the complete randomization of the procedure.

For our experiment, the number of observations was determined ex ante and we used the randomization procedure known as BCD, which was presented by Efron (1971) as a method that "tends to balance the experiment, but at the same time is not over vulnerable to various common forms of experimental bias." BCD sequentially assigns the participants to control or treated group: when group sizes are equal, allocation is made with probability 0.5; when they are not, BCD allocates the participant to the underrepresented group with a constant probability "p." Following Atkinson et al. (2014), we set p=2/3 for our experiment. BCD has several advantages over other randomization procedures. First, although the probability of being assigned to one group depends to some extent on previous assignments, it is never fully determined by them.

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[6] A randomization procedure is completely random if the probability of being assigned to treatment is independent of past assignments, past outcomes, and current and past values of the covariates.

Second, the probability of providing a balanced assignment in finite samples is far superior in BCD than that in SRS (Canay 2013), providing a greater statistical power in estimations.

The experiment is carried out by six males specially trained to perform the task and similarly dressed (jeans with a dark shirt). All evaluators followed a protocol. For the treated group, the observer entered into the restroom 8 seconds after the participant and placed himself at another urinal. In restrooms with four urinals the observer placed himself leaving a free urinal in between. In restrooms with three urinals the observer placed himself at the opposite end, and if the participant placed in the middle, the observer chose randomly between either end units. The observer acted as another user of the restroom, without flushing the urinal or washing his hands, staying in the urinal until the participant left the restroom. The evaluator registered, without being noticed, if the participant flushed the urinal and/or washed his hands after using the urinal. For the control group, the evaluator waited outside and listened if the participant flushed the urinal and/or washed his hands.

III.   ECONOMETRIC MODEL AND RESULTS

Table 1 presents the descriptive statistics. On average, 66% of sample individuals wash their hands after using a public restroom when they are alone[7] and 79% when someone else is present. Given random assignment, the impact of peer pressure (i.e., being observed in a public restroom) on handwashing behavior can be estimated straightforwardly by applying ordinary least squares (OLS) to the following regression model:

$$(1) \ Wash_i = \alpha + \beta Treated_i + \varepsilon_i$$

where *Wash* is a dummy variable that takes the value of one if handwashing is performed and zero otherwise. Treated is a dummy variable that takes the value of one if the participant is treated (i.e., observed) and zero otherwise.

TABLE 1
Summary Statistics

	Mean	Standard Deviation
Washed hands	0.7268	.4468
When someone else is present	0.7879	.4109
Alone	0.6632	.4751

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[7] This number is similar to the one found in most of the related literature: between 40% and 60% of people wash their hands after using a public restroom (Johnson et al. 2003; Munger and Harris 1989; Nalbone et al. 2005).

Table 2 presents OLS estimates of Equation (1). Column 1 shows that, on average, 66.3% of people wash their hands in public restrooms when no one else is present. This proportion increases by 12.5 percentage points if someone else is present. In the remaining columns of Table 2 we show that results remain unchanged when we include either time of the day fixed effects (column 2), restroom fixed effects (column 3), evaluator fixed effects (column 4) or any combination of these (columns 5, 6, 7, and 8). The estimated coefficients on Treated are positive and statistically significant in all the specifications of Table 2, indicating that male handwashing in public restrooms is influenced by peer pressure.[8]

TABLE 2
Results for Handwashing

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated	0.125*	0.126*	0.126*	0.136**	0.127*	0.137**	0.134**	0.136**
	(0.0639)	(0.0644)	(0.0644)	(0.0648)	(0.0653)	(0.0651)	(0.0651)	(0.0657)
Constant	0.663***	0.668***	0.655***	0.696***	0.661***	0.738***	0.748***	0.797***
	(0.0487)	(0.0946)	(0.167)	(0.0826)	(0.195)	(0.121)	(0.212)	(0.231)
Time of the day fixed effects	No	Yes	No	No	Yes	Yes	No	Yes
Restroom fixed effects	No	No	Yes	No	Yes	No	Yes	Yes
Evaluator fixed effects	No	No	No	Yes	No	Yes	Yes	Yes
Observations	194	194	194	194	194	194	194	194

Notes: Robust standard errors are in parentheses. All models are estimated by OLS.
$*p < .1, ** p < .05, *** p < .01$.

IV. FURTHER EVIDENCE FROM URINAL FLUSHING BEHAVIOR

In this section we present estimates of the effect of peer pressure on urinal flushing behavior. We define a Flush dummy as a variable taking the value of one if the participant flushes the urinal and zero otherwise. Given the random assignment of treatment, we estimate the following equation with OLS:

$$(2)\ Flush_i = \alpha + \beta Treated_i + \varepsilon_i$$

where *Treated* is a dummy variable that takes the value of one if the participant is observed and zero if he is alone.

Table 3 reports the OLS estimates of Equation (2). Column 1 shows that, on average, 55.8% of people flush the urinal in public restrooms when no one else is present. Having an observer present raises the average of people flushing the urinal by 14.9 percentage points, and the result is statistically significant at the 5% level. In the remaining columns of Table 3, we show the results

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[8] Given that the assignment procedure implies that the probability of assignment differs by observation, as a robustness check we weight the observations by 1/p, where p is the probability of being assigned to the group the observation is in. All results remain unchanged when we reweight the observations (all results mentioned and not shown are available from the authors upon request).

are robust to alternative specifications. Results remain unchanged when we include either time of the day fixed effects (column 2), restroom fixed effects (column 3), evaluator fixed effects (column 4), or any combination of these (columns 5, 6, 7, and 8). The estimated coefficients on Treated are positive and statistically significant in all the specifications of Table 3, indicating that urinal flushing in public restrooms is influenced by peer pressure.

TABLE 3
Results for Urinal Flushing

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated	0.149*	0.154*	0.141*	0.148*	0.144*	0.154*	0.147*	0.149*
	(0.0688)	(0.0697)	(0.0694)	(0.0707)	(0.0691)	(0.0687)	(0.0697)
Constant	0.558**	0.539**	0.644**	0.539**	0.582**	0.540**	0.641**	0.613**
	(0.0512)	(0.101)	(0.160)	(0.0901)	(0.195)	(0.128)	(0.197)	(0.226)
Time of the day fixed effects	No	Yes	No	No	Yes	Yes	No	Yes
Restroom fixed effects	No	No	Yes	No	Yes	No	Yes	Yes
Evaluator fixed effects	No	No	No	Yes	No	Yes	Yes	Yes
Observations	194	194	194	194	194	194	194	194

Notes: Robust standard errors are in parentheses. All models are estimated by OLS.
$*p < 0.05$; $** p < .01$.

A. *Potential Concern*

Even though our study relies on a randomized controlled experiment, there are still potential concerns regarding the identification of the effect of peer pressure on handwashing. Since we observe handwashing after urinal flushing for each unit, handwashing estimates could be a result of an indirect effect of the treatment through urinal flushing. For example, it could be that peer pressure induces urinal flushing and then people wash their hands to prevent the potential health hazards associated with urinal flushing. Nevertheless, it is also possible that the probability of urinal flushing increases only as an indirect effect of the treatment on handwashing. For instance, it could be that treated units foresee they will wash their hands because of peer pressure, so they flush the urinal knowing that future handwashing will prevent potential health hazards associated with urinal flushing. To address this concern, we estimate the correlation between handwashing and urinal flushing on the control group. The estimated coefficient is 0.12 and not statistically significant, so we have no evidence that supports this concern.[9]

V.   CONCLUSIONS AND DISCUSSION

We ran a field experiment to assess whether peer pressure affects individual behavior in public restrooms. We found a positive and statistically significant effect of peer pressure on the probability of handwashing and urinal flushing. Our estimates show that the presence of an

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[9] We also estimate the correlation between handwashing and urinal flushing for the treated group. The estimated coefficient is .04 and is not statistically significant at standard levels.

observer increases the probability of handwashing by around 13 percentage points and the probability of urinal flushing by around 15 percentage points. The results are statistically significant and robust to an array of alternative specifications that include fixed effects for time of the day, evaluator, and restroom.

Our paper contributes to the recent literature that suggests that social factors (such as peer pressure) may provide an additional solution to the suboptimality arising from externalities (Calvó-Armengol and Jackson 2010; Daughety and Reinganum 2010; Kandel and Lazear 1992; Karlan 2007). Both handwashing and urinal flushing are activities that generate externalities, since social benefits exceed individual benefits. In the presence of externalities the allocation through competitive markets usually yields a socially suboptimal outcome (Stiglitz 1988). Classical solutions to the externalities problem include pigouvian taxes and allocation of property rights (Mas-Colell et al. 1995). There are situations, however, where none of these solutions are applicable. For example, Pigouvian taxes solutions rely on the estimation of social costs (benefits) that sometimes may be impossible to measure (e.g., psychological costs of pollution) (Baumol 1972). The Coasian solution may be inapplicable when property rights are not enforceable (Anderton 1990).

A necessary condition for peer pressure to attenuate the suboptimality associated with externalities is that people should feel socially pressured to undertake socially optimal actions, for whatever reason. In our particular case, handwashing and urinal flushing are taught since childhood, they are socially desirable activities, and numerous campaigns remind people of their benefits.[10]

Our findings provide empirical support for peer pressure as an additional way of solving or attenuating the suboptimality arising from externalities. As to the possibility of peer pressure inducing an over-provision of handwashing or urinal flushing, given the low private cost of handwashing and urinal flushing in the university restroom and the fact that exposure to an observer increases handwashing from 0.66 to 0.79 and urinal flushing from 0.56 to 0.71, it seems plausible that this increase is toward the social optimum.

Clearly, further research could include other interventions arms in the field experiment besides the presence of an observer. For example, hanging a visible poster on the externality benefits of handwashing somewhere in the public restroom could help to determine the relevance of externalities in the handwashing decision. In this regard, even though it is implausible for the State to administer peer pressure in order to induce socially optimal actions, it can lay the groundwork for the peer pressure mechanism to act on its own (e.g., through promotional campaigns that remind people of the externality so that, when observed by others, they feel pressured to undertake the socially optimal action).

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[10] For example, the Global Handwashing Day that takes place on October 15.

VI.   REFERENCES

Anderton, Charles H. 1990. "Teaching Arms-Race Concepts in Intermediate Microeconomics." *The Journal of Economic Education* 21 (2): 148–66.

Atkinson, Anthony C. 2014. "Selecting a Biased-Coin Design." *Statistical Science* 29 (1): 144–63.

Baumol, William J. 1972. "On Taxation and the Control of Externalities." *The American Economic Review* 62 (3): 307–22.

Calvó-Armengol, Antoni, and Matthew O. Jackson. 2010. "Peer Pressure." *Journal of the European Economic Association* 8 (1): 62–89.

Canay, I. 2013. "Treatment Assignment in Randomized Controlled Experiments."

Daughety, Andrew F., and Jennifer F. Reinganum. 2010. "Public Goods, Social Pressure, and the Choice between Privacy and Publicity." *American Economic Journal: Microeconomics* 2 (2): 191–221.

Drankiewicz, Danielle, and Lauren Dundes. 2003. "Handwashing among Female College Students." *American Journal of Infection Control* 31 (2): 67–71.

Efron, Bradley. 1971. "Forcing a Sequential Experiment to Be Balanced." *Biometrika* 58 (3): 403–17.

Gerber, Alan S., Donald P. Green, and Christopher W. Larimer. 2008. "Social Pressure and Voter Turnout: Evidence from a Large-Scale Field Experiment." *American Political Science Review* 102 (1): 33–48.

Johnson, H. Durell, Danielle Sholcosky, Karen Gabello, Robert Ragni, and Nicole Ogonosky. 2003. "Sex Differences in Public Restroom Handwashing Behavior Associated with Visual Behavior Prompts." *Perceptual and Motor Skills* 97 (3): 805–10.

Judah, Gaby, Robert Aunger, Wolf-Peter Schmidt, Susan Michie, Stewart Granger, and Val Curtis. 2009. "Experimental Pretesting of Hand-Washing Interventions in a Natural Setting." *American Journal of Public Health* 99 (S2): S405–11.

Kandel, Eugene, and Edward P. Lazear. 1992. "Peer Pressure and Partnerships." *Journal of Political Economy* 100 (4): 801–17.

Karlan, Dean S. 2007. "Social Connections and Group Banking." *The Economic Journal* 117 (517): F52–84.

Mas-Colell, Andreu, Michael Dennis Whinston, and Jerry R. Green. 1995. *Microeconomic Theory*. Vol. 1. Oxford university press New York.

Munger, Kristen, and Shelby J. Harris. 1989. "Effects of an Observer on Handwashing in a Public Restroom." *Perceptual and Motor Skills* 69 (3–1): 733–34.

Nalbone, David P., Kevin P. Lee, Amanda R. Suroviak, and Jennifer M. Lannon. 2005. "The Effects of Social Norms on Male Hygiene." *Individual Differences Research* 3 (3).

Pattanayak, Subhrendu K., Jui-Chen Yang, Katherine L. Dickinson, Christine Poulos, Sumeet R. Patil, Ranjan K. Mallick, Jonathan L. Blitstein, and Purujit Praharaj. 2009. "Shame or Subsidy Revisited: Social Mobilization for Sanitation in Orissa, India." *Bulletin of the World Health Organization* 87: 580–87.

Sharir, R., N. Teitler, I. Lavi, and R. Raz. 2001. "High-Level Handwashing Compliance in a Community Teaching Hospital: A Challenge That Can Be Met!" *Journal of Hospital Infection* 49 (1): 55–58.

Stiglitz, Joseph E. 1988. "Economic Organization, Information, and Development." *Handbook of Development Economics* 1: 93–160.

Whitby, M., and M.-L. McLaws. 2004. "Handwashing in Healthcare Workers: Accessibility of Sink Location Does Not Improve Compliance." *Journal of Hospital Infection* 58 (4): 247–53.

Whitby, Michael, Mary-Louise McLaws, and Michael W. Ross. 2006. "Why Healthcare Workers Don't Wash Their Hands: A Behavioral Explanation." *Infection Control & Hospital Epidemiology* 27 (5): 484–92.

Capítulo 2

Crime and Violence:

Desensitization in Victims to Watching Criminal Events[1]

Crime is one of the main social problems in developing nations. It is particularly serious in Latin America, a region with 8.6% of the world's population, but 36.5% of the world's homicides.[2] Its citizens systematically rank crime as one of their main concerns (Latinobarómetro, 1995-2015). Yet, Latin American societies seem to show a tolerance for crime, and our understanding of the phenomenon is limited. For example, many incumbent politicians are re-elected even as crime increases or remains constant at extremely high rates. Moreover, the relationship between crime victimization and happiness looks weak (Di Tella and Schargrodsky, 2009; Graham and Chaparro, 2012). Figure 1 illustrates one aspect of this problem: sometimes increases in crime victimization coincide with society's mounting concern over crime, yet, at other times, there is, if anything, a *negative* correlation (e.g., the correlation is 0.036 for the overall period 1995-2015, but -0.113 for 2005-2015).

Figure 1: Victimization and Crime as the most important problem in Latin America
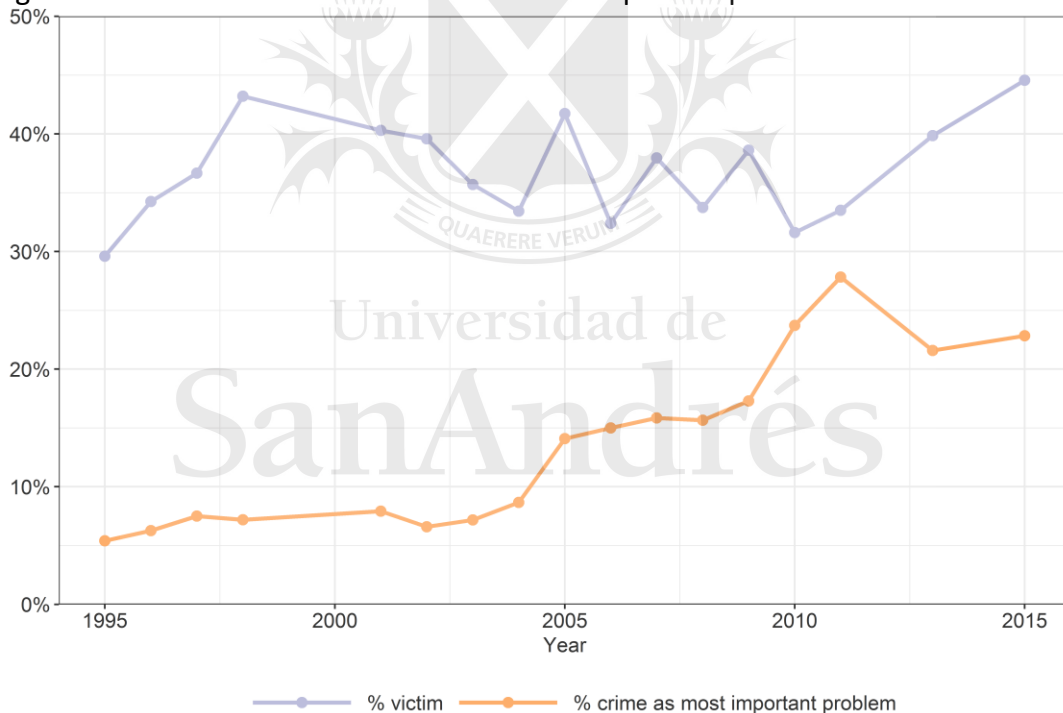
Source: Latinobarómetro (1995-2015). The top blue line shows the percentage of positive responses to the question: "Have you or a relative been assaulted, attacked, or the victim of a crime in the last 12 months?" The red line shows the percentage of crime responses to the question: "In your opinion, which is the most important problem in the country?"

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[2] Authors' calculation from the World Development Indicators for 2014.

A natural hypothesis in this context is that victims gradually become used to high levels of crime, so that perceptions of crime are not primarily driven by the actual amount of crime. This hypothesis follows "desensitization" (or "habituation" or "adaptation") phenomena, namely the reduction in the response to repeat stimuli observed in humans across many settings (see, for example, Thompson and Spencer, 1966; on hearing habituation to sound, Rosburg et al., 2002, 2006; Sörös et al., 2001). One strand of papers in this field has investigated "desensitization" to media violence (see, for example, Fanti et al., 2009; Huesmann et al., 2007; Bartholow et al., 2006, inter alia). More closely related to our paper, Carnagey et al. (2007) find that individuals who previously played a violent video game had a lower heart rate and galvanic skin response while viewing a video with scenes of real violence than the control group, which the authors interpret as demonstrating physiological desensitization to violence (for work connecting desensitization to aggression, see Engelhardt et al., 2011). A difference with our paper lies in the aims: whereas we want to study how people that were victimized experience new episodes of crime, they are interested in how people that play videogames might become desensitized and, in turn, increase aggressive behavior. Additionally, actively playing a violent videogame is different from passively being a victim of a crime. Our paper is also related to work by Mullin and Linz (1995), who document how repeated exposure to sexually violent films led to lower self-reported physiological arousal, emotional response, and ratings of the extent of sexual violence in films.

In this paper, we discuss an experiment we conducted to examine whether victims of crimes become desensitized to violence, on the assumption that watching footage of criminal events provides an approximation to suffering a criminal event in real life. We study implicit markers of habituation, including biological (cortisol and heart rate levels) and cognitive (executive functions) effects. Participants with different victimization experiences are monitored while watching footage of crime scenes (treatment) or of standard, non-violent footage (control) from the same real TV news programs.[3] The expectation is that participants that were previously victimized would exhibit small changes in cortisol, heart rate, and measures of cognitive function and fluid thinking in response to violent footage (desensitization), relative to control participants watching videos without violence. In contrast, we expect participants who were not previously victimized (whom we call "naive" subjects) to respond to exposure to crime-related videos with significant changes in physiological and cognitive tests relative to participants in the control group. Our findings confirm the "desensitization" hypothesis: naive individuals respond to the treatment, but previously victimized individuals exposed to the treatment video show instead

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[3] Our sample shows high victimization rates, although it does not include victims of very severe crimes like rape, kidnapping or homicide.

biological markers and cognitive performance comparable to those measured in the control group, suggesting that prior victimization desensitizes subjects to violence.

A natural consequence of such desensitization is that concern over crime will not directly follow increases in crime, particularly when crime levels are high and a large proportion of victims have been previously victimized. Indeed, our evidence is consistent with the observed mismatch between the evolution of crime victimization and concerns related to crime in Latin America. If victims become desensitized, welfare evaluations of high levels of crime will require a better understanding of the costs of victimization, a parameter that is central in Becker (1968) and about which there is a dearth of empirical work.

Our findings may also be helpful in explaining episodes where the share of violent crime grows as crime does: more violence may be necessary to induce desensitized subjects to surrender their possession in a robbery.[4] In fact, Figure 2 illustrates how most countries in the region have recently experienced a positive correlation between victimization rates and the proportion of violent crimes.[5]

Figure 2: Victimization and Violent Crime in Latin America
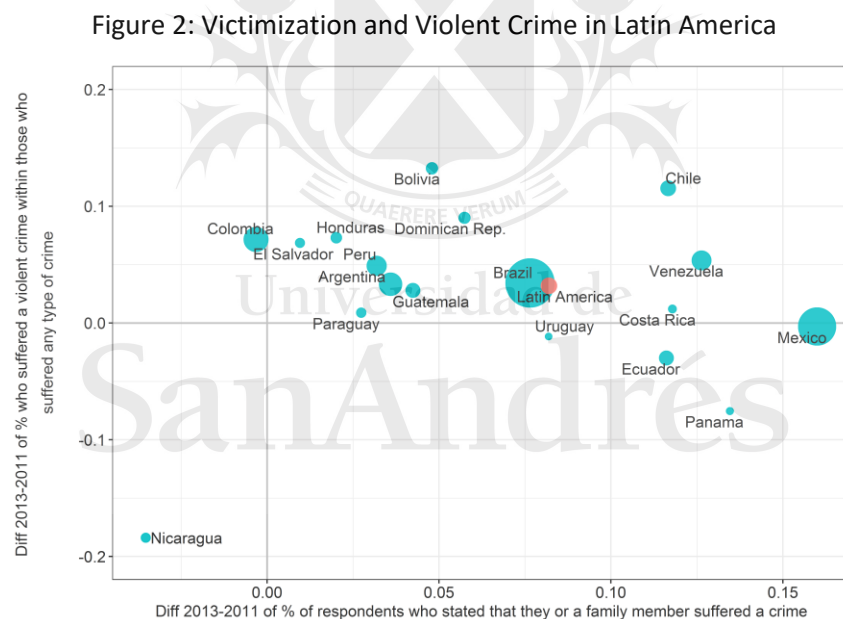
Source: Latinobarómetro (2011, 2013). The horizontal axis shows the change in the percentage of positive responses to the question: "Have you or a relative been assaulted, attacked, or the victim of a crime in the last 12 months?" The vertical axis shows the change in the percentage of respondents that, having themselves or a relative suffered a crime, indicate that the crime was violent when asked: "Was it a violent crime or a nonviolent crime?" This last question is only available for the 2011 and 2013 Latinobarómetro surveys. The size of each circle is proportional to the country population, but the red circle represents the average for the whole region.

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[4] In terms of Becker (1968)'s simple model, potential criminals might see the costs of crime change as victims react less to threats, and they are forced to exert growing physical violence to extract the same loot. For a model with a separating equilibrium with high/low violence, see, for example, O'Flaherty and Sethi (2010).
[5] Of course, other factors can also explain the observed increase in violence as crime grows. One of them is that, as crime increases, people protect themselves. Di Tella et al. (2010) document a growing use of private security devices in Argentina as crime increased (see also Amodio, 2013).

The organization of the paper is as follows. After this introduction, Section 2 develops the main hypothesis of the paper, section 3 describes our method, and section 4 presents our results. Section 5 summarizes our conclusions.

II.   MAIN HYPOTHESIS

The aim of this study is to examine whether individuals who had been previously victimized became desensitized and, thus, respond less to exposure to crime images than naive individuals (not previously victimized). To this aim, we asked treatment participants to watch a series of videos obtained from open TV programs in which different real crime scenes were presented. A key assumption of this exercise is that, within what is an acceptable cost to subjects and other ethical constraints, watching these short films provides a reasonable proxy of what the victim of a crime experiences during a real-life criminal event. One possible channel involves identification: at least one of the videos may resemble the type of crime that victimized participants have previously suffered. Another channel involves altruism: at least one of the videos may resemble the type of crime that a family member of a victimized participant has previously suffered. This is a relevant dimension of crime: it is not unusual for our participants to voice fear for their family's safety and several videos were selected to prime participants on this dimension. Indeed, one of the videos shows footage of a father covering his children during a homicide, and several videos show footage of interviews of victims' (very distressed) family members.[6] A third possible channel involves expectations: The videos could change our participants' perceptions of the likelihood and characteristics (such as violence) of future crime episodes. A control group watched, instead, videos which had the same duration and context, and were obtained from the same TV programs, but did not contain scenes of violence and crime. Subjects were asked to remain in control and watch the videos without moving or stopping.

We hypothesize that for non-victimized participants, the violent videos will result in increased stress and in the engagement of the executive function system to remain in control. The critical prediction is that victimized participants may have become desensitized to crime and will hence present cognitive and biological measures more similar to those in the control group.

A main novelty of our work is that we propose to use hard biological measures of suffering or stress: salivary cortisol and heart rate, and cognitive measures of executive functions. The use of objective measures is crucial as self-reporting of stress might be very different across people of different socioeconomic and educational levels.[7]

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[6] On altruistic fear of crime see Warr (1992), Warr and Ellison (2000), Tulloch (2004), and Snedker (2006).

[7] For seminal work on differences in crime reporting by income level (and other individual characteristics) see Soares (2004).

Cortisol is a steroid hormone commonly employed in experimental settings as an index of the individual's response to stress (Kirschbaum et al., 2000). It can be measured through non-invasive salivary tests and has been used in similar contexts to ours in Heinrichs et al. (2003), Dickerson and Kemeny (2004), Young (2004), Wirtz et al. (2008), Ditzen et al. (2009), Schultheiss and Stanton (2009), and Carney et al. (2010). According to our hypothesis, cortisol should increase in the non-victimized population in the treatment group relative to the control group. Instead, for the victimized population, watching the crime videos should not induce an increase in salivary cortisol relative to watching the control videos.

Heart rate, by being innervated by the sympathetic and parasympathetic systems, is another autonomous variable known to change under different stimulus. Heart rate measures have been used in similar contexts to ours in Hubert et al. (1991), Palomba et al. (2000), and Roelofs et al. (2010), inter alia. In particular, heart rate deceleration has been consistently reported in studies in which participants watch unpleasant images or videos containing violence, disgust, sadness or fear (Bradley et al., 1993; Lang et al., 1993; Angrilli et al., 1994; Palomba et al., 1997). This result may at first seem paradoxical and unexpected. It is natural and intuitive to believe that heart rate should increase with the perception of violence. The interpretation of this consistent finding is however important for our hypothesis. The decrease in heart rate in response to passive exposure to unpleasant visual material might have been related to attentional requirements of such emotional stimuli, which is associated with a parasympathetic dominance in the autonomic nervous system (Lang, 1997). Heart rate is governed by the balance between the sympathetic and the parasympathetic components of the autonomic nervous system. Engagement of the sympathetic system is related to fight or flight responses and results in an increase in heart rate. Instead, engagement of the parasympathetic system is related to rest and digest. Hence in the case of real crime violence, a domination of the sympathetic system is expected, leading to very fast responses of aggression or defense. However, in a situation of passive viewing of violence in which participants have to avoid reacting to violence and are asked to stay still, this response has to be inhibited leading to an engagement of the parasympathetic system and, as a consequence, a decrease in heart rate. In summary, the consensus over a large number of studies is that passive observation of violence leads to decreased heart rate. Our hypothesis is that heart rate decreases will be larger in the non-victimized population in the treatment group. Instead, for the victimized population, whom we conjecture are desensitized to violence, watching these videos should not lead to a similar decrease in heart rate.

Our hypothesis also makes predictions on how participants perform in tests that measure cognitive control. Raven's progressive matrices are a nonverbal test typically used to measure "fluid intelligence", the ability to reason and solve problems involving new information, without

relying extensively on an explicit base of declarative knowledge derived from either schooling or previous experience (see Carpenter et al., 1990).[8] In turn, the Stroop-like "flower-heart" test is a nonverbal task designed to measure aspects of cognitive and inhibitory control through exposing participants to tasks for which the correct answer is often contrary to their initial impulse (MacLeod, 1991; Davidson et al., 2006; Wright and Diamond, 2014).[9] Asking participants to watch scenes of violence while remaining calm requires engaging response inhibition (controlling emotions). However, the control of emotional reactions during our experiment should lead to an engagement of other components of executive functions that, in turn, could improve performance in tasks that use similar resources such as Raven or Stroop tests (Posner, 1998; Engle et al., 1999a; Engle et al., 1999b; Raven, 2000; Davidson, 2006; and Hunt, 2010). It is then expected that exposure to violence in the non-victimized treatment group should increase subsequent performance in the cognitive tasks examined in this study.

In summary, our main hypothesis is that, for a similar episode, the stress of victims may be different depending on their previous victimization history (i.e., if there is some habituation). We explore this hypothesis in an experimental setting using biological markers of stress and behavioral indices of cognitive control. We are not aware of previous empirical research analyzing these issues.

III.   METHODS

a. Participants, Victimization History and Treatment Assignment

With the assistance of a recruiting agency, a sample of 160 individuals from 24 to 65 years old were invited, induced by a cash payment, to participate in the experiment. In order to replicate Argentina's socioeconomic distribution and given potential correlations between socioeconomic status, crime victimization, and crime reporting (see Soares, 2004, and Di Tella et al., 2010), the recruiting agency was instructed to follow a sampling quota scheme based on gender and socioeconomic status.[10]

Apart from obtaining saliva samples and measures of heart rate, cognitive ability, and cognitive control, participants were administered a two-part survey. The first and shorter part took place

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[8] For example, the Raven's test has been used in Linde et al. (1992) to study the effects of spending a night without sleep on the performance of complex cognitive tasks, or in Mani et al. (2013) to study the effect of poverty on cognitive function.

[9] Amir et al. (1996) uses the Stroop tests to study performance under high anxiety scenarios, while Shah et al. (2012) uses Stroop tests to study the effect of scarcity on cognitive fatigue. Other examples include Mani et al. (2013), Shibasaki et al. (2014) and Goldin et al. (2014).

[10] The recruitment quotas did not cover the full 160 participants, but just 70% of them. Once the quotas were covered for each quota group the agency was allowed to recruit freely without any restriction.

closely upon arrival of the participants, before the observation of the videos. The second and longer part took place just before ending their participation.

Our measures of prior exposure to crime were obtained from standard victimization questions included in the first part of our survey. The first measure is *Respondent's Victimization*, a dummy variable indicating that the respondent had been a victim of a crime in the last twelve months. The second measure is *Household Victimization*, a dummy variable indicating that the respondent or a family member living with her/him had been a victim of a crime in the last twelve months. The first measure, *Respondent's Victimization*, is especially useful to study the first and third channels through which exposure to videos might affect our participants, namely by inducing identification with victims or changing their expectations with respect to crime. The second measure, *Household Victimization*, is especially useful to study the second channel (involving altruism towards family members).

Table 1 describes previous victimization at the respondent and at the respondent's household level. Victimization rates in our sample are high: 25% of the respondents (40 subjects) have personally been victims of a crime in the last 12 months, while the percentage is 41% (66 subjects) for victimization of all the respondents' household members.[11] Those who answered affirmatively that they or their household members had been victimized were then asked what the type of crime suffered was. Although victimization is high, participants were not exposed to very severe crimes, like murder, rape, or kidnapping, in the last twelve months. The most severe and frequent crime is robbery, with 55% of the cases (63.6% at the household level), followed by larceny with 32.5% (27.3% at the household level), while the rest entails different forms of car theft, burglary and fraud.

We tried to keep priming on crime to a minimum. The initial questions regarding victimization were a short part of a longer set of general questions (including basic socioeconomic variables, voting intentions, preferences on sports, etc.). Similarly, we did not recruit participants based on previous victimization, but rather using quotas on gender and socioeconomic status, as explained above. A standard victimization survey was included in the second part of the survey after the videos. But as watching crime-related videos could impact on the participants' recall of victimization events, we used, of course, pre-treatment answers for our empirical analysis.[12]

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[11] These figures are in line with results from LICIP victimization surveys for the Buenos Aires Metropolitan Area for the months of January (37.1%) and February (36.2%) of 2015 when the experiment was performed.
[12] The more detailed questions regarding crime included in the second part of the survey reveal an increase in victimization rates (in part because a list of all possible crimes -including for example threats, vandalism and bribes- was read and participants should give an answer for each of them). This increase in victimization

TABLE 1: Types of Crime

Type of Crime[1]	Respondent		Respondent's household	
	Freq.	Percent	Freq.	Percent
Robbery	22	55.0	42	63.6
Larceny / Attempted larceny	13	32.5	18	27.3
Objects stolen from a vehicle	2	5.0	3	4.6
Car theft	1	2.5	2	3.0
Burglary	1	2.5	1	1.5
Fraud	1	2.5	0	0.0
Total	**40**	**100.0**	**66**	**100.0**

Note: In the pre-treatment short questionnaire, participants were asked "Have you or a member of your family living with you been a victim of a crime in the last 12 months?" For the individuals that responded affirmatively that they had been a victim of a crime, they were asked what was the crime. If more than one crime was suffered, the most serious crime suffered by the respondent was considered. For the individuals that responded affirmatively that a member of her/his family living with her/him had been a victim of a crime, they were asked what was the crime suffered by the family member. If more than one crime was suffered by the respondent's household member during the last twelve months, the most serious crime was considered. Both positive responses were recorded if both the respondent and a household member were victimized. The first two columns correspond to respondent's victimization, while the last two columns include victimization of all household members. Using the detailed description from the second, post-treatment part of the survey, the 22 robbery cases suffered by the respondent can be disaggregated into 8 cases of violent armed robbery with violence, 9 cases of armed robbery, and 5 cases of robbery without use of arms (or unknown). The 42 robberies suffered at the household level can be disaggregated into 12, 9, and 21 cases, respectively.

For participants of each socioeconomic status, we randomly selected one group to receive the treatment (watching a series of crime-related videos) and another one the placebo (watching alternative videos with no crime-related content). 79 participants received the treatment and 81 were assigned to the control group.[13]

In Table 2 we show the balance between our treatment and control groups regarding the pre-treatment characteristics of the participants. There are no statistically significant differences in age, gender, income levels (mean and median tests), and previous victimization at both the respondent and household level, suggesting the randomization was successful. Moreover, measurements of the four outcome variables (cortisol, Raven test, Stroop test, and heart rate) were taken before treatment, and the differences in these variables across treatment and control groups were insignificant, again suggesting that the randomization was successful.

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is larger for the treated group, but the difference is not statistically significant for neither the respondent nor the household victimization measures.

[13] Before running the experiment, assignment of the participants covered by quotas to treatment or control groups was done randomly for every socioeconomic group. Once the recruiting agency covered the quotas and could summit participants from any socioeconomic group freely, the assignment of treatment was done upon order of arrival. We used the following scheme: for each socioeconomic group j we defined two groups, A^j and B^j, and randomly assigned A^j to represent treatment or control (while B^j represented the opposite group), so the first participant from socioeconomic group j was assigned to group A^j, the second one to group B^j, the third one to group A^j, and so on. As the order of arrival of participants is presumed to be random, this scheme conserves randomness and intra-socioeconomic-group balance of treated and control group participants at the expense of potentially not splitting the final sample exactly in half between treatment and control groups.

TABLE 2: Pre-treatment Characteristics and Measures for Control and Treatment Groups

Pre-treatment Characteristics	Control Group (mean)	Treatment Group (mean)	p-Value	Observations
Age	41.42	42.94	0.3641	160
Sex	0.49	0.47	0.749	160
Income (mean test)	16732	17979	0.6371	160
Income (median test)	12000	15000	0.269	160
% Respondent victimized	0.28	0.22	0.3183	160
% Respondent's household victimized	0.46	0.37	0.2519	160
Pre-treatment Measures				
Cortisol	0.46	0.40	0.1373	156[1]
Raven (C and D)	0.49	0.48	0.825	160
Time Stroop[2]	-0.27	-0.27	0.9478	125[3]
Time Stroop (all cases)[2]	-0.29	-0.25	0.5017	160
Heart Rate[4]	-3.14	-2.47	0.1141	132[5]

Notes: 1. In four cases it was not possible to measure cortisol levels because the volume of saliva was insufficient (2 cases), or it was not clean enough (2 cases). 2. Time Stroop is measured in logs of time (seconds). 3. We discarded those participants that have accuracy equal or lower than 75% considering all incongruent trials from the mixed blocks. 4. Heart rate is normalized by deducting from the mean of each respondent, her/his own mean up to the video section. 5. 28 participants were unable to be measured due to poor ECG quality signal. Age is measured in years. Sex is a dummy variable that equals one for males. Income measures monthly household income expressed in local currency.

In turn, Table 3 shows the balance of pre-treatment characteristics and dependent variables of the participants by victimization status. Again, there are no statistically significant differences in pre-treatment characteristics (age, gender, mean income, and median income), treatment status, and pre-treatment outcome variables (cortisol, Raven test, Stroop test, and heart rate), between participants both by their victimization status or their household victimization status.

TABLE 3: Pre-treatment Characteristics and Measures for Victims and Non-Victims

Pre-treatment Characteristics	Respondent Victimization		p-Value	Household Victimization		p-Value	Observations
	Victims	Non-Victims		Victims	Non-Victims		
Age	40.80	42.63	0.3089	42.09	42.22	0.9368	160
Sex	0.48	0.48	0.9282	0.42	0.52	0.2286	160
Income (mean test)	17783	17203	0.8271	18468	16561	0.4433	160
Income (median test)	13000	15000	0.4670	12000	15500	0.108	160
% Treated	0.43	0.52	0.3197	0.44	0.53	0.2519	160
Pre-treatment Measures							
Cortisol	0.47	0.42	0.3178	0.47	0.41	0.1749	156[1]
Raven (C and D)	0.49	0.48	0.9743	0.48	0.49	0.7778	160
Time Stroop[2]	-0.25	-0.28	0.6662	-0.26	-0.27	0.8188	125[3]
Time Stroop (all cases)[2]	-0.30	-0.26	0.6486	-0.26	-0.27	0.8862	160
Heart Rate[4]	-2.66	-2.87	0.6686	-2.86	-2.78	0.8485	132[5]

Notes: 1. In four cases it was not possible to measure cortisol levels because the volume of saliva was insufficient (2 cases), or it was not clean enough (2 cases). 2. Time Stroop is measured in logs of time (seconds). 3. We discarded those participants that have accuracy equal or lower than 75% considering all incongruent trials from the mixed blocks. 4. Heart rate is normalized by deducting from the mean of each respondent, her/his own mean up to the video section. 5. 28 participants were unable to be measured due to poor ECG quality signal. Age is measured in years. Sex is a dummy variable that equals one for males. Income measures monthly household income expressed in local currency.

In order to control for possible circadian rhythm effects that might affect cortisol levels, all sessions of the experiment were run from 12pm to 8pm. Upon arrival, the experiment was explained in detail to each participant and time was given for her/him to ask every question they might have. Once each participant opted for participation in the experiment, she/he was asked to sign a written informed consent.[14] Upon signing, the first part of the survey was administered. Then, she/he received a small recipient, and was asked to submit a first sample of saliva. Afterwards, she/he was asked to sit in front of a computer, and the equipment for measurement of cardiac rhythm was installed. From this moment on, the heart rate of the participant was measured.

The participant was then asked to start the completion of a set of tasks, for which she/he received instructions on the screen. In this stage and before each task, the participant completed a few training trials of each task. During training trials, the participant was encouraged to ask the lab assistant for guidance in case of not understanding the task or system interface. The first task consisted in providing answers to a series of eight Raven´s Progressive Matrices. Then the participant completed a "flower-heart" Stroop-like test and reaction time was recorded for each trial. Upon completion of both tasks, one minute was given to the participant in order for she/him to rest. The mean heart rate during this time was taken as the pre-treatment level of heart rate.

After this rest period, the intervention was performed. Each person participated individually and the randomization was done at the individual level, so that there are no clustering issues involved. The intervention had the objective of making salient the concern about crime. It consisted of showing the participants a series of videos. If the participant had been assigned to the treatment group she/he was shown TV videos showing situations of violent crime, theft and insecurity. If she/he had been assigned to the control group, she/he was exposed to neutral trails with similar duration, location, colors, etc., but without any content of violent crime, theft or insecurity. All the videos had been obtained from recent open TV programs from Argentina. The treatment and placebo videos are described in detail in Annex I. All participants were indicated to pay attention to the videos.

Following the observation of the videos, the participant repeated both the Raven´s Progressive Matrices test (with new matrices), and the Stroop-like test. At this time no training trials were offered. Next, participants responded to the second part of the survey containing detailed

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[14] All participants provided written consent to their participation in the experiment.

questions covering socio-demographic characteristics and victimization history. Once the survey was completed, the participant submitted a second sample of saliva in a new recipient, payment was done, and the experiment concluded.

c. Econometric Specification and Response Variable Definitions

After the data collection process, we ran panel fixed-effect regressions for the different dependent variables under consideration obtained before and after the intervention on the treatment dummy, and on the interaction of the treatment dummy with the past victimization dummy. In particular, we used the following regression model:

$$(1)\ S_{it} = \alpha_i + \beta_1 \times Post_t + \beta_2 \times Treatment_{it} \times Victimization_i + \beta_3 \times Treatment_{it} \times (1 - Victimization_i) + \varepsilon_{it},$$

where S_{it} are our four different dependent variables (cortisol level, Raven test, Stroop test, and heart rate) for individual i and time t, α_i is a fixed effect for individual i, $Post_t$ is an indicator dummy for measures obtained after the interventions (the videos). There are two observations (pre and post) for each individual. $Treatment_{it}$ is an indicator dummy for the crime video. $Victimization_i$ is a dummy variable measuring previous crime victimization suffered by individual i (*Respondent's Victimization*) or her/his household members (*Household Victimization*). It is obtained from the response of the participants to the standard victimization question asked before the videos on whether the interviewed person or any household member had been victim of a crime in the last twelve months. ε_{it} is the error term. We used robust standard errors. The coefficients of interest for our hypothesis are β_2 and β_3 which measure the interactions of the treatment, which makes crime salient, with previous respondent or household victimization.

The four dependent variables under consideration are the following:
i. Cortisol is a steroid hormone which is released, among other things, in response to stress. Cortisol levels vary across individuals. Moreover, individual levels usually vary by time of the day, with a circadian cycle that peaks in the morning at awakening, and falls during the rest of the day. For each participant, we obtained two saliva samples, one obtained about 10 minutes after arrival and another one after the video at the end of the survey. For cortisol levels (in ug/dl) we take the first provided sample as the pre-treatment value and the second one as the post-treatment value. Cortisol levels were measured from these saliva samples.[15]

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[15] Saliva samples were analyzed at the Laboratory ManLab in Buenos Aires. Diez et al. (2011) used this laboratory to measure salivary cortisol for their study of bus drivers in Argentina. The variable is low-censured at 0.08 ug/dl (all measures below that level are reported at 0.08). In two cases the volume of the saliva was insufficient, and in two

ii. Raven's Progressive Matrices are a popular test used to measure the capacity to think logically and solve problems in different situations. Each Raven matrix presents a sequence of shapes with one shape missing and eight alternatives for this missing space, and each participant must choose which one of these alternatives best completes the missing part of the main image.

Sixteen matrices were presented in total: eight before and eight after the video. Each set of eight matrices was selected from three different chapters of the Standard Set of Progressive Matrices (Raven, 2003), where each successive chapter contains matrices of increasing levels of difficulty. For each set of eight matrices, we selected three matrices from chapter C, two matrices from chapter D, and three matrices from chapter E. We found that most of the participants (in both groups, and before and after) were not able to solve the three most difficult matrices (from chapter E), with a failure rate of 72%, so we decided to focus on the easier five in order to have greater variance. The Raven variable indicates each respondent's percentage of accuracy for these five matrices, taking the pre-video task accuracy as the pre-treatment value and the post-video task accuracy as the post-treatment one.

iii. For the Stroop Test, a version known as the "flower-heart" test was used. This test is considered to measure selective attention, cognitive flexibility and processing speed. In this test, a series of images are shown to the participant. These can be flowers or hearts and are placed randomly on the right or left side of a screen. If the figure is a heart and the image is on the left side of the screen, participants have to press "s" on the computer's keyboard (a key which is located on the left side of the keyboard) and if it is on the right side he/she has to press "k" (a key which is located on the right side of the keyboard). Instead, if the figure shown is a flower, she/he has to press the key which is on the opposite side with respect to the flower (i.e., if the flower is on the right side, she/he has to press "s" and if it is on the left side, she/he has to press "k").

The test consists of three blocks presented in the following order. First, in the congruent block only hearts are shown randomly on different sides of the screen (twelve times, six times on each side). Second, in the incongruent block only flowers are shown on different sides of the screen (twelve times, six times on each side). Finally, in the mixed block both figures are randomly shown thirty-four times on different sides of the screen (seventeen times each figure, and seventeen times on each side of the screen).[16] For every figure shown, we record the response time (the

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other occasions it was not clean enough. The results of five people were excluded because the absolute value variation between pre and post cortisol levels were larger than 2.5 standard deviations.

[16] Only during the pre-video test, the participants were instructed on how to respond to the task by showing them six training figures before each block (which did not count for the final test scores). For further details, see Wright and Diamond (2014).

time it took the participant to press the key since the picture was shown) and if the response is correct or not. Based on previous studies (Goldin et al., 2014), we focus on reaction times to incongruent trials from the mixed block for the participants with accuracy higher than 75% in the mixed trials. As a right skewness is seen in the distribution of reaction time, we took the logarithm of reaction time (in seconds) as our response variable and response times were saturated to a maximum of 5 seconds. We take the pre-video mean of the logarithm of the reaction time across trials as the pre-treatment value, and the post-video mean of the logarithm reaction time across trials as the post-treatment one.

iv. Heart rate, which also responds to emotional stress, was measured (in bpm) for each respondent throughout the experiment. Here we are comparing the mean of the heart rate during a minute of rest before the video is presented, as the pre-treatment value, relative to the mean of the heart rate during the video exposure as the post-treatment one. We normalize our variable by deducting from the measures of each respondent, her/his own mean up to the video section.[17] In other words, heart rate changes to the videos were computed as differential values between video presentation and the one-minute rest baseline.

IV. RESULTS

We ran a panel fixed effect regression for the four dependent variables under consideration measured before and after the intervention. In Table 4, we first analyze the overall effect of the video treatment, without considering interactions. The video per se produces no significant effects on cortisol and Raven matrices results. For heart rate, there is a significant reduction induced by watching the crime video. As explained, it has been shown that normal subjects exposed to affective filmed scenes show a reduction in their heart rate, the largest decelerations occurring during the viewing of unpleasant scenes.[18] There is also a reduction in time Stroop induced by the crime video.

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[17] For similar normalization, see Hubert et al. (1991), Lang et al. (1993), Palomba et al. (1997), and Palomba et al. (2000). Continuous electrocardiogram signal was acquired through a BioSemi electrode system. 28 participants were unable to be measured due to poor ECG quality signal.

[18] Palomba et al. (2000) explains that sustained heart rate deceleration is the systematic reaction to the sight of stimuli depicting mutilations, injuries or blood (see also Bradley et al., 1993; Gross and Levenson, 1993; Lang et al., 1993; Angrilli et al., 1994; Palomba et al., 1997). This phenomenon has been repeatedly observed in normal subjects as well as in blood phobics exposed to films depicting the feared situation (Klorman et al., 1977; Kleinknecht, 1988; Steptoe and Wardle, 1988; Lumley and Melamed, 1992).

TABLE 4: Overall Treatment Effects

VARIABLES	(1) Cortisol	(2) Raven C & D	(3) Time Stroop	(4) Heart Rate
Post	-0.119***	0.190***	-0.0980***	2.158***
	(0.0203)	(0.0341)	(0.0214)	(0.343)
Treatment	0.0211	0.0656	-0.0425*	-1.255**
	(0.0286)	(0.0474)	(0.0255)	(0.490)
Observations	302	320	250	264
R-squared	0.282	0.363	0.434	0.264
Number of individuals	151	160	125	132

Notes: Individual fixed effects are included in all the regressions. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. **Post** is a dummy variable that equals one if the observation was recorded after the videos, zero otherwise. **Treatment** is a dummy variable that equals one if the respondent belongs to the treated group, and zero otherwise.

Tables 5 and 6 present our main results. In these tables, we analyze the interaction of treatment and previous victimization for two different definitions of victimization: at the individual and household levels. A very interesting pattern emerges. The individuals who have been previously victimized show similar behavior as the control group. Instead, the treated individuals not previously victimized react to the treatment.

TABLE 5: Treatment Effects for Victimized and Non-Victimized Participants
(Respondent Level Victimization)

VARIABLES	(1) Cortisol	(2) Raven C & D	(3) Time Stroop	(4) Heart Rate
Post	-0.119***	0.190***	-0.0980***	2.158***
	(0.0204)	(0.0341)	(0.0215)	(0.344)
Treatment × Victimization	-0.0847**	-0.0372	-0.0271	-0.840
	(0.0402)	(0.0781)	(0.0288)	(0.962)
Treatment × No Victimization	0.0503*	0.0937*	-0.0460*	-1.351***
	(0.0302)	(0.0501)	(0.0270)	(0.511)
Observations	302	320	250	264
R-squared	0.318	0.373	0.435	0.265
Number of individuals	151	160	125	132

Notes: Individual fixed effects are included in all the regressions. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. **Post** is a dummy variable that equals one if the observation was recorded after the videos, zero otherwise. **Treatment × Victimization** is the interaction of the **Treatment** and **Victimization** dummies. **Treatment** is a dummy variable that equals one if the respondent belongs to the treated group, and zero otherwise. **Victimization** is a dummy variable that equals one if the respondent has been victimized during the last twelve months, zero otherwise. We cannot reject the null hypothesis that the four coefficients associated with the **Treatment × Victimization** variable are jointly equal to zero (F=1.57, p=0.1803). Instead, we reject the null hypothesis that the four coefficients associated with the **Treatment × No Victimization** variable are jointly equal to zero at the 99% confidence level (F=4.03, p=0.0031). Moreover, we reject the joint hypothesis that the coefficients of the variables **Treatment × Victimization** and **Treatment × No Victimization** in each equation are equal at the 99% confidence level (F=3.56, p=0.0071).

In Table 5, victimization is defined at the respondent's level. Non-previously victimized participants show higher cortisol levels, higher Raven scores, faster Stroop, and a lower heart

rate than the control group. The differences are statistically significant for each variable, and they are jointly significant with a p=0.0031. Instead, the treatment effects are not significant for the victimized group for Raven answers, time Stroop and heart rate, and they show a significant but opposite effect for cortisol. We cannot reject the joint null hypothesis of no effect for the previously victimized individuals at standard significance levels (p=0.1803). Moreover, we reject the joint hypothesis of similar effects for the victimized and non-victimized treated groups (p=0.0071).

In Table 6, victimization is defined at the respondent's household level. Non-victimized participants show higher cortisol levels, faster Stroop, higher Raven scores, and a lower heart rate, than the control group. The differences are statistically significant, but for the Raven scores, and they are jointly significant with a p=0.0035. Instead, the treatment effects are not significant for the victimized group (joint p=0.562). Again, we reject the joint hypothesis of similar effects for the victimized and non-victimized treated groups at standard significance levels (p=0.082).

TABLE 6: Treatment Effects for Victimized and Non-Victimized Participants
(Household Level Victimization)

VARIABLES	(1) Cortisol	(2) Raven C & D	(3) Time Stroop	(4) Heart Rate
Post	-0.119***	0.190***	-0.0980***	2.158***
	(0.0204)	(0.0341)	(0.0215)	(0.344)
Treatment × Victimization	-0.0320	0.0444	-0.0116	-0.871
	(0.0387)	(0.0710)	(0.0279)	(0.660)
Treatment × No Victimization	0.0534*	0.0779	-0.0563**	-1.443**
	(0.0316)	(0.0508)	(0.0280)	(0.559)
Observations	302	320	250	264
R-squared	0.302	0.364	0.441	0.267
Number of individuals	151	160	125	132

Notes: Individual fixed effects are included in all the regressions. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. **Post** is a dummy variable that equals one if the observation was recorded after the videos, zero otherwise. **Treatment × Victimization** is the interaction of the **Treatment** and **Victimization** dummies. **Treatment** is a dummy variable that equals one if the respondent belongs to the treated group, and zero otherwise. **Victimization** is a dummy variable that equals one if at least one member of the respondent's household has been victimized during the last twelve months, zero otherwise. We cannot reject the null hypothesis that the four coefficients associated with the **Treatment × Victimization** variable are jointly equal to zero (F=0.74, p=0.562). Instead, we reject the null hypothesis that the four coefficients associated with the **Treatment × No Victimization** variable are jointly equal to zero at the 99% confidence level (F=3.97, p=0.0035). Moreover, we reject the joint hypothesis that the coefficients of the variables **Treatment × Victimization** and **Treatment × No Victimization** in each equation are equal at the 90% confidence level (F=2.08, p=0.082).

Thus, previous victimization seems to induce a "desensitization" or "adaptation" effect: individuals previously victimized, or from previously victimized households, seem to develop no reaction to the treatment, showing similar performance than the individuals treated with the placebo. Instead, non-victimized respondent show significant reactions to the treatment videos.

The use of respondent and household victimization yields similar results, suggesting the presence of desensitization under both the case of respondents or their close relatives being victimized.[19] However, although household members may be altruistically linked, we could expect desensitization to be lower in response to more indirect stimuli. Indeed, if we split victimized treated participants into respondent's victimization and relatives' victimization, the impact of treatment for relatives' victimization seems somewhat intermediate between the effect on victimized respondents and the effect on non-victims.[20]

Additional tests reveal our results to be robust: for example, considering the Stroop time for all the participants and not only, as explained above, for those with 75% of positive responses; considering all the Raven matrices -including those from chapter E which showed high failure rates-; and excluding five individuals for whom cortisol readings were low-censored by the laboratory at 0.08 ug/dl (the laboratory's minimum ug/dl detection value for salivary cortisol). The results are also robust to considering victimization in the last 5 years, instead of the last 12 months. In all these cases, the pattern of previous victimization reducing the impact of treatment remains unaltered. The treatment shows no significant impact for the previously victimized participants, whereas it is significant for the non-victimized participants.[21]

A potential concern is that the different behavior between victimized and non-victimized participants might not be a result of our treatment video, but could also occur in the control group. One could think that victims and non-victims react differently to watching videos regardless of the contents of those videos. In Tables 7 and 8, we instead consider the placebo video as a treatment, and the crime video as a control. For both victimization definitions, the pattern of responses for victimized and non-victimized participants is extremely similar and we cannot reject the joint hypothesis of similar effects at standard significance levels (p=0.5255 for respondent's victimization and p=0.5507 household victimization). Thus, a different behavior by victimized vis-a-vis non-victimized participants is not observed in the group exposed to the control video.[22]

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[19] Purposely, treatment videos (#2, #5, and #7) show interviews to relatives of crime victims, while treatment video #4 shows a father covering his children during a homicide (See Annex I).

[20] Results available upon request. Statistical power is not enough for conclusive results.

[21] Results available upon request. We also explored differential impact of the video treatment by socioeconomic level, and found no heterogeneous effects between rich and poor. It should be noted, however, that the differences in income in our sample are not large.

[22] Of course, the statistical significance observed on the Time Stroop and Heart Rate variables in Tables 7 and 8 is just the mirror of the overall impact of treatment on these same variables shown in Table 4.

TABLE 7: Differences in Effects of Placebo Video for Victimized and Non-Victimized Participants (Respondent Level Victimization)

VARIABLES	(1) Cortisol	(2) Raven C & D	(3) Time Stroop	(4) Heart Rate
Post	-0.0980***	0.256***	-0.141***	0.903**
	(0.0201)	(0.0331)	(0.0138)	(0.351)
Control ×	-0.0442	-0.0296	0.0921*	1.064*
Victimization	(0.0453)	(0.0706)	(0.0470)	(0.600)
Control ×	-0.0113	-0.0798	0.0196	1.341**
No Victimization	(0.0307)	(0.0523)	(0.0266)	(0.568)
Observations	302	320	250	264
R-squared	0.285	0.364	0.450	0.264
Number of individuals	151	160	125	132

Notes: Individual fixed effects are included in all the regressions. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. **Post** is a dummy variable that equals one if the observation was recorded after the videos, zero otherwise. **Control × Victimization** is the interaction of the **Control** and **Victimization** dummies. **Control** is a dummy variable that equals one if the respondent belongs to the control group, and zero otherwise. **Victimization** is a dummy variable that equals one if the respondent has been victimized during the last twelve months, zero otherwise. We reject the null hypothesis that the four coefficients associated with the **Control × Victimization** variable are jointly equal to zero at the 90% confidence level (F=2.03, p=0.0894). We reject the null hypothesis that the four coefficients associated with the **Control × No Victimization** variable are jointly equal to zero at the 90% confidence level (F=2.14, p=0.0750). Instead, we cannot reject the joint hypothesis that the coefficients of the variables **Control × Victimization** and **Control × No Victimization** in each equation are equal (F=0.80, p=0.5255).

TABLE 8: Differences in Effects of Placebo Video for Victimized and Non-Victimized Participants (Household Level Victimization)

VARIABLES	(1) Cortisol	(2) Raven C & D	(3) Time Stroop	(4) Heart Rate
Post	-0.0980***	0.256***	-0.141***	0.903**
	(0.0201)	(0.0331)	(0.0138)	(0.351)
Control ×	-0.0417	-0.0611	0.0711**	1.015*
Victimization	(0.0378)	(0.0571)	(0.0345)	(0.550)
Control ×	-0.00300	-0.0693	0.0158	1.469**
No Victimization	(0.0325)	(0.0592)	(0.0316)	(0.633)
Observations	302	320	250	264
R-squared	0.286	0.363	0.445	0.266
Number of individuals	151	160	125	132

Notes: Individual fixed effects are included in all the regressions. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. **Post** is a dummy variable that equals one if the observation was recorded after the videos, zero otherwise. **Control × Victimization** is the interaction of the **Control** and **Victimization** dummies. **Control** is a dummy variable that equals one if the respondent belongs to the control group, and zero otherwise. **Victimization** is a dummy variable that equals one if at least one member of the respondent's household has been victimized during the last twelve months, zero otherwise. We reject the null hypothesis that the four coefficients associated with the **Control × Victimization** variable are jointly equal to zero at the 95% confidence level (F=2.50, p=0.0417). Instead, we cannot reject the null hypothesis that the four coefficients associated with the **Control × No Victimization** variable are jointly equal to zero (F=1.75, p=0.1374). Moreover, we cannot reject the joint hypothesis that the coefficients of the variables **Control × Victimization** and **Control × No Victimization** in each equation are equal (F=0.76, p=0.5507).

V. CONCLUSIONS

We find that victims of (non-very severe) crimes have smaller emotional and cognitive reactions to watching real crime scenes on a video than non-victims. Our data consistently reveal that victims of crime become "desensitized" compared with non-victims. The evidence might help to understand tolerance to crime and a weak relationship between crime and happiness in high-crime areas, like Latin America. It might also help to understand the correlation between crime levels and the proportion of violent crime, as it might be necessary to exert increasing levels of violence on previously victimized individuals to scare them.

Previous research has shown that people exposed to media violence, such as those playing violent video games, can become desensitized (Bartholow et al., 2006; Carnagey et al., 2007; Fanti et al., 2009). Indeed, it appears that, at least for some groups, playing a violent video game caused a reduction in the brain's response to depictions of real-life violence. Our paper complements this literature by showing desensitization amongst crime victims. This phenomenon has both emotional (cortisol and heart rate levels) and cognitive (Raven´s matrices scores and Stroop-like test reaction times) components.

The fact that watching crime did not affect the responses of those previously victimized is interesting and might evoke several reactions. One concern is to think that the size of the stimuli was insufficient to provoke a response, but that being in the presence of a real crime –and not just one on a TV monitor– would be enough. Another concern is that some unmeasured factor might cause both a predisposition to avoid crime, and an increased response to images of crime on TV. Even in this case, it is important to note that as the rate of crime victimization increases, a larger group of the population shares this increased desensitization. Future research might investigate the use of stronger stimuli and the role of omitted factors in the victimization/desensitization link.

VI. REFERENCES

Amir, N., R. J. Mcnally, B. C. Riemann, J. Burns, M. Lorenz and J. T. Mullen (1996). "Suppression of the emotional Stroop effect by increased anxiety in patients with social phobia". *Behaviour Research and Therapy*, 34.11: 945-948.

Amodio, F. (2013). "Crime Protection Investment Spillovers: Theory and evidence from the City of Buenos Aires". Documento de Trabajo CAF N° 2013/06, Caracas: CAF.

Angrilli, A., Palomba, D. and Stegagno, L. (1994), "Modulazione psicofisiologica delle emozioni indotte da stimoli visivi". *Giornale Italiano di Psicologia,* XXI 5, 833-856.

Bartholow, B. D., B. J. Bushman and M. A. Sestir (2006). "Chronic violent video game exposure and desensitization to violence: Behavioral and event-related brain potential data". *Journal of Experimental Social Psychology*, 42: 532–539.

Becker, G. S. (1968). "Crime and punishment: an economic approach". *Journal of Political Economy*, 76 (2): 169–217.

Bradley, M.M., Greenwald, M.K. and Hamm, A.O. (1993), "Affective picture processing". In: Birbaumer, N., Ohman, A. (eds.), The Structure of Emotion. Hogrefe and Huber, Toronto.

Carnagey, N. L., Anderson, C. A., and Bushman, B. J. (2007). "The effect of video game violence on physiological desensitization to real-life violence". *Journal of Experimental Social Psychology*, 43: 489–496.

Carney, D., A. Cuddy, and A. Yap (2010) "Power Posing: Brief Nonverbal Displays Affect Neuroendocrine Levels and Risk Tolerance". *Psychological Science*, 21(10): 1363-1368.

Carpenter, P. A., M. A. Just, and P. Shell (1990). "What one intelligence test measures: a theoretical account of the processing in the Raven Progressive Matrices Test". *Psychological Review*, 97.3: 404.

Davidson, M. C., Amso, D., Anderson, L. C., & Diamond, A. (2006). "Development of cognitive control and executive functions from 4 to 13 years: Evidence from manipulations of memory, inhibition, and task switching". *Neuropsychologia*, 44(11), 2037-2078.

Di Tella, R. and E. Schargrodsky (2009). "Happiness, ideology and crime in Argentine cities", IDB Working Paper Series 112.

Di Tella, R., S. Galiani and E. Schargrodsky (2010). "Crime Inequality and Victim Behavior during a Crime Wave", in Di Tella, Edwards and Schargrodsky (eds.), The Economics of Crime: Lessons for and from Latin America, Chicago and London: NBER-University of Chicago Press.

Dickerson, S. and M. Kemeny (2004). "Acute Stressors and Cortisol Responses: A Theoretical Integration and Synthesis of Laboratory Research", *Psychological Bulletin*, 130, pp. 355-391.

Diez, J. J., D. E. Vigo, S. Pérez Lloret, S. Rigters, N. Role, D. P. Cardinali, and D. Pérez Chada (2011) "Sleep habits, alertness, cortisol levels and cardiac autonomic activity in short distance bus drivers: differences between morning and afternoon shifts". *Journal of Occupational and Environmental Medicine*, 53(7).

Ditzen, B., M. Schaer, B. Gabriel, G. Bodenmann, U. Ehlert, M. Heinrichs (2009). "Intranasal oxytocin increases positive communication and reduces cortisol levels during couple conflict." *Biological Psychiatry*, vol. 65.9, pp. 728-731.

Engelhardt, C. R., B. D. Bartholow, G. T. Kerr, B. J. Bushman, (2011) "This is your brain on violent

video games: Neural desensitization to violence predicts increased aggression following violent video game exposure", *Journal of Experimental Social Psychology* 47, 1033–1036.

Engle, R. W., Kane, M. J., & Tuholski, S. W. (1999a). "Individual differences in working memory capacity and what they tell us about controlled attention, general fluid intelligence, and functions of the prefrontal cortex". Models of working memory: Mechanisms of active maintenance and executive control, pp. 102-134.

Engle, R. W., Tuholski, S. W., Laughlin, J. E., & Conway, A. R. (1999b). "Working memory, short-term memory, and general fluid intelligence: a latent-variable approach". *Journal of Experimental Psychology: General*, 128(3), 309.

Fanti, K. A., E. Vanman, C. C.Henrichand and M. N. Avraamides (2009). "Desensitization to media violence over a short period of time". *Aggressive Behavior*, 35: 179–187.

Goldin, A. P., M. J. Hermida, D. E. Shalom, M. E. Costa, M. Lopez-Rosenfeld, M. S. Segretin and M. Sigman (2014). "Far transfer to language and math of a short software-based gaming intervention". Proceedings of the National Academy of Sciences,111 (17): 6443-6448.

Graham C., and J. C. Chaparro (2012). "The Linkages Between Insecurity, Health, and Well-Being in Latin America: An Initial Exploration Based on Happiness Surveys" in Webb D., and E. Wills-Herrera (eds.), Subjective Well-Being and Security. Social Indicators Research Series, 46: 197-252, Springer, Dordrecht.

Gross, J.J. and Levenson, R.W. (1993), "Emotional suppression: physiology, self-report and expressive behavior". *Journal of Personality and Social Psychology,* 64, 970-986.

Heinrichs, M., T. Baumgartner, C. Kirschbaum and U. Ehlert (2003). "Social support and oxytocin interact to suppress cortisol and subjective responses to psychosocial stress." *Biological Psychiatry*, vol. 54.12, pp. 1389-1398.

Hubert, W., and R. de Jong-Meyer (1991)."Autonomic, neuroendocrine, and subjective responses to emotion-inducing film stimuli." *International Journal of Psychophysiology*, 11(2): 131-140.

Huesmann, L. Rowell and L. Kirwil (2007). "Why observing violence increases the risk of violent behavior in the observer". In D. J. Flannery, A. T. Vazsonyi, & I. D. Waldman (eds.), Cambridge Handbook of Violent Behavior and Aggression, Cambridge University Press, pp. 545–570.

Hunt, E. (2010). "Human intelligence". Cambridge University Press.

Kirschbaum, C., and D. H. Hellhammer (2000). "Salivary Cortisol". Encyclopedia of Stress, 3: 379-383.

Kleinknecht, R.A. (1988), "Specificity and psychosocial correlates of blood injury fear and fainting". *Behaviour Research and Therapy,* 26, 303-309.

Klorman, R., Weissberg, R.P. and Wiesenfeld, A.R., (1977), "Individual differences in fear and autonomic reactions to affective stimulation". *Psychophysiology*, 14, 45-51.

Lang, P.J., Greenwald, M.K., Bradley, M.M. and Hamm, A.O. (1993), "Looking at pictures: affective, facial, visceral and behavioral reactions". *Psychophysiology* 30, 261-273.

Lang, P.J., Bradley, M.M. and Cuthbert, B.N. (1997), "Motivated attention: affect, activation and action". In: Lang, P.J., Simons, R.F., Balaban, M.T. (eds.). Attention and Orienting: Sensory and Motivational Processes. Erlbaum, Hillsdale, NJ.

Latinobarómetro (1995-2015), "Informe Latinobarómetro", available at http://www.latinobarometro.org/latContents.jsp?CMSID=InformesAnuales

Linde, L., and M. Bergströme (1992)."The effect of one night without sleep on problem-solving and immediate recall". *Psychological Research*, vol. 54.2, pp. 127-136.

Lumley, M.A., Melamed, B.G. (1992), "Blood phobics and non phobics: psychological differences and affect during exposure". *Behaviour Research and Therapy,* 30, 425-434.

MacLeod, Colin M. (1991). "Half a century of research on the Stroop effect: an integrative review". *Psychological Bulletin*, 109.2: 163.

Mani, A., Mullainathan, S., Shafir, E., & Zhao, J. (2013). "Poverty Impedes Cognitive Function". *Science*, 341(6149), 976-980.

Mullin, C.R. and D. Linz (1995) "Desensitization and resensitization to violence against women: effects of exposure to sexually violent films on judgments of domestic violence victims", *Journal of Personality and Social Psychology*, Sep; 69(3):449-59.

O'Flaherty, B., and R. Sethi (2010). "Peaceable Kingdoms and War Zones: Preemption, Ballistics and Murder in Newark" in Di Tella, Edwards and Schargrodsky (eds.), The Economics of Crime: Lessons for and from Latin America, Chicago and London: NBER-University of Chicago Press.

Palomba, D., Angrilli, A. and Mini, A. (1997), "Visual evoked potentials, heart rate responses and memory to emotional pictorial stimuli". *International Journal of Psychophysiology,* 27, 55-67.

Palomba, D., Sarlo, M., Angrilli, A., Mini, A., and Stegagno, L. (2000). "Cardiac responses associated with affective processing of unpleasant film stimuli". *International Journal of Psychophysiology*, 36(1), 45-57.

Posner, M. I., & DiGirolamo G. J. (1998). "Conflict, target detection and cognitive control". In R. Parasuraman, (ed.), The Attentive Brain. Cambridge, MA: MIT Press.

Raven, J. (2000). "The Raven's progressive matrices: change and stability over culture and time". *Cognitive Psychology*, 41(1), 1-48.

Raven, J. (2003). "Test de Matrices Progresivas: Escala General" (2nd ed.). Buenos Aires, Paidós.

Roelofs, K., M. A. Hagenaars and J. Stins (2010). "Facing Freeze Social Threat Induces Bodily Freeze in Humans." *Psychological Science*.

Rosburg, T., Haueisen, J., and Sauer, B. (2002). "Habituation of the auditory evoked field component N100m and its dependence on stimulus duration".*Clin. Neurophysiol,* 113: 421-428.

Rosburg, T., Trautner, P., Boutros, N. N., Korzyukov, O. A., Schaller, C., Elger, C. E., et al. (2006). "Habituation of auditory evoked potentials in intracranial and extracranial recordings". *Psychophysiology* 43, pp. 137–144.

Schultheiss, O. and S. Stanton (2009). "Assesment of Salivary Hormones"in E. Harmon-Jones and J. Beer (eds.), Methods in the Neurobiology of Social and Personality Psychology, New York, NY: Guilford.

Shah, A., S. Mullainathan, and E. Shafir (2012). "Some Consequences of Having Too Little", *Science* 338, pp. 682-685.

Shibasaki, M., T. Isomura, and N. Masataka (2014). "Viewing images of snakes accelerates making judgements of their colour in humans: red snake effect as an instance of 'emotional Stroop facilitation'". *Royal Society Open Science*, 1.3, 140066.

Snedker, K. A. (2006). "Altruistic and vicarious fear of crime: Fear for others and gendered social roles." *Sociological Forum*, 21(2), 163-195.

Soares, R. (2004), "Crime Reporting as a Measure of Institutional Development". *Economic Development and Cultural Change*, 52 (4), pp. 851-871

Sörös, P., Knecht, S., Manemann, E., Teismann, I., Imai, T., Lütkenhöner, B., et al. (2001). "Hemispheric asymmetries for auditory short- term habituation of tones?". In Biomag 2000, Proceedings 12th International Conference on Biomagnetism, eds J. Nenonen, R. J. Ilmoniemi, and T. Katila (Espoo: Helsinki University of Technology), 47–49.

Steptoe, A. and Wardle, J. (1988), "Emotional fainting and the psychophysiologic response to blood and injury: autonomic mechanisms and coping strategies". *Psychosomatic Medicine*, 50, 402-417.

Thompson, R. F., and Spencer, W. A. (1966). "Habituation: a model phenomenon for the study of neuronal substrates of behavior". *Psychol. Rev.*, vol. 73, pp. 16–43.

Tulloch, M. I. (2004). "Parental fear of crime: A discursive analysis." *Journal of Sociology*, 40(4), 362-377.

Warr, M. (1992). "Altruistic fear of victimization in households." *Social Science Quarterly*, 73(4), 723-736.

Warr, M., and Ellison, C. G. (2000). "Rethinking social reactions to crime: Personal and altruistic fear in family households." *American Journal of Sociology*, 106(3), 551-578.

Wirtz, P. H., J. Siegrist, U. Rimmele, and U. Ehlert (2008). "Higher overcommitment to work is associated with lower norepinephrine secretion before and after acute psychosocial stress in men". *Psychoneuroendocrinology*, 33, pp. 92-99.

Wright, A., and A. Diamond (2014). "An effect of inhibitory load in children while keeping working memory load constant". *Frontiers in Psychology*, vol. 5.

Young, A. H. (2004). "Cortisol in mood disorders". *Stress: The International Journal on the Biology of Stress*, 7(4), 205-208.

Annex I – The Treatment and Placebo Videos

The Treatment Video

The treatment video opens with a black screen for the first minute, and then continues with the following nine short videos, all of them extracted from open TV programs, which amount to 13 minutes and 51 seconds:

Video #1:

Two young girls are walking through a park in Buenos Aires and two boys approach them. The girls try to dodge the two guys but fail to. Then one boy steals the bag from one of the girls and both boys run away. In the background, a journalist narrates the story.

Video #2:

A man whose child was killed is interviewed by a journalist. He tells the story of how someone killed his oldest kid when they were returning from soccer practice. Apparently, a couple of men on a motorcycle mistook him for the owner of a business that they had just robbed and shot the car, wounding the child. During the interview, the father cries, a woman protests, and images of the family affected by the events are shown.

Video #3:

The crime happened in a supermarket in the cashier area. A young man appears with a gun in his hand shooting the ceiling and leads everyone, customers and employees to the back of the supermarket. At the same time, he is taking the money from the cashiers. He cannot open one of them and takes the whole box with him. Meanwhile, an old man is confused and moves slowly backwards. The images are from a security camera, therefore the sound is off. In the background, a journalist is heard narrating the story.

Video #4:

Once again, this video is from a security camera, therefore the sound is off. Instead, in the background, the voice of a journalist describing the case is heard. A thief gets into a retail store to rob it. Few seconds before him, a man had entered too with his two children, a boy aged eight or nine years old and a girl of about five years old. The thief approaches the cash register but suddenly realizes there's a security guard standing next to him. Suddenly, the offender shoots the guard in the head and runs. The father looks at the man on the floor and tries to cover his children so that they cannot see the dead body.

Video #5:

This video starts showing images of an outdoor security camera: a car intercepts another car, one armed man gets out and into the intercepted car, forces the victims to go to the back seat of their own car, and drives away. Then the video features the testimony of the victim's sister telling how her brother, as well as his wife, his daughter, and his sister-in-law were kidnapped. She tells how they asked their parents for ransom, and how the money was paid to the kidnappers.

Video #6:

Again, these are images taken by a security camera in a supermarket. The video shows how a

supermarket guard realized that a couple of men on a motorbike were about to rob the store. He managed to enter the store and close the door behind him. The criminals tried to enter the supermarket by forcing the door. Once they failed to open the door, they leave, but first shot through the door, hurting the guard in the foot. During the whole scene a reporter's voice is heard narrating the event.

Video #7:

This is an interview about two parents whose son was killed two blocks away from their home on a Sunday afternoon. A journalist asks them what happened while they are holding hands. Apparently a couple of criminals attempted to steal his cell phone, he resisted, and they wounded him with a knife. Both parents tell how they felt at the time, how difficult it was -and still is- losing their child.

Video #8:

Two Chilean tourists ask a young man for directions for a place to eat out and he tells them to follow him through the streets of Buenos Aires, which they do for a long time. Finally, when the tourists tell they want to go since it is too late and it is raining, the young man steals their camera from them.

Video #9:

These images belong to an event that took place at a gas station in Buenos Aires. Two armed men held one hostage each, pointing their guns to the victims' heads. They kept threatening them and yelling, saying that if they didn't get a lawyer and a judge on site immediately, they were going to kill them. One of them shot up to the sky. Finally, heavily armed policemen entered the building, captured the criminals, and freed the hostages.

The Control Video

The control video opens with a black screen for the first minute, and then continues with the following nine short videos, all of them extracted from open TV programs, which amount to 13 minutes and 51 seconds:

Video #1:

It happens in the same park as the first treatment video. A large group of children are running while they film themselves carrying a camera as they run. They pass each other the camera and cheerful background music is heard.

Video #2:

This is an interview with two experts in drones in a park where people are playing with drones. The experts describe what a drone is and how it works. The video shows images of the journalist and the two people talking, as well as images of the small aircraft flying in the air.

Video #3:

It is a segment of a newscast where two journalists presented a price agreement. You can see both journalists talking, images of various supermarket shelves, and people shopping through

the shelves.

Video #4:

It shows how a butcher arrives at his workplace and changes shifts with the person who was working before. Then three men come to the butcher's to buy some sausages. They speak with the butcher, buy the sausages, pay and leave. Finally, a woman walks in to buy some chicken.

Video #5:

On this video, the story explains how one should sit to avoid problems in blood circulation, especially in the legs. A reporter interviews a specialist who explains the proper way to sit to avoid these problems and describes some exercises that can help to reduce these problems. While the interview is done, images of people sitting in different places crossing and uncrossing their legs are shown.

Video #6:

These are images taken by a security camera in a store. The image of a counter where there are three people tending to customers and them being served or waiting to be served is visible on screen. No audio is heard, only neutral music.

Video #7:

This is a piece from the same program as the corresponding video in the video treatment. In this case, the issue of young Argentines moving to Peru, searching for a better economic situation, is addressed. It is an interview with a girl who narrates her experience, describes how quickly she found a job and how happy she is living in Peru.

Video #8:

This video shows winter images of Buenos Aires, images quite similar to those shown in the corresponding video treatment, similar neighborhood, people walking, etc.

Video #9:

Again, it is a story from the same TV show that the corresponding video of the video treatment. It is an interview to a musician who explains the problems the orchestra of the Colón Theater-an important traditional national theater- is having to rehearse. During the interview images of the musicians on the street talking to each other are shown.

Capítulo 3

Can Fear Change our Beliefs?

I. INTRODUCTION

2020 has been very challenging for the entire world, and Argentina was one of the most affected countries. The advent of the Covid-19 pandemic brought along a mandatory lockdown that lasted over 200 days.[1,2] This situation has amplified existing problems for its society, divided and frayed for several years.[3] In December 2020, the national government attempted to inject optimism by announcing the arrival of millions of doses of vaccines by the end of the year[4]. Thus, the vaccine became a significant symbol of salvation for the national government (Lasswell 1927).

Initially, there were rumors about the arrival of several vaccines (Sputnik, AstraZeneca, Pfizer and Sinopharm).[5] However, by the end of 2020, the Russian vaccine Sputnik was thrust into the limelight[6] and was immersed in an intense polarized political discussion.[7]

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[1] https://www.infobae.com/politica/2020/09/18/el-gobierno-extendera-la-cuarentena-hasta-el-11-de-octubre-y-superara-los-200-dias-de-aislamiento/

[2] https://www.elindependiente.com/politica/2020/09/02/hartazgo-en-argentina-por-la-cuarentena-mas-larga-del-mundo/

[3] https://www.perfil.com/noticias/opinion/yehonatan-abelson-la-grieta-los-extremos-como-el-todo.phtml
https://www.perfil.com/noticias/politica/florencio-randazzo-contra-macri-y-cristina-llevaron-a-la-argentina-al-desastre.phtml
https://www.perfil.com/noticias/politica/encuesta-opinaia-aunque-grieta-se-fortalece-menos-40-por-ciento-pertenece-a-nucleo-duro.phtml
https://www.cronista.com/3dias/Confesiones-de-CFK-la-foto-que-le-nego-a-Macri-y-ahondo-la-grieta-20190503-0002.html
https://tn.com.ar/opinion/2021/06/27/cristina-kirchner-y-mauricio-macri-los-abanderados-de-la-grieta-en-campana/
https://www.cronista.com/economia-politica/grieta-pandemia-y-una-economia-que-no-remonta-se-largo-la-campana/
https://elpais.com/internacional/2017/11/08/argentina/1510162393_610131.html

[4] https://www.infobae.com/politica/2020/11/06/alberto-fernandez-la-vacunas-tienen-una-altisima-calidad-tecnica-en-todos-los-casos/
https://www.cronista.com/economia-politica/Alberto-Fernandez-anuncio-que-se-firmo-el-acuerdo-por-la-vacuna-rusa-20201210-0015.html
https://www.pagina12.com.ar/306816-alberto-fernandez-a-fines-de-diciembre-podriamos-contar-con-
https://www.cancilleria.gob.ar/es/actualidad/noticias/coronavirus-alberto-fernandez-anuncio-que-el-gobierno-firmo-el-acuerdo-con-rusia
https://www.lanacion.com.ar/politica/alberto-fernandez-vamos-poder-vacunar-300-mil-nid2528860/
https://www.clarin.com/politica/mensaje-alberto-fernandez-llegada-vacuna-rusa-abre-camino-esperanza-pandemia-termino-_0_UtbWfaM9f.html

[5] https://www.infobae.com/america/tendencias-america/2020/11/09/cuales-son-las-vacunas-contra-el-covid-19-que-llegaran-a-la-argentina/

[6] https://www.casarosada.gob.ar/informacion/discursos/47394-anuncio-y-conferencia-de-prensa-del-presidente-de-la-nacion-alberto-fernandez-y-el-ministro-de-salud-de-la-nacion-gines-gonzalez-garcia-en-la-sala-de-conferencias-casa-rosada

[7] By way of example, the following two newspaper articles can be compared:
1) https://www.lanacion.com.ar/politica/criticas-oposicion-compra-dosis-vacuna-rusa-nid2497888/
2) https://www.elmundo.es/ciencia-y-salud/salud/2020/12/23/5fe3a2ebfdddff9d0c8b4796.html

At the time of the government announcement, the phase 3 study results of the Sputnik vaccine were not yet available.[8] They were finally published in the scientific journal The Lancet 45 days later, on February 2, 2021. During these 45 days the safety and efficacy of the vaccine were not entirely clear for the Argentinian population.[9]

The opposition to the government and some media outlets reacted, stating that the reports certifying its safety and efficacy had not been submitted yet.[10] A significant portion of the population, including many opposition leaders, were mistrustful of its efficacy and expressed doubts about its safety. For example, in our data, we can see that the people who had voted for the incumbent national government (Alberto Fernández) in the last elections of October 2019 showed, in a Likert scale from 1 (No trust) to 10 (Completely trust), an average trust level in the vaccine of 7.64 points. Meanwhile, the rest of the voters showed an average trust level of 4.71 points. If we consider only those who voted for the leading opposing candidate (Mauricio Macri), the indicator falls to 3.85 points.[11] Amid this polarization of opinions, public opinion debated between celebrating the arrival of the vaccine, which would help everything go back to normal, and aligning with the questions posed regarding the vaccine efficacy and safety.

In this scenario, it is interesting to delve into the potential impact which varying news about the vaccine might have on the opinions of Argentinians. Therefore, the first question that this paper will attempt to answer is whether the emotional response to different information depends on the political standing of the person exposed to the news. Then, we will try to establish the impact of the information on the vaccine trust levels.

To answer these questions, we conducted a controlled experiment consisting of a traditional online survey, along with the reading of the facial expressions of the respondents while they watched one of three testimonials selected at random. With this procedure, we measure emotional responses in real-time, avoiding any changes of mind that might occur when there is a second to think about it. The first video showed the governor of the Buenos Aires Province telling his experience when he was vaccinated and emphasizing that the end of the pandemic problem was close. The second video showed a pathologist questioning the efficacy and safety of the Russian vaccine. And the third video, used as a benchmark, showed a news report about a solar eclipse. The transcription of the three videos is in Appendix 1.

We used Facial Automatic Coding (FAC) to identify emotions in participants' faces. It is a mechanism seldom used in Economics or Political Sciences (K. Fridkin et al. 2021; K. L. Fridkin et al. 2021; McDuff et al. 2013), which reads facial expressions in participants' faces in a non-invasive way, measuring the intensity of the six universal emotions: happiness, sadness, anger, surprise, fear, and disgust. From these

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[8] According to the World Health Organization in phase 3, the vaccine is given to thousands of volunteers – and compared to a similar group of people who didn't get the vaccine but received a placebo product – to determine if the vaccine is effective against the disease it is designed to protect against and to study its safety in a much larger group of people. Most of the time, phase three trials are conducted across multiple countries and multiple sites within a country to assure the findings of the vaccine performance apply to many different populations.

[9] https://espanol.medscape.com/verarticulo/5906563

[10] https://chequeado.com/el-explicador/que-se-sabe-y-que-no-sobre-la-vacuna-rusa/
https://cattiviscienziati.com/2020/09/07/note-of-concern/
https://www.france24.com/es/20200814-por-qu%C3%A9-ha-causado-tanta-pol%C3%A9mica-la-vacuna-rusa-contra-el-covid-19

[11] Data was obtained from a survey to 460 respondents from December 23, 2020 to March 4, 2021.

six emotions, fear will be the center of the present analysis. Fear as a tool to change people's opinions about the security of the Russian vaccine.

We found significant changes in fear intensity levels for the respondents exposed to the negative information about the vaccine. However, most of them did not change their trust levels, which were instead determined by the participant's political standing. Regardless of the information presented, the opinions about the vaccine were reinforced. Those in favor of the government showed increases in their declared levels of trust, while those aligned with the opposition showed a decrease in their levels of trust. The only group of participants showing both, a significant intensity increase in fear and a significant drop in trust, when exposed to negative information was the group of people without a defined political orientation. It seems that this less politically partisan group is the most likely to be influenced in this kind of situations.

Since discourse requires preparation and rationalization, reading facial expressions is particularly interesting. As ideological referent opinions might influence our verbal discourse (Lord, Ross, and Lepper 1979; Munro et al. 2002), a real-time measure of the participant's facial emotion is entirely different. The findings of this paper are aligned with the idea that when information generates uncertainty, for example, fear, we only manage to process and listen to new knowledge if we do not have a preconception on the subject or if the group to which we belong, in this case our political standing, has not constructed a belief system (Biddle 1931; Nierenberg 2018). In this work, we see that a negative testimony of the vaccine generates a significant change in fear, and only manages to change the discourse in those who do not have a defined political orientation.

In section 2 of this paper, we will present fear as a mechanism to change beliefs. In section 3, we will show the design of the experiment we conducted. In section 4, we will present the main results and, finally, in section 5, we will make final remarks.

II.   FEAR AS THE MECHANISM THROUGH WHICH BELIEFS CAN BE CHANGED

It is difficult to accept information that does not coincide with previous beliefs. When this happens, there is a tendency to disqualify the acquired information, categorize it as poor-quality and build arguments against it (Kunda 1990; Lord, Ross, and Lepper 1979; Munro et al. 2002; Redlawsk, Civettini, and Emmerson 2010). The question then becomes: why does this biased way of thinking occur?

Psychologists have shown that evoking emotions causes changes in people's opinions and people's behavior. It impacts how individuals process messages and make their political decisions (Brader 2005; Eagly and Chaiken 1993; Lodge and Taber 2013; Petty, DeSteno, and Rucker 2001). So maybe this biased reasoning is related to the emotions evoked by the information received.

According to Biddle (Biddle 1931), there are four mechanisms through which propaganda attempts to induce individuals to follow emotional, rather than rational, impulses. The first involves establishing the idea of 'us' against the 'enemy.' The second lies in the scope of propaganda, which seeks to reach both groups and individuals. The third consists of concealing propaganda as entertainment or news. And finally, propaganda should never aim at confrontation and should be rooted in evoking emotions.

The first mechanism establishes that propaganda divides people according to their thinking: those who agree versus those who disagree. In our example, the categories correspond to the respondent's political standing, determining the respondent's reaction to the news: tell me what group you belong to, and I will tell you how much you must trust the vaccine.

Theoretically, through a certain degree of manipulation, any emotion can be translated into action. The vaccine became a symbol, and different news could evoke different emotions through that same symbol. Positive news about the vaccine could inspire positive feelings such as peace and quietness, while negative news could spark fear and anger. Likewise, the emotional responses to stimuli could be conditioning certain ideas or attitudes. Through emotions, positive news could increase the trust levels of the vaccine, while negative information could have the opposite effect for the same variable. On the other hand, negative news could be seen as information about the vaccine, but it could also be perceived as disguised propaganda against the government. It will depend on the person who receives the information.

Mattingly et al. (Mattingly and Yao 2020) found that exposure to nationalist propaganda increases anger. Moreover, several studies have also discussed the idea that it generates fear and that fear is the mechanism that can change people's opinions or behavior. Carter et al. (Carter and Carter 2020) found that in China, propaganda-based threats of repression decrease protest rates. In his work, Huang (Huang 2015) analyzes the use of propaganda by authoritarian governments to signal the government´s strength in maintaining social control and political order. Finally, Di Tella et al. (Di Tella, Galiani, and Schargrodsky 2021) studied how a negative propaganda campaign sponsored by the Argentine government against the main political challenger in the days preceding the 2015 election may have caused a significant drop in the intention to vote for that candidate.

Consequently, two elements are present. First, the idea that previous beliefs condition the acceptance of new information. Besides, exposure to specific news can induce a reaction by evoking emotions, such as fear.

Fear is very powerful and spreads even faster than the virus itself. The way in which bad news are conveyed to the public can have significant consequences on the opinions and actions of their recipients. The emergence of social networks has made it possible for bad news to spread even faster, thus achieving an even greater outreach.

As stated by Nierenberg (Nierenberg 2018), "[i]f politicians can make you afraid, you should be afraid of the fear they can induce in your brain". If a piece of news manages to generate fear, it could suppress the ability to think properly, producing a reaction (or opinion) that may differ from the one that would occur in the absence of that, with analytical reasoning. When faced with a stressful situation, the salience network is activated (Hermans et al. 2014), and the executive control network is deactivated. In the presence of a threat, it might be preferable to act and not overthink.

When faced with certain information that arouses fear or anger, the first impulse may be defensive, individually and collectively. Following the example given by Jacek Debiec in an article published in the newspaper *The Conversation*,[12] let us imagine a herd of zebras grazing in the tranquil African savannah on a sunny day. Suddenly, one of the zebras realizes a lion stalking: at first, the zebra stays still, alert, but

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[12] https://theconversation.com/fear-can-spread-from-person-to-person-faster-than-the-coronavirus-but-there-are-ways-to-slow-it-down-133129

then it reacts and begins to sprint. The rest of the zebras will not stop to analyze what is happening; they will simply bolt once the first zebra has raised the alarm. The same happens with people in a risky situation: we all begin to run, and we do not stop to think if there really is a reason to do so. Our brains are wired to react this way in the face of potential threats. The amygdala, a small structure in the center of our brains, is responsible for our reactions to potential dangers and coordinates our responses to fear. When we see another person being afraid, our brain is also activated (Olsson, Nearing, and Phelps 2007). The same happens when the alarm is raised on the news or social media: we all become alert (Towers et al. 2015).[13] When afraid, it is not possible to think clearly; it is not possible to have a critical outlook on the information received, and the only remaining option is to join the general opinion of the group to which we belong.[14]

The findings of this work support this premise for some respondents. Those with defined preconceptions (and with a defined political standing) reinforce their previous beliefs. However, those who did not claim to have clear political affinity and therefore did not have established preconceptions, despite their fear, accepted the negative information about the vaccine, which made them drop their trust levels.

In short, the hypotheses of this work are as follows:

(H1) When being exposed to information about the vaccine, previous beliefs can affect the emotions evoked.

(H2) When being exposed to a frightening situation, if there is a clear group of belonging, following the group's statements seems to be an option. However, in the absence of a clear group of belonging, the information received can change individual opinions.

III.   EXPERIMENT DESIGN

a. Data

In this work, through a controlled online experiment with a convenient sample, we collected data on real-time emotional reactions to vaccine-positive-news and vaccine-negative-news. Furthermore, the respondents' opinions regarding various variables were compiled, including their confidence in the Russian Covid-19 vaccine (Sputnik). We obtained a convenient sample through Offerwise;[15] a panel company specialized in Latin American countries. Four hundred and sixty subjects from Argentina participated in the experiment (N=460, 51.09% female, average age 31.98 years old, 62.39% with at least complete secondary education).

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[13] Towers et al. (Towers et al. 2015) found that the news about a few cases of Ebola in the United States resulted in tens of thousands of tweets and Internet searches.

[14] Debiec et al. (Debiec and Olsson 2017) concluded that learning through fear is stronger among people related or who belong to the same group.

[15] Offerwise: https://www.offerwise.com/. Survey panels pose the problem that many people routinely answer their surveys, so they may not pay special attention to the entire questionnaire. To exclude such people from our study, we included an attention question, in which they had to give a specific answer, and if they failed to reply correctly, the survey concluded. About 3 out of 10 people who came to the question did not pass the filter.

First, participants had to complete a pre-test questionnaire providing information about their age, gender, educational level, Sputnik vaccine confidence level, and a series of pre-treatment variables associated with their political orientation, personality, and demographics.[16] Then, they were directed to watch a randomly selected video on their computer screens. This random selection was made from a set of three videos: the first video showed positive news about the Sputnik vaccine, the second video showed a negative testimony about the stated vaccine, and, finally, there was a neutral video.[17] The videos had the same format; they were all obtained from similar television shows and lasted for approximately 60 seconds.[18]

While the participants were watching the video,[19] the software analyzed the participants' facial expressions. For each individual, data for facial expressions were obtained at 200-millisecond intervals, resulting in approximately 120,000 frames of data. Finally, the subjects completed the post-test questionnaire, reporting again, among other things, their trust level in the Sputnik vaccine.

The fieldwork was conducted from December 23, 2020, until March 4, 2021. During this time, the daily average number of Covid-19 cases in Argentina was 8030[20] (Dong, Du, and Gardner 2020), and there were many doubts about the arrival and efficiency of the vaccines.

b. Measuring emotional reactions to the videos

Most of the studies that have analyzed emotions were survey-based, and subjects reported their feelings. However, answering based on a scale from 1 to 10 to a question like 'Could you indicate how much fear you felt?' requires a moment of reflection, where answers might be conditioned by several factors, such as the opinion of a political referent. Therefore, this manner of measuring emotions may not be adequate, or may generate some bias (Civettini and Redlawsk 2005).

In this work, we did not measure emotions through self-reports. Instead, we measured emotions from participant's faces while they were viewing some videos. Measuring feelings based on facial expressions has advantages over reported opinions. Facial expressions are more spontaneous and more difficult to control by the respondent; they reveal much about our inner emotional states (Paul Ekman 1992; Paul Ekman and Friesen 1982; Paul Ekman and Oster 1979).

Different methods have been used to measure facial expressions. Facial Electromyography (EMG) has been one of the most widely used methods, but it can only be performed in a laboratory context since it requires special technical equipment and placing electrodes on the face, which can be rather invasive.

Facial Action Coding System (FACS) emerged as an alternative to EMG. The FACS system refers to a set of facial muscle movements (action units) that correspond to a displayed emotion (P. Ekman, Friesen, and

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[16] The questionnaire is included in Appendix 2.
[17] The transcription of the videos is provided in Appendix 1.
[18] The first ten seconds did not show any relevant images so as to obtain a baseline measurement and to control natural differences in terms of bone structure, wrinkles, age, etc.
[19] At the beginning of the video, participants were asked their consent to turn on their cameras and record their faces. Those people who did not accept this condition were not included in the study.
[20] https://github.com/CSSEGISandData/COVID-19

Hager 2002; Paul Ekman 1970; Paul Ekman and Keltner 1997). First, each action unit is characterized through photographs showing the movements of facial muscles and the different intensity levels that these movements may have. Then, each emotion and its intensity are composed by several action units. FACS coding, in turn, allows inferences about basic emotions.[21] There are many works analyzing the theoretical and practical aspects of FACS that can be consulted for more detailed information (P. Ekman, Friesen, and Hager 2002; Paul Ekman and Friesen 1976; Paul Ekman and Keltner 1997; Matsumoto, Hwang, and Frank 2016; Meiselman 2016).

Although this system was used for years, it involved trained and certified people[22] to classify images. It was a slow process requiring approximately 24 minutes to process a 1-minute video.[23] As a result of the sluggishness of these processes and thanks to technological advances, automatic software has been developed, completing the task in a faster, more efficient, and more reliable manner (Bailenson et al. 2008; Bartlett et al. 2008; Bos et al. 2020; Kulke, Feyerabend, and Schacht 2020; Stöckli et al. 2018; Suhr 2017; Terzis, Moridis, and Economides 2010). The only requirement is a camera that can record the person's face during the interview or during the screening of the video. It does not need physical contact, and it is a much simpler and less intrusive process in a much more natural environment. It is also much more accessible, especially in pandemic times.

At present, many software programs claim to measure emotions from facial expressions.[24] However, the quality of very few has been studied. For this work, we used the online platform FaceReader, which allows screening a video to the participants while recording the face in front of the screen. Later, the platform carries out an analysis of the faces by classifying expressions into one of six basic universal emotions[25] (Paul Ekman 1970): Happy, Sad, Angry, Surprised, Scared and Disgusted.

FaceReader is a software marketed by Noldus (www.noldus.com), whose results have been evaluated in several papers (Datcu and Rothkrantz 2007; Den Uyl and Van Kuilenburg 2005; Lewinski, den Uyl, and Butler 2014; Stöckli et al. 2018; Suhr 2017). For example, Dupré et al. (Dupré et al. 2020) tested eight classifiers and compared their performance in emotion recognition with that of human observers. In that case human observers did a better job, with an accuracy of about 75%. But Facereader was very close, with an accuracy of about 60%.

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[21] For example, activating AUs 1, 2, 4, 5, 7, 20, and 26 (i.e., Inner brow raiser, Outer brow raiser, Brow lower, Upper lid raiser, Lid tightener, Lip stretcher, and Jaw drop) typically occurs when expressing emotions such as fear (Du, Tao, and Martinez 2014; Paul Ekman 1970; Paul Ekman and Friesen 2003).

[22] FACS coding requires certified coders who are trained for up to 100 h. (e.g., at workshops by the Paul Ekman Group LLC).

[23] Video recordings of participants' faces are often recorded with a resolution of 24 frames/s, meaning that for each second of recording, the coder has to produce 24 ratings of the 46 AUs. So, for one participant with only 1 min of video, 1,440 individual ratings are necessary. Assuming that a coder could rate one picture per second, this would add up to approximately 24 min of work for 1 min of video data (Paul Ekman and Oster 1979).

[24] Some of the best-known software are eMotion (University of Amsterdam), FaceReader (Noldus), and OKAO (Omron Corporation).

[25] Ekman and Friesen published a study in 1971 showing that facial expressions for each emotion are universal. The association between any muscle pattern on the face and an emotion are universal. Cultural differences may reflect on situations or events generating a particular emotion. Something that may be funny in Argentina might be violent in Germany. Therefore, the differences lie in what generates the emotion, not in how we express that emotion on our faces (Paul Ekman and Friesen 1971).

The FaceReader-automated-facial-expression-analysis is based on FACS and uses FACS classified pictures as a training database. It repeats the same process in three stages for each image every two-hundredths of a second. First, the software locates the face and the eyes in the picture. Then, it constructs a detailed model of the face using an algorithmic approach based on the Active Appearance method described by Cootes et al. (Cootes, Walker, and Taylor 2000).[26] Finally, using the facial model and the input image, the classification of facial expressions is performed by training a state-of-the-art deep neural network (Gudi et al. 2015). The emotion detection algorithm output is a measurement of the intensity of each emotion, ranging from 0 to 1 for each timeframe. Higher values indicate a higher probability that a viewer has experienced that emotion in every 200-millisecond moment. More than 10,000 manually codified images were used to train this model.

Revising the literature, we found some works that had already used this tool to answer questions related to social sciences. Teixeira *et al.* (43) analyze the impact on the decision to channel-hop of the happiness and surprise generated by advertisements. Fridkin *et al.* (K. L. Fridkin et al. 2021) used facial expression software to explore real-time reactions to the candidates during the first presidential debate of 2016 in the United States. They found that men and women respond differently to candidates' messaging during the debate and these emotional responses influence post-debate evaluations. In another work, Fridkin *et al.* (K. Fridkin et al. 2021) examine the impact of public service announcements about gun violence (PSAs) on people's emotional reactions, and its influence on information acquisition, policy preferences, and political engagement. They found that when people feel anger, contempt, and fear after watching the PSAs, they change their views about gun policies. They also stated that fear and contempt increase people's likelihood of becoming politically mobilized.

        c.   Measurements

Pre-test and Post-test Questionnaire

In the pre-test questionnaire, we asked a series of questions assessing people's attitudes toward the Covid-19 Sputnik vaccine, as well as their political interest, partisanship, beliefs, general attitudes towards the two main characters in Argentine politics, Cristina Fernández de Kirchner (CFK) and Mauricio Macri (MM), and demographic questions. In the post-test questionnaire, we asked again about the confidence in the vaccine[27], and we also repeated some of the attitudinal questions.

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[26] It describes over 500 key points across the face and the facial texture between those points. Key points include (A) points delineating the face (the part of the face analyzed by FaceReader) and (B) easily recognizable points across the face (lips, eyebrows, nose, and eyes). The texture is important because it conveys additional information about the state of the face. Key points describe the global position and shape of the face but do not give any information about, for instance, the presence of wrinkles and the shape of the eyebrows. These are important keys to classify facial expressions.

[27] Before watching the video, the respondents were asked, 'How safe do you think the Russian vaccine is?'.
Then, after watching the video, they were asked, 'If the vaccine was compulsory and you had to get it today, how confident would you feel about it?'. In both cases, a scale from 1 to 10 was used.

Political orientation

Cristina Fernández de Kirchner was one of the main political referents in Argentina when conducting this study. She was the wife of Néstor Kirchner, president of Argentina, from May 2003 until December 2007. Then, Cristina Fernández became the president of Argentina from December 2007 until December 2015 and has been vice president since December 2019. On the other hand, Mauricio Macri has been the main image of the opposition to the current government, and he was the elected president from December 2015 until December 2019. Both figures define what in Argentina is known as 'the gap'; the love for each of them clearly segregates the population ideology-wise. You either love Cristina, or you love Macri; it is impossible to love them both.[28]

Following the figure below, the assessment questions about former presidents Cristina Fernández de Kirchner and Mauricio Macri were used to generate a single variable called *Political Orientation*.[29] From this variable, all the respondents were segmented into three groups: **Pro-government**, **Anti-government**, and **Moderate**. If the respondent gave Cristina Fernández de Kirchner a higher score than to Mauricio Macri, they were assigned to the Pro-government group. By contrast, if the respondent gave a higher score to Mauricio Macri, they were assigned to the Anti-government group. Finally, if the respondent gave the same score to both, or a score below five to both political figures, they were assigned to the Moderate group.[30]

Figure 1: Political orientation
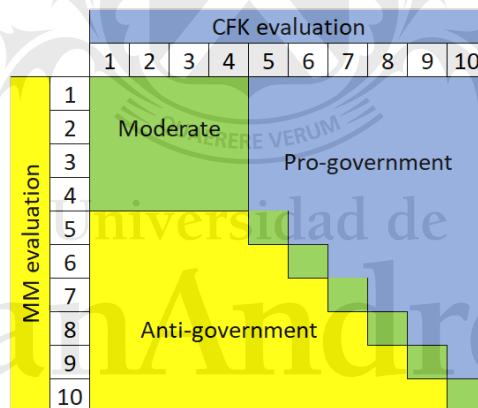
Note: The vertical axis represents Mauricio Macri (MM) evaluation[31], and the horizontal axis represents Cristina Fernández de Kirchner (CFK) evaluation. Those participants who assigned a higher score to CFK form the Pro-government group, while those who gave a higher score to MM form the Anti-government group. Finally, all those participants who gave the same score to both of them, or a score below five to both of them, form the Moderate group.

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[28] https://www.perfil.com/noticias/politica/segun-un-estudio-cristina-y-macri-generan-sentimientos-de-profundo-e-intenso-amor-y-rechazo.phtml
https://www.lanacion.com.ar/politica/grieta-kirchnerismo-cambiemos-nid1925952/
[29] The questions posed to the participants were: 'What did you think of Cristina Fernández de Kircher as president?' and 'What did you think of Mauricio Macri as president?', and in both cases, they had to answer using a scale from 1 to 10 where 1 was 'He/she was a terrible president', and 10 was 'He/she was an excellent president'.
[30] There were 131 participants in the Pro-government group, 135 in the Anti-government group and 194 in the Moderate group.
[31] 'What did you think of Mauricio Macri as president?' using a scale from 1 to 10, where 1 is 'He was a terrible president', and 10 is 'He was an excellent president'.

Measuring Emotional Reaction to Propaganda

In this study, we examined emotional responses to three different videos. Since moving stimuli cause different muscle/behavioral response patterns (Sato and Yoshikawa 2007b, 2007a) and brain activation compared to static stimuli (Zinchenko, Yaple, and Arsalidou 2018), showing a video seemed more interesting than showing a text or an image.

After the pre-questionnaire, respondents were shown a video selected at random from a group of three videos. The first video showed the Buenos Aires Province governor's experience when he was vaccinated and the thrill that the solution to the pandemic problem was close. The second video showed a pathologist questioning the Russian vaccine efficacy and safety. Finally, the third video, used as a benchmark, showed a news report about a solar eclipse.[32]

Since people's permanent wrinkle patterns may differ and may not be distinguishable from creases caused by muscle movements, in the three videos, an image was shown for ten seconds to obtain a baseline measurement of emotions.

Thus, measurements of the intensity of people's emotional reactions as they view the videos, relying on an automated facial action coding software (FaceReader), were obtained. The analysis conducted by the software provides data of the intensity every two-hundredths of a second for each of the six emotions observed on the participant's face. However, our focus will be on the results concerning fear.

d. The models

First, to measure the impact of each of the news reports on anger and fear, we run regressions at the participant level for every 200 milliseconds of the following form:

$$Emotion_{it} = \beta_{0t} + \beta_{1t}\,PP_{it} + \beta_{2t}PN_{it} + \beta_{3t}X_i + \varepsilon_{it} \qquad (1)$$

where *Emotion_{it}* corresponds to Anger and Fear, and it is the intensity of each of those emotions measured for participant *i* and time *t*. *PP_{it}* is a dummy variable equal to one if the participant saw the positive news about the vaccine at timepoint t, and zero if otherwise. *PN_{it}* is a dummy variable equal to one if the participant saw the negative news about the vaccine at timepoint t, and zero if otherwise. The controls *X_i* (*Age, Female, Years of Education, Household Head, Buenos Aires Metropolitan Area, Bad economic situation, Covid-19 bankruptcy and Support from the government*) are measured for participant *i.* and *ε_{it}* is the error term. Age is the age of the respondent. Female is a dummy variable that equals one if the respondent is female, and zero otherwise. Years of Education is the years of education calculated from the school level declared by the respondent. *Head of Household* is a dummy variable that equals one if the respondent self-defines as the head of the household, and zero if otherwise. *Buenos Aires Metropolitan Area* is a dummy variable that equals one if the respondent lives in Buenos Aires City or in Greater Buenos Aires. *Bad economic situation* is a dummy variable that equals one if the respondent does not have a job or if the participant's income is insufficient to support their family. *Covid-19 bankruptcy* is a dummy variable that equals one if the respondent agrees with the idea that 'The coronavirus is going to

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[32] The transcription of the three videos is presented at the end, in Appendix 1.

bankrupt me, leave me broke' and zero if otherwise. Finally, *Support from the government* is a dummy variable that equals one if the respondent indicated having received government subsidies during the pandemic, and zero if otherwise. The results of these estimations are presented in figures 2 and 3.

Then, to delve into the impact that the news had on the trust level in the vaccine, we run the following regression:

$$\text{Confidence in the Covid} - 19 \text{ Sputnik Vaccine}_{it} = \beta_1 PP_{it} + \beta_2 PN_{it} + \beta_3 X_i + \gamma_i + \varepsilon_{it} \quad (2)$$

where *Confidence in the Covid-19 Sputnik Vaccine$_{it}$* is the assessment of the vaccine as declared by the participant before and after watching the video, the controls X_i (*Age, Female, Years of Education, Household Head, Buenos Aires Metropolitan Area, Bad economic situation, Covid-19 bankruptcy and Support from the government*) are measured for participant *I,* γ_i are individual fixed effects and ε_{it} is the error term. Standard errors are clustered at the participant level.

IV.   RESULTS

a.   Randomization

Since this work was based on randomization into three groups as a starting point — the first group was exposed to a neutral news report, the second group was shown a positive news report, and the third group was shown a negative news report—, it is essential to verify that the randomization was successful and that the groups were properly balanced. The first column of Table 1 displays the averages (and standard deviations in parentheses) for the pre-treatment characteristics in the first group (neutral news). The following columns provide the coefficients and robust standard errors of regressing each characteristic on a treatment dummy, disaggregating the treatment into positive news (column 2) and negative news (column 3).

We can see that the groups were quite well balanced, including the 'Trust in the vaccine' variable, which will be of the utmost importance for the analysis conducted later. The only significant observed difference is for the participation of people aligned with the government in the case of positive news. There is a significant difference in the proportion of people classified as 'Pro-government' between the control group and the group that was exposed to positive vaccine news. This difference may be rooted in the fact that the positive news was presented by the Province of Buenos Aires governor, which may have caused a bias in the people who abandoned the survey when they saw who was on the video. However, as the analysis below segments each group according to this variable, this would not have relevant consequences on our findings.

Table 1: Pre-treatment Characteristics

Variables	(1) Neutral news	(2) Positive news	(3) Negative news
Age	31.546	0.629	0.617
	(10.708)	(1.234)	(1.261)
Female	0.489	-0.001	0.066
	(0.502)	(0.057)	(0.058)
Years of Education	14.816	0.353	0.394
	(2.448)	(0.266)	(0.258)
Head of Household	0.461	0.015	0.010
	(0.500)	(0.057)	(0.058)
Buenos Aires Metropolitan Area	0.220	0.009	0.055
	(0.416)	(0.048)	(0.050)
Pro-government	0.234	0.103**	0.040
	(0.425)	(0.051)	(0.051)
Anti-government	0.298	0.021	-0.036
	(0.459)	(0.053)	(0.053)
Bad economic situation	0.355	-0.029	0.005
	(0.480)	(0.054)	(0.056)
Covid-19 bankruptcy	0.504	0.051	0.000
	(0.502)	(0.057)	(0.059)
Support from the government	0.199	0.024	0.050
	(0.400)	(0.047)	(0.049)
Confidence in the Covid-19 Sputnik Vaccine	5.170	0.511	0.242
	(2.983)	(0.349)	(0.349)
Number of Observations in each group	141	166	153

Note: Column (1) reports the means (and standard deviations in parentheses) for the pre-treatment characteristics in the group of people who were shown neutral news. The following columns provide the coefficients and robust standard errors of regressing the characteristics on a treatment dummy, disaggregating the treatment into **positive news** (column 2) and **negative news** (column 3). *Age* is the age of the respondent. *Female* is a dummy variable that equals one if the respondent is female, and zero if otherwise. *Head of Household* is a dummy variable that equals one if the respondent self-defines as the head of the household, and zero if otherwise. *Years of Education* is the years of education of the respondent. *Buenos Aires Metropolitan Area* is a dummy variable that equals one if the respondent lives in Buenos Aires City or Greater Buenos Aires, and zero if otherwise. **Pro-government** is a dummy variable that equals one if the respondent is aligned with the government, and zero if otherwise. *Anti-government* is a dummy variable that equals one if the respondent is aligned with the main opposition to the government, and zero if otherwise. *Bad economic situation* is a dummy variable that equals 1 if the respondent does not have a job, or the participant's income is insufficient to support their family, and zero if otherwise. **Covid-19 bankruptcy** is a dummy variable that equals one if the respondent agrees with the idea that 'The coronavirus is going to bankrupt me, leave me broke', and zero if otherwise. *Support from the government* is a dummy variable that equals one if the respondent indicated having received government subsidies during the pandemic, and zero if otherwise. *Confidence in the Covid-19 Sputnik Vaccine* is the level of trust that the participant assigned to the vaccine before watching the video (*If the vaccine was compulsory and if you had to get it today, how confident would you feel about it? Use a scale from 1 to 10, where 1 is 'Complete lack of confidence' and 10 is 'Complete confidence'*). The last row indicates the number of observations considered in each group, but all the regressions are run with the 460 observations. ** Significant at 5%.

b. The impact of news on anger and fear

There is a growing body of evidence suggesting that the dynamics of facial expressions are crucial for the interpretation of emotions (Ambadar, Schooler, and Cohn 2005; Krumhuber, Kappas, and Manstead 2013; Sato et al. 2019). A first analysis of the videos' impact on anger and fear every 200 milliseconds was

conducted to capture these dynamics in expressions.[33] In Figure 2, we present the results for estimating the first model (1) for **anger**, segmented according to political orientation. The graphs show the impact of positive and negative news on the intensity of anger observed on participants' faces, controlling for *Age, Female, Years of Education, Household Head, Buenos Aires Metropolitan Area, Bad economic situation, Covid-19 bankruptcy, and Support from the government*. We see that political orientation does not define the levels of anger intensity; all respondents seem to feel some degree of anger during the video. The vertical line depicted in the four graphs marks the moment when, following the introduction, the actual positive or negative news about the vaccine is introduced.[34]

Figure 2: Evolution of the impact of the news on the anger emotion
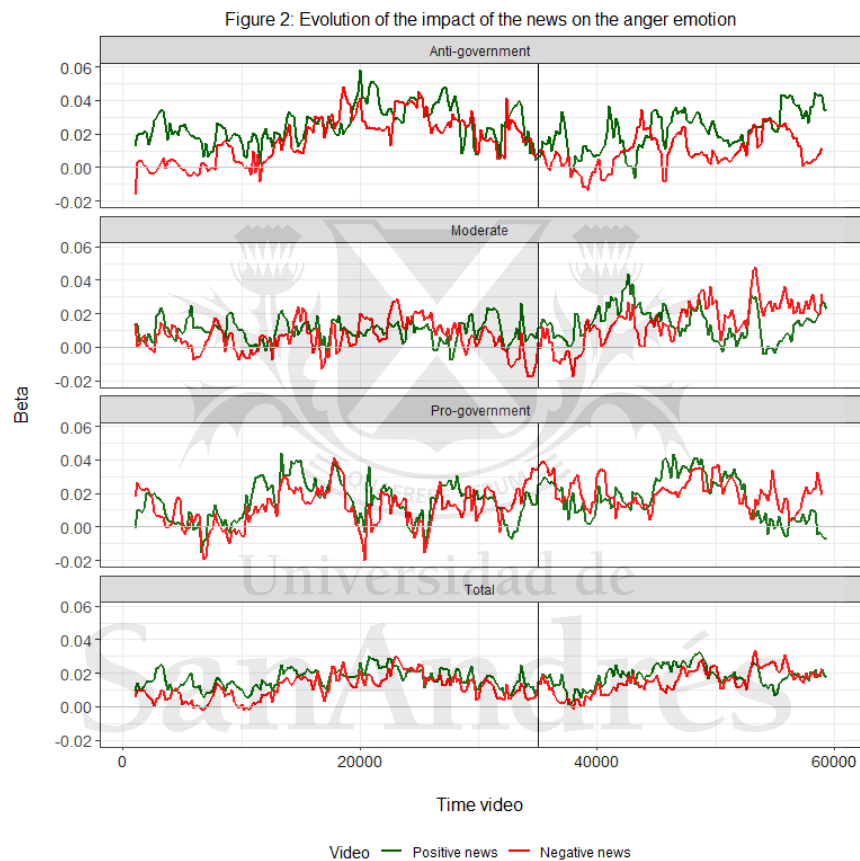
Note: The vertical axis represents the estimations of coefficients β_1 and β_2 for the first model (1), that is, the impact of Positive news (blue line) and Negative news (red line) on **anger**. The horizontal axis represents the time of the video (expressed in 200-millisecond intervals). The first model (1) for anger was estimated every 200 milliseconds, segmenting according to groups based on pre-established political orientation.

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[33] Initially, although it was not our focus point, we analyzed the impact on the six basic emotions, but no significant effects of the news were observed. The results for the four remaining basic emotions are available on request.
[34] In the transcription of the videos attached in Appendix 2, these time points are identified.

The graphs in Figure 3 show the impact of the videos for the **fear** emotion, again controlling for *Age, Female, Years of Education, Household Head, Buenos Aires Metropolitan Area, Bad economic situation, Covid-19 bankruptcy, and Support from the government*. In this case, the exposure to negative news generates a significant change in the intensity of fear for all political standings (for the overall sample, the average intensity of fear observed is 0.01008, with a SE=0.00127). However, we observed significant differences among political orientations. On the one hand, those participants from the Anti-government group exposed to positive news show a significantly larger impact on fear than those exposed to negative information. On the other hand, for the group defined as Pro-government, fear is larger when exposed to negative news. Both groups display a more significant impact on fear when the discourse to which they are told does not match their previous beliefs, or the beliefs of the group to which they belong. Individuals aligned with the opposition show a more significant impact on fear in the face of good news about the vaccine, while people aligned with the government show a larger impact on fear when the video states that the vaccine would be applied massively without having completed its third phase of research.

Figure 3: Evolution of the impact of the news on the fear emotion with all the controls
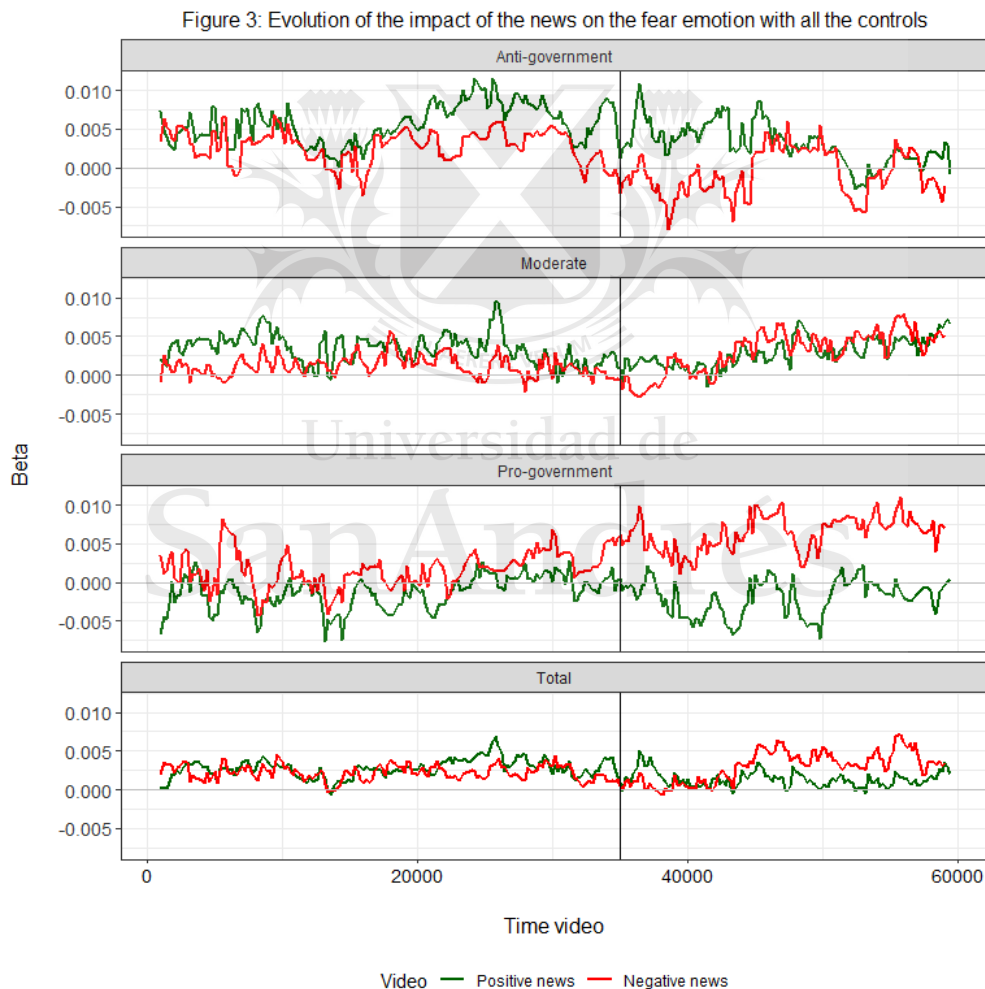
Note: The vertical axis represents the OLS estimations of coefficients β_1 and β_2 for the first model (1), that is, the impact of positive news (blue line) and negative news (red line) on **fear**. The horizontal axis represents the time of the video (expressed in 200-millisecond intervals). The first model for fear was estimated every 200 milliseconds, segmenting according to groups based on pre-established political orientation.

Finally, the group defined as Moderate seems to be affected by both videos. People not aligned with either the opposition or the current government, who do not have a clearly defined preconception, would appear to feel fear when exposed to both stimuli.

Figure 4 shows histograms for parameters (beta) estimated from the forty seconds of the videos when the relevant information had already been presented in both videos. We can observe that for the Anti-government group, those exposed to positive news show a positive average impact significantly different from 0 (Mean=0.00262, $SE_{Bootsrap}$=0.00028, $CI_{95\%}$=[0.00207; 0.00317]), while those exposed to negative news present an average impact not significantly different from 0 (Mean=-0.00032, $SE_{Bootsrap}$ =0.00033, $CI_{95\%}$=[-0.00098;0.00034]).

Figure 4: Beta histograms
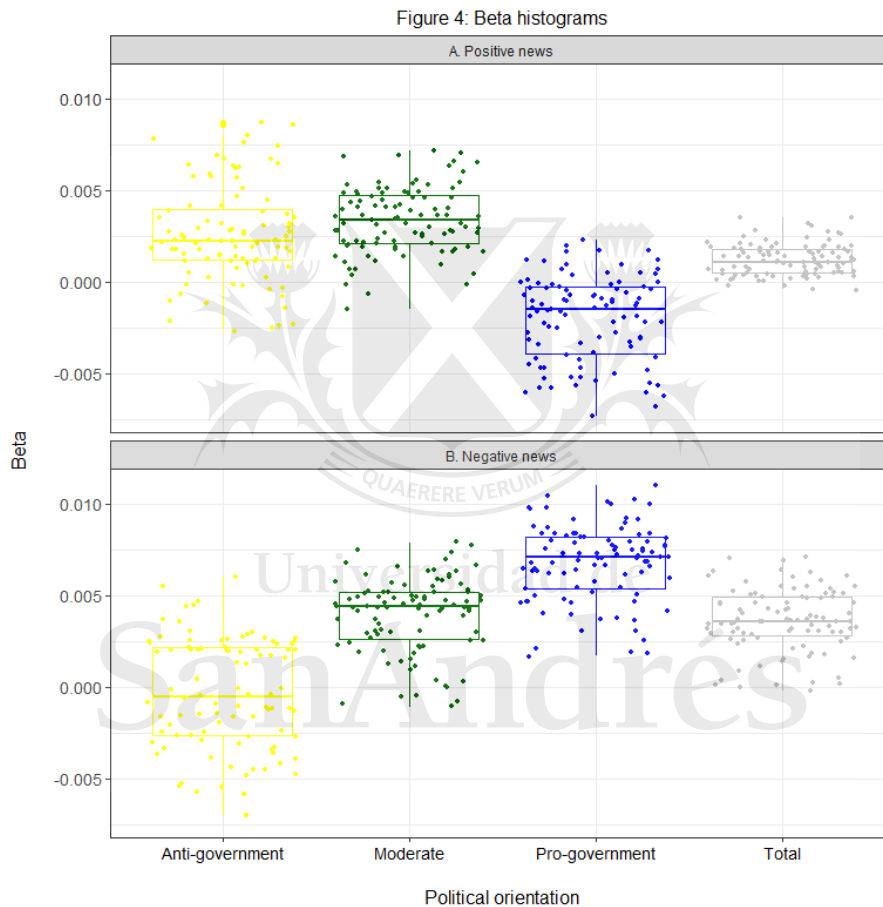
Note: The vertical axis represents the estimations every 200 milliseconds for the OLS coefficient estimations of β_1 and β_2 from the first model (1) as of 00:00:40, when the relevant news for both videos has already been made explicit. The horizontal axis represents political orientation: Anti-government, Moderate, Pro-government, and Total.

On the other hand, participants from the Moderate group display in both cases a significant positive average impact on fear, whether they were exposed to positive news (Mean=0.00335, $SE_{Bootsrap}$ =0.00017, $CI_{95\%}$=[0.00302; 0.00368]) or negative news (Mean=0.00396, $SE_{Bootsrap}$=0.00018, $CI_{95\%}$=[0.00360; 0.00432]),

being the estimated impact of negative news significantly bigger than that of positive news (diff=0.000615, p-value=0.0304).

Finally, in the case of participants of the Pro-government group, we observed that for those exposed to positive news, the average impact on fear is negative and significantly different from 0 (Mean= -0.00199, $SE_{Bootsrap}$=0.00022, $CI_{95\%}$=[-0.00242; -0.00156]), while for those exposed to negative news, the average impact on fear is positive but also significantly different from 0 (Mean=0.00680, $SE_{Bootsrap}$=0.00022, $CI_{95\%}$=[0.00637; 0.00723]).

Additionally, if we compare the positive average impact of negative news on Moderate and Pro-government, ($Mean_{Moderate}$ =0.00396, $Mean_{Pro-government}$ =0.00680), we can see that the impact is greater for participants of the Pro-government group, with a statistically significant difference (diff= 0.00284, p-value=0.00000).

Therefore, results would indicate that those participants with the greatest reaction to negative information about the vaccine were those aligned with the government, followed by those belonging to the moderate group, who reacted to both videos but more intensely to the negative news video. Lastly, participants from the Anti-government group exposed to negative news do not display a significantly different behavior from those exposed to neutral news, but they do show a certain increase in the intensity of fear when exposed to positive news.

c. The impact of news on the confidence in the vaccine

The results regarding the impact of news on confidence levels in the Sputnik vaccine are shown in Tables 2 and 3. Table 2 presents the estimation results for the second model (2) disaggregating by type of news. Column 1 shows the impact of news on confidence levels in the vaccine, without any additional variables as controls. People who watched positive news did not exhibit a significant change in their confidence levels. However, negative news did have a significant negative impact of approximately half a point on a scale of 1 to 10 (estimated impact is -0.47 in Column 1).

Controls are gradually added from Column 2 to Column 4. We do not see any relevant change by adding *Age, Female gender, Years of education, Head of household,* and *Buenos Aires Metropolitan Area* (Column 2). The negative news impact is still significant and negative, and coefficients remain constant. The significance and coefficient values also remain constant In Column 3 when two variables are added to control for the economic situation of the respondent (Bad economic situation and Covid-19 bankruptcy). In Column 4, the *Support from the government* variable is added. In this case, although the significance is maintained, the coefficient linked with negative news increases in its absolute value to 0.501. Participant fixed effects are included in all the columns, and time fixed effects are included in column 5.

Table 2: Impact of news on the confidence level in the Covid-19 Sputnik vaccine

Variables	(1) Confidence in the Covid-19 Sputnik Vaccine	(2) Confidence in the Covid-19 Sputnik Vaccine	(3) Confidence in the Covid-19 Sputnik Vaccine	(4) Confidence in the Covid-19 Sputnik Vaccine	(5) Confidence in the Covid-19 Sputnik Vaccine
Positive News	-0.030	-0.030	-0.030	-0.030	-0.030
	(0.155)	(0.155)	(0.155)	(0.155)	(0.155)
Negative News	-0.497***	-0.497***	-0.497***	-0.497***	-0.497***
	(0.167)	(0.167)	(0.167)	(0.167)	(0.167)
Age		-5.625***	14.468***	14.468***	14.468***
		(0.165)	(3.291)	(3.291)	(3.291)
Age^2		0.076***	-0.175***	-0.175***	-0.175***
		(0.002)	(0.041)	(0.041)	(0.041)
Female		-22.221***	48.400***	8.243	8.243
		(0.792)	(12.733)	(5.360)	(5.360)
Years of Education		-0.921***	1.423***	1.423***	1.423***
		(0.166)	(0.458)	(0.458)	(0.458)
Head of Household		-0.483	-36.270***	-36.270***	-36.270***
		(0.558)	(4.990)	(4.990)	(4.990)
Buenos Aires Metropolitan Area		-1.106	5.964***	5.964***	5.964***
		(0.963)	(0.798)	(0.798)	(0.798)
Bad economic situation			-35.787***	-35.787***	-35.787***
			(4.842)	(4.842)	(4.842)
Covid-19 bankruptcy			2.383***	2.383***	2.383***
			(0.823)	(0.823)	(0.823)
Support from the government				40.157***	40.157***
				(7.492)	(7.492)
Individual fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	No	No	No	No	Yes
Observations	920	920	920	920	920
Adjusted R-squared	0.814	0.814	0.814	0.814	0.814

Note: Ordinary least squares (OLS) regression estimates. **The *Confidence in the Covid-19 Sputnik Vaccine*** dependent variable is the average of the respondent's confidence assessment assigned to the vaccine before and after watching the news report. *Positive News* is a dummy variable that equals 1 if the respondent was exposed to positive news about the Covid-19 Sputnik vaccine, and 0 if otherwise. *Negative News* is a dummy variable that equals 1 if the respondent was exposed to negative news about the Covid-19 Sputnik vaccine, and 0 if otherwise. *Age* is the age of the respondent. *Female* is a dummy variable that equals 1 if the respondent is female, and 0 if otherwise. *Head of Household* is a dummy variable that equals 1 if the respondent self-defines as the head of the household, and 0 if otherwise. *Years of Education* is the years of education of the respondent. *Buenos Aires Metropolitan Area* is a dummy variable that equals 1 if the respondent lives in the City of Buenos Aires or Greater Buenos Aires, and 0 if otherwise. *Bad economic situation* is a dummy variable that equals 1 if the respondent does not have a job, or if their income is insufficient to support their family, and 0 if otherwise. *Covid-19 bankruptcy* is a dummy variable that equals 1 if the respondent agrees with the idea that 'The coronavirus is going to bankrupt me, leave me broke', and 0 if otherwise. *Support from the government* is a dummy variable that equals 1 if the respondent indicated having received subsidies from the government during the pandemic, and 0 if otherwise. The last row indicates the number of observations. Cluster at the participant level standard errors in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: Impact of news on the confidence level in the Covid-19 Sputnik vaccine according to different political orientations

Variables	(1) Confidence in the Covid-19 Sputnik Vaccine	(2) Confidence in the Covid-19 Sputnik Vaccine	(3) Confidence in the Covid-19 Sputnik Vaccine	(4) Confidence in the Covid-19 Sputnik Vaccine
Positive News * Pro-government	-0.089	-0.089	-0.089	-0.089
	(0.167)	(0.167)	(0.167)	(0.167)
Positive News * Anti-government	-0.019	-0.019	-0.019	-0.019
	(0.280)	(0.280)	(0.280)	(0.280)
Positive News * Moderate	0.018	0.018	0.018	0.018
	(0.334)	(0.334)	(0.334)	(0.334)
Negative News * Pro-government	-0.429	-0.429	-0.429	-0.429
	(0.278)	(0.278)	(0.278)	(0.278)
Negative News * Anti-government	-0.625	-0.625	-0.625	-0.625
	(0.393)	(0.393)	(0.393)	(0.393)
Negative News * Moderate	-0.465**	-0.465**	-0.465**	-0.465**
	(0.232)	(0.232)	(0.232)	(0.232)
Age		-5.653***	14.420***	14.420***
		(0.167)	(3.332)	(3.332)
Age^2		0.076***	-0.175***	-0.175***
		(0.002)	(0.042)	(0.042)
Female		-22.362***	48.197***	8.143
		(0.824)	(12.889)	(5.418)
Years of Education		-0.922***	1.420***	1.420***
		(0.172)	(0.467)	(0.467)
Head of Household		-0.473	-36.214***	-36.214***
		(0.576)	(5.067)	(5.067)
Buenos Aires Metropolitan Area		-1.103	5.951***	5.951***
		(0.993)	(0.857)	(0.857)
Bad economic situation			-35.741***	-35.741***
			(4.909)	(4.909)
Covid-19 bankruptcy			2.371***	2.371***
			(0.833)	(0.833)
Support from the government				40.055***
				(7.587)
Individual fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	No	No	No	Yes
Observations	920	920	920	920
Adjusted R-squared	0.812	0.812	0.812	0.812

Note: Ordinary least squares (OLS) regression estimates. The **Confidence in the Covid-19 Sputnik Vaccine** dependent variable is the average of the respondent's confidence assessment assigned to the vaccine before and after watching the news report. **Positive News** is a dummy variable that equals 1 if the respondent was exposed to positive news about the Covid-19 Sputnik vaccine, and 0 if otherwise. **Negative News** is a dummy variable that equals 1 if the respondent was exposed to negative news about the Covid-19 Sputnik vaccine, and 0 if otherwise. **Pro-government** is a dummy variable that equals 1 if the respondent is aligned with the government, and 0 if otherwise. **Anti-government** is a dummy variable that equals 1 if the respondent is aligned with the main opposition to the government, and 0 if otherwise. **Moderate** is a dummy variable that equals 1 if the respondent is not aligned with the government or with the government's opposition, and 0 if otherwise. **Age** is the age of the respondent. **Female** is a dummy variable that equals 1 if the respondent is female, and 0 if otherwise. **Years of Education** is the years of education of the respondent. **Head of Household** is a dummy variable that equals 1 if the respondent self-defines as the head of the household, and 0 if otherwise. **Buenos Aires Metropolitan Area** is a dummy variable that equals 1 if the respondent lives in the City of Buenos Aires or Greater Buenos Aires, and 0 if otherwise. **Bad economic situation** is a dummy variable that equals 1 if the respondent does not have a job, or if their income is insufficient to support their family, and 0 if otherwise. **Covid-19 bankruptcy** is a dummy variable that equals 1 if the respondent agrees with the idea that 'The coronavirus is going to bankrupt me, leave me broke', and 0 if otherwise. **Support from the government** is a dummy variable that equals 1 if the respondent indicated having received subsidies from the government during the pandemic, and 0 if otherwise. The last row indicates the number of observations. Cluster at the participant level standard errors in parentheses. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Finally, Table 3 shows the estimation results for the second model (2) segmenting by political orientation. Those aligned with the main opposition (Anti-government) have a significant drop for both kinds of news. This result is maintained throughout the different columns while controls are gradually added. We have the same result, but in the opposite direction for participants in the Pro-government group. Independently of the type of news they watched, the result is an increase in confidence. Finally, the only group displaying a consistent behavior with the observed emotional change is the Moderate participants' group. In this case, the coefficient is negative for both types of news but negative and significantly different from zero for those exposed to negative news.

Consequently, these results would indicate that, when exposed to different types of news, those who belong clearly to one political group reinforce the views already established by their referents. Regardless of whether they were exposed to positive or negative news, respondents aligned with the government experience a positive and significant increase in their assessment of the vaccine (the difference between coefficients in Column 4 is not significantly different from zero, p-value equal to 0.41). The same, but in the opposite direction, happens with respondents against the current government, exposure to news involved a significant drop in their stated level of confidence (again, the difference between both coefficients in Column 4 is not significantly different from zero, with a p-value equal to 0.36).

The result is different for those respondents in the Moderate group; for them, there is not a significant impact when they are exposed to positive news, but there is a significant negative impact when are exposed to negative information about the vaccine (the difference between the coefficients in column 4 is significantly different from zero, with a p-value equal to 0.09). Thus, it is only in this group that the change observed in the levels of fear display a certain consistency with the stated changes in the levels of confidence.

d. Is there a Causal Relationship between Fear and Confidence in the Covid-19 Sputnik Vaccine?

So far, we know that when participants were exposed to negative information about the vaccine, we observed an increment of fear for the whole sample (Mean= 0.00364, SE$_{Bootsrap}$=0.00019, CI$_{95\%}$=[0.00327; -0.00401]), and a decrease in the confidence of the vaccine, also for the whole sample ($\beta_{Negative\ news}$=-0.497***).

Now seems natural to try to find some relation between the emotion of fear and the level of confidence in the vaccine. In this section, we cautiously explore whether this relationship is causal. One challenge to a causal interpretation of our estimates of the relationship between fear and confidence is reverse causality. Feeling fear may cause a drop in confidence, but surely lack of confidence in the vaccine causes more fear.

For this exercise, we use the random video assignment to instrument for Fear in 2SLS regressions of the form:

$$\text{Confidence in the Covid} - 19 \text{ Sputnik Vaccine}_{it} = \beta_1 Fear_{it} + \beta_2 X_i + \gamma_i + \varepsilon_{it} \quad (3)$$

where *Confidence in the Covid-19 Sputnik Vaccine$_{it}$* is the assessment of the vaccine as declared by the participant before and after watching the video, *Fear$_{it}$* is the intensity of fear before and after being exposed to the video, *X$_i$* are used as controls (*Age, Female, Years of Education, Household Head, Buenos Aires Metropolitan Area, Bad economic situation, Covid-19 bankruptcy and Support from the government*) and are measured for participant *i.* and ε_{it} is the error term.

Our 2SLS regressions are presented in Table 4. The average impact of the Negative news on the intensity of fear for the whole sample is 0.00364. According to the results presented in the first column, that means a drop in the trust level of 0.203 points. If we disaggregate the result across groups with different political orientations, we see that Moderate participants are the only case in which the significance of fear in explaining trust is maintained. The average impact of the negative news for this group is 0.00396, which means a drop of 0.171 in the confidence in the vaccine.

Table 4: Instrumenting Fear with Random Assignment of the videos

	Confidence in the Covid-19 Sputnik Vaccine			
	Total Sample (1)	Pro-government (2)	Moderate (3)	Anti-government (4)
Second stage:				
Fear	-55.717***	-44.908	-43.243**	-124.943
	(20.413)	(31.420)	(20.725)	(141.918)
Age	1.845	24.331*	-0.818	-2.206
	(3.041)	(14.677)	(0.701)	(3.879)
Age^2	-0.018	-0.254*	0.017	0.042
	(0.038)	(0.153)	(0.012)	(0.072)
Female	3.865	179.380	-3.735*	1.049
	(5.132)	(109.059)	(1.940)	(17.935)
Years of Education	0.672	3.707	0.832**	-0.028
	(0.624)	(2.275)	(0.361)	(2.233)
Head of Household	-2.512	42.987	-7.058**	-5.717
	(2.211)	(27.908)	(3.102)	(12.485)
Buenos Aires Metropolitan Area	2.110*	6.137	9.898**	-0.446
	(1.253)	(4.715)	(4.185)	(13.667)
Bad economic situation	3.607*	13.198	-0.087	5.698
	(2.017)	(8.838)	(2.478)	(14.324)
Covid-19 bankruptcy	-2.396	-57.708	-6.446***	0.203
	(3.252)	(39.235)	(1.622)	(14.325)
Support from the government	16.542**	253.870	12.917***	2.887
	(7.712)	(161.057)	(3.680)	(18.472)
Adj R-squared (second stage)	0.486	0.442	0.579	-
First stage:				
Negative News	0.009**	0.010	0.011*	0.005
	(0.004)	(0.006)	(0.006)	(0.008)
Adj R-squared (first stage)	0.440	0.632	0.313	-
Observations	588	150	274	164

Note: Two-stage least squares (2SLS) regression estimates. The **Confidence in the Covid-19 Sputnik Vaccine** dependent variable is the average of the respondent's confidence assessment assigned to the vaccine before and after watching the news report. **Pro-government** is the set of respondents aligned with the government. **Moderate** is the set of respondents that is not aligned with the government nor with the government's opposition. **Anti-government** is the set of participants aligned with the main opposition to the government. **Fear** is the intensity of fear before and after being exposed to the video. **Age** is the age of the respondent. **Female** is a dummy variable that equals 1 if the respondent is female, and 0 if otherwise. **Head of Household** is a dummy variable that equals 1 if the respondent self-defines as the head of the household, and 0 if otherwise. **Years of Education** is the years of education of the respondent. **Buenos Aires Metropolitan Area** is a dummy variable that equals 1 if the respondent lives in the City of Buenos Aires or Greater Buenos Aires, and 0 if otherwise. **Bad economic situation** is a dummy variable that equals 1 if the respondent does not have a job, or if their income is insufficient to support their family, and 0 if otherwise. **Covid-19 bankruptcy** is a dummy variable that equals 1 if the respondent agrees with the idea that 'The coronavirus is going to bankrupt me, leave me broke', and 0 if otherwise. **Support from the government** is a dummy variable that equals 1 if the respondent indicated having received subsidies from the government during the pandemic, and 0 if otherwise. **Negative News** is a dummy variable that equals 1 if the respondent was exposed to negative news about the Covid-19 Sputnik vaccine, and 0 if otherwise. The constants are not presented. The last row indicates the number of observations. Standard errors in parentheses. *** $p < .01$; ** $p < .05$; * $p < .1$.

V.   FINAL REMARKS

Following the World Wars of the 20th century, it is difficult to identify an event in contemporary history that has globally generated so much uncertainty about the individual future as the Covid-19 pandemic has. Particularly in Argentina, the pandemic has had a significant impact due to the high number of fatalities and the strict lockdown over a large portion of 2020.

In December 2020, the government tried to inject hope by announcing the purchase of several millions of Russian vaccines. However, by then, the information about this vaccine was still scarce, and we found that this news would give us a unique opportunity to understand how emotions and beliefs are decoded from different perspectives of political affinity.

The study shows that news highlighting possible risks of such a relevant vital event instills fear in most people, regardless of their partisan affinity; nevertheless, in the face of this pervasive fear, partisan affinity works as a mold that shapes the impact of fear in various ways.

Those in more clearly defined political positions react by bolstering their previous beliefs; naturally, those aligned with the opposition listen to the news and confirm their already high mistrust in the benefits of the vaccine, while supporters of the government rely on their partisan belonging to course the fear caused by the news with their previous confidence.

However, those with a vaguer political standing appear to be more susceptible to change their preconceptions. A more independent mindset from the dominant political leaders makes them more prone to fear generated by negative news, significantly altering their previous levels of confidence.

VI.   REFERENCES

Ambadar, Zara, Jonathan W. Schooler, and Jeffrey F. Cohn. 2005. "Deciphering the Enigmatic Face: The Importance of Facial Dynamics in Interpreting Subtle Facial Expressions." *Psychological science* 16(5): 403–10.

Bailenson, Jeremy N. et al. 2008. "Real-Time Classification of Evoked Emotions Using Facial Feature Tracking and Physiological Responses." *International journal of human-computer studies* 66(5): 303–17.

Bartlett, Marian, Gwen Littlewort, Tingfan Wu, and Javier Movellan. 2008. "Computer Expression Recognition Toolbox." In *2008 8th IEEE International Conference on Automatic Face & Gesture Recognition*, IEEE, 1–2.

Biddle, William W. 1931. "A Psychological Definition of Propaganda." *The Journal of Abnormal and Social Psychology* 26(3): 283.

Bos, Andreia Solange, Marcelo Vettori, M. PIZZATO, and Milton Antônio Zaro. 2020. "Recognition of Facial Expressions: Active Emotions during the Use of Audiovisuals." *International Journal of Development Research* 10(08): 39779–83.

Brader, Ted. 2005. "Striking a Responsive Chord: How Political Ads Motivate and Persuade Voters by Appealing to Emotions." *American Journal of Political Science* 49(2): 388–405.

Carter, Erin Baggott, and Brett L. Carter. 2020. "When Autocrats Threaten Citizens With Repression: Evidence from China."

Civettini, Andrew, and David P. Redlawsk. 2005. "A Feeling Person's Game: Affect and Voter Information Processing and Learning in a Campaign." In *Annual Meeting of the American Political Science Association, Washington, DC,*.

Cootes, Timothy F., K. Walker, and Christopher J. Taylor. 2000. "View-Based Active Appearance Models." In *Proceedings Fourth IEEE International Conference on Automatic Face and Gesture Recognition (Cat. No. PR00580)*, IEEE, 227–32.

Datcu, Dragoş, and Léon Rothkrantz. 2007. "Facial Expression Recognition in Still Pictures and Videos Using Active Appearance Models: A Comparison Approach." In *Proceedings of the 2007 International Conference on Computer Systems and Technologies*, , 1–6.

Debiec, Jacek, and Andreas Olsson. 2017. "Social Fear Learning: From Animal Models to Human Function." *Trends in cognitive sciences* 21(7): 546–55.

Den Uyl, M. J., and H. Van Kuilenburg. 2005. "The FaceReader: Online Facial Expression Recognition." In *Proceedings of Measuring Behavior*, Wageningen, 589–90.

Di Tella, Rafael, Sebastian Galiani, and Ernesto Schargrodsky. 2021. "Persuasive Propaganda during the 2015 Argentine Ballotage." *Journal of Comparative Economics*.

Dong, Ensheng, Hongru Du, and Lauren Gardner. 2020. "An Interactive Web-Based Dashboard to Track COVID-19 in Real Time." *The Lancet infectious diseases* 20(5): 533–34.

Du, Shichuan, Yong Tao, and Aleix M. Martinez. 2014. "Compound Facial Expressions of Emotion." *Proceedings of the National Academy of Sciences* 111(15): E1454–62.

Dupré, Damien, Eva G. Krumhuber, Dennis Küster, and Gary J. McKeown. 2020. "A Performance Comparison of Eight Commercially Available Automatic Classifiers for Facial Affect Recognition." *PloS one* 15(4): e0231968.

Eagly, Alice H., and Shelly Chaiken. 1993. *The Psychology of Attitudes.* Harcourt brace Jovanovich college publishers.

Ekman, P., W. V. Friesen, and J. C. Hager. 2002. "The Facial Action Coding System: The Manual on CD-ROM & Investigator's Guide." *Salt Lake City, UT: Research Nexus*.

Ekman, Paul. 1970. "Universal Facial Expressions of Emotions." *California mental health research digest* 8(4): 151–58.

———. 1992. "Facial Expressions of Emotion: An Old Controversy and New Findings." *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences* 335(1273): 63–69.

Ekman, Paul, and Wallace V. Friesen. 1971. "Constants across Cultures in the Face and Emotion." *Journal of personality and social psychology* 17(2): 124.

———. 1976. "Measuring Facial Movement." *Environmental psychology and nonverbal behavior* 1(1): 56–75.

———. 1982. "Felt, False, and Miserable Smiles." *Journal of nonverbal behavior* 6(4): 238–52.

———. 2003. 10 *Unmasking the Face: A Guide to Recognizing Emotions from Facial Clues*. Ishk.

Ekman, Paul, and Dacher Keltner. 1997. "Universal Facial Expressions of Emotion." *Segerstrale U, P. Molnar P, eds. Nonverbal communication: Where nature meets culture* 27: 46.

Ekman, Paul, and Harriet Oster. 1979. "Facial Expressions of Emotion." *Annual review of psychology* 30(1): 527–54.

Fridkin, Kim, Patrick Kenney, Manuel Gutiérrez, and Ryan Deutsch. 2021. "The Impact of Emotional Responses to Public Service Announcements: The Case of Gun Violence in Schools." *American Politics Research*: 1532673X211004158.

Fridkin, Kim L., Sarah Allen Gershon, Jillian Courey, and Kristina LaPlant. 2021. "Gender Differences in Emotional Reactions to the First 2016 Presidential Debate." *Political Behavior* 43(1): 55–85.

Gudi, Amogh, H. Emrah Tasli, Tim M. Den Uyl, and Andreas Maroulis. 2015. "Deep Learning Based Facs Action Unit Occurrence and Intensity Estimation." In *2015 11th IEEE International Conference and Workshops on Automatic Face and Gesture Recognition (FG)*, IEEE, 1–5.

Hermans, Erno J., Marloes JAG Henckens, Marian Joëls, and Guillén Fernández. 2014. "Dynamic Adaptation of Large-Scale Brain Networks in Response to Acute Stressors." *Trends in neurosciences* 37(6): 304–14.

Huang, Haifeng. 2015. "Propaganda as Signaling." *Comparative Politics* 47(4): 419–44.

Krumhuber, Eva G., Arvid Kappas, and Antony SR Manstead. 2013. "Effects of Dynamic Aspects of Facial Expressions: A Review." *Emotion Review* 5(1): 41–46.

Kulke, Louisa, Dennis Feyerabend, and Annekathrin Schacht. 2020. "A Comparison of the Affectiva IMotions Facial Expression Analysis Software with EMG for Identifying Facial Expressions of Emotion." *Frontiers in psychology* 11: 329.

Kunda, Ziva. 1990. "The Case for Motivated Reasoning." *Psychological bulletin* 108(3): 480.

Lasswell, Harold D. 1927. "The Theory of Political Propaganda." *American Political Science Review* 21(3): 627–31.

Lewinski, Peter, Tim M. den Uyl, and Crystal Butler. 2014. "Automated Facial Coding: Validation of Basic Emotions and FACS AUs in FaceReader." *Journal of Neuroscience, Psychology, and Economics* 7(4): 227.

Lodge, Milton, and Charles S. Taber. 2013. *The Rationalizing Voter*. Cambridge University Press.

Lord, Charles G., Lee Ross, and Mark R. Lepper. 1979. "Biased Assimilation and Attitude Polarization: The Effects of Prior Theories on Subsequently Considered Evidence." *Journal of personality and social psychology* 37(11): 2098.

Matsumoto, David Ed, Hyisung C. Hwang, and Mark G. Frank. 2016. *APA Handbook of Nonverbal Communication.* American Psychological Association.

Mattingly, Daniel, and Elaine Yao. 2020. "How Propaganda Manipulates Emotion to Fuel Nationalism: Experimental Evidence from China." *Available at SSRN 3514716*.

McDuff, Daniel, Rana El Kaliouby, Evan Kodra, and Rosalind Picard. 2013. "Measuring Voter's Candidate Preference Based on Affective Responses to Election Debates." In *2013 Humaine Association Conference on Affective Computing and Intelligent Interaction*, IEEE, 369–74.

Meiselman, Herbert L. 2016. "Emotion Measurement: Integrative Summary." In *Emotion Measurement*, Elsevier, 645–97.

Munro, Geoffrey D. et al. 2002. "Biased Assimilation of Sociopolitical Arguments: Evaluating the 1996 US Presidential Debate." *Basic and Applied Social Psychology* 24(1): 15–26.

Nierenberg, Andrew A. 2018. *Why Does Propaganda Work? Fear-Induced Repression of the Executive Control Brain Network*. SLACK Incorporated Thorofare, NJ.

Olsson, Andreas, Katherine I. Nearing, and Elizabeth A. Phelps. 2007. "Learning Fears by Observing Others: The Neural Systems of Social Fear Transmission." *Social cognitive and affective neuroscience* 2(1): 3–11.

Petty, Richard E., David DeSteno, and Derek D. Rucker. 2001. "The Role of Affect in Attitude Change."

Redlawsk, David P., Andrew JW Civettini, and Karen M. Emmerson. 2010. "The Affective Tipping Point: Do Motivated Reasoners Ever 'Get It'?" *Political Psychology* 31(4): 563–93.

Sato, Wataru, Sylwia Hyniewska, Kazusa Minemoto, and Sakiko Yoshikawa. 2019. "Facial Expressions of Basic Emotions in Japanese Laypeople." *Frontiers in psychology* 10: 259.

Sato, Wataru, and Sakiko Yoshikawa. 2007a. "Enhanced Experience of Emotional Arousal in Response to Dynamic Facial Expressions." *Journal of Nonverbal Behavior* 31(2): 119–35.

———. 2007b. "Spontaneous Facial Mimicry in Response to Dynamic Facial Expressions." *Cognition* 104(1): 1–18.

Stöckli, Sabrina, Michael Schulte-Mecklenbeck, Stefan Borer, and Andrea C. Samson. 2018. "Facial Expression Analysis with AFFDEX and FACET: A Validation Study." *Behavior research methods* 50(4): 1446–60.

Suhr, Yannick T. 2017. "FaceReader, a Promising Instrument for Measuring Facial Emotion Expression? A Comparison to Facial Electromyography and Self-Reports." Master's Thesis.

Terzis, Vasileios, Christos N. Moridis, and Anastasios A. Economides. 2010. "Measuring Instant Emotions during a Self-Assessment Test: The Use of FaceReader." In *Proceedings of the 7th International Conference on Methods and Techniques in Behavioral Research*, , 1–4.

Towers, Sherry et al. 2015. "Mass Media and the Contagion of Fear: The Case of Ebola in America." *PloS one* 10(6): e0129179.

Zinchenko, Oksana, Zachary A. Yaple, and Marie Arsalidou. 2018. "Brain Responses to Dynamic Facial Expressions: A Normative Meta-Analysis." *Frontiers in Human Neuroscience* 12: 227.

APPENDIX 1: VIDEO TRASNCRIPTIONS

Positive news:

00:00:00 Neutral image
00:00:08 Axel Kicillof: Hello, Good morning, everyone.
00:00:12 The truth is, that today is a really exciting day. I have to say that… well, no… not just me… we were all excited:
00:00:22 doctors, nurses, hospital staff, those who got vaccinated and those who vaccinated us.
00:00:30 I believe that today marks the beginning of a new phase for us
00:00:38 This morning, we launched the vaccination campaign
00:00:40 that is the largest in the history of the Province of Buenos Aires
00:00:45 and it is a vaccine that does not merely prevent a disease,
00:00:50 as all do, but it is a vaccine that signals a real triumph,
00:00:57 a scientific revolution (...)

Negative news:

00:00:00 Neutral image
00:00:08 Journalist: You are a pathologist, you live in England, you have received multiple awards (…)
 00:00:15 [What does the pathologist think of the Russian vaccine?]
00:00:15 Pathologist: Newspapers like "The Guardian", which is a newspaper that I respect…
00:00:18 Journalist: Yes, of course.
00:00:19 Pathologist: There I read that Phase 2 had been studied in volunteers from the Russian Armed Forces, that they were thirty-six healthy volunteers, and that at that point, the Russian Prime Minister approved it, at Phase 2.
00:00:38 Pathologist: Without completing Phase 3, and what would happen if the vaccine was administered without completing Phase 3. (…)
00:00:41 Pathologist: (…) Exactly, the Phase 3 vaccine will be administered massively to the population. One cannot market a vaccine massively when it has not been approved.
00:00:53 (...) But you may have an adverse effect that is worse than the disease.

Neutral news:

00:00:00 Neutral image
00:00:08 Journalist 1: There, it's starting!
00:00:09 Journalist 2: There it is, look!
00:00:10 Journalist 3: We are looking at this sight from Chile.
00:00:11 Journalist 1: On the left, you can see it there!
00:00:12 Journalist 2: Yes, on the lower left-hand side...
00:00:13 Journalist 1: Now we can see it.
00:00:14 Journalist 3: Yes.
00:00:15 Journalist 1: Perfectly, exactly, in Chile, of course, that is why I am saying that...
00:00:18 Journalist 3: This image is from Chile.
00:00:19 Journalist 2: Right on time!
00:00:19 Journalist 1: We have to be careful, right?
00:00:20 Journalist 2: Right on time!
00:00:21 Journalist 1: We have to be careful, we are very close to Chile. It has not begun here yet, but I'm telling you, we have to watch it very, very, very close and maybe there will be some mirroring.
00:00:33 Journalist 2: Yes, because it goes so fast, José!
00:00:36 Journalist 1: Exactly, yes, yes, but, like I was saying, as this inversion that some telescopes have may cause confusion (…)
00:00:42 Journalist 1: Use the hashtag "Solar eclipse in TN" and send us your photo by Instagram, by Twitter, of how you are experiencing this. We want to know if you got together, if we managed to get you all together, how many people are watching this, if you got your kids out of school early, as we asked.

APPENDIX 2: QUESTIONNAIRE

Hello! Today, we are going to show you some questions, we want to know what you think and how you feel. Please bear in mind that all your replies are anonymous: we will not know, and we are not interested in knowing, who gave each replies. Your participation and your answers are very valuable for us. Thank you very much!

1. To start, please state your gender (as indicated in your ID card):
1. Female
2. Male

2. How old are you? …………………

3. What is the highest degree of education you have achieved?
1. Less than complete primary school
2. Complete primary school
3. Incomplete secondary school
4. Complete secondary school
5. Incomplete tertiary school
6. Complete tertiary school
7. Incomplete university studies
8. University degree
9. Postgraduate degree (Masters, specialization, PhD)

4. Who is the head of household in your home? (that is the person who provides the largest income)
1. Me
2. Somebody else

5. How would you describe your current working situation?
1. I am unemployed.
2. I have some work, but my income does not cover my needs.
3. I have a job and my income just covers my needs.
4. I have a job and I am doing well.

6. Did you receive any financial aid during the lockdown?
1. Yes, I received financial aid from family members and friends.
2. Yes, I received financial aid from the government.
3. Yes, I received financial aid from family members, friends and the government.
4. No, I did not receive any financial aid.

7. Based on this scale, where would you place your household income including any financial aid you have received?
1. Less than 20,000 pesos.
2. Between 20,000 and 40,000 pesos.
3. Between 40,000 and 60,000 pesos.
4. Between 60,000 and 80,000 pesos.
5. Between 80,000 and 100,000 pesos.
6. More than 100,000 pesos.

8. How safe do you think the Russian vaccine is?

Completely unsafe	<--	-->	Very safe
☐	☐ ☐ ☐ ☐	☐ ☐ ☐ ☐	☐

9. Would you get vaccinated if it became available this week?
1. Yes, I would get vaccinated.
2. No, I would not get vaccinated.

10. What do you think of Alberto Fernández as president?

He is a terrible president <-- ---> He is an excellent president

☐　☐　☐　☐　☐　☐　☐　☐　☐　☐

11. What did you think of Mauricio Macri as president?

He was a terrible president <-- ---> He was an excellent president

☐　☐　☐　☐　☐　☐　☐　☐　☐　☐

12. ¿What did you think of Cristina Fernández de Kirchner as president?

She was a terrible president <-- ---> She was an excellent president

☐　☐　☐　☐　☐　☐　☐　☐　☐　☐

13. Who did you vote for in the last general elections of October 27, 2019?

☐ Nicolás del Caño
☐ José Luis Espert
☐ Alberto Fernández
☐ Juan José Gómez Centurión
☐ Roberto Lavagna
☐ Mauricio Macri
☐ Blank vote
☐ I did not vote

14. Changing the subject completely, and moving on to your current mood, how do you feel in relation with the following aspects? ALWAYS CHOOSE THE OPTION THAT IS CLOSER TO YOUR CURRENT FEELINGS.
RANDOMIZE QUESTIONS

I feel in a very bad mood <-- ---> I feel in a very good mood

☐　☐　☐　☐　☐　☐　☐　☐　☐　☐

I feel very depressed <-- ---> I do not feel depressed at all

☐　☐　☐　☐　☐　☐　☐　☐　☐　☐

The coronavirus is going to bankrupt me, leave me broke <-- ---> The coronavirus will not affect my income

☐　☐　☐　☐　☐　☐　☐　☐　☐　☐

I do not feel like smoking, I do not smoke <-- ---> I feel like smoking all the time

☐　☐　☐　☐　☐　☐　☐　☐　☐　☐

15.
Thank you very much for reading and answering. We are almost finished, there are a couple of questions left.
For this research, it is very important that you have paid attention and that you have answered responsibly all the questions we have made. To confirm that you have been paying attention and reading all the information, we ask you to please select "Santa Fe" in the following question. This will help us verify which people have followed the instructions and which have not. There may be a similar question later. Based on the instructions of this page, which of the following cities had the best response to the Covid-19 crisis?

1. City of Buenos Aires BROKEN LINK
2. Córdoba BROKEN LINK
3. Santa Fe CONTINUE WITH SURVEY
4. Rosario BROKEN LINK
5. La Plata BROKEN LINK

MESSAGE:
Next, you will watch a one-minute video, we ask you to please pay attention. Thank you!

16. Were you able to watch the video?   1. Yes 2. NO Why not? _____

17. How objective and professional do you think the journalists were when discussing this news?

Not objective or professional at all <---   ---> Very objective and professional

□   □   □   □   □   □   □   □   □   □

18. ¿Do you think that the possible availability in the near future of the Russian vaccine in our country is good or bad news?

Very bad   <---   --->   Very good

□   □   □   □   □   □   □   □   □   □

19. If the vaccine were compulsory and if you had to get it today, how confident would you feel about it?

Completely mistrustful   <---   --->   Completely confident

□   □   □   □   □   □   □   □   □   □

20. And if you could choose, would you get the Russian vaccine if it were available today?
1. Yes, I would get it.
2. No, I would not get it.

22. Do you trust that the government will act in the best interest of the population?

I do not trust them at all   <---   --->   I have complete trust

□   □   □   □   □   □   □   □   □   □

23. How appropriate do you find the decisions that the president has been making in connection with the coronavirus?

I did not find them appropriate at all   <---   --->   I found them very appropriate

□   □   □   □   □   □   □   □   □   □

24. ¿How do you feel about having to stay at home?

Too much, given the circumstances   <---   --->   The best we can do, given the circumstances

□   □   □   □   □   □   □   □   □   □

25. Do you stay at home?

I go out all the time on walks, to meet my friends, to work, etc.   <---   --->   I stay at home as much as I can

□   □   □   □   □   □   □   □   □   □

26. If the risk of contagion persists and we have to stay at home during the first six months of 2021:

I will go crazy   <---   --->   I do not mind, I love staying at home

☐   ☐   ☐   ☐   ☐   ☐   ☐   ☐   ☐   ☐

34. Had you seen the video before?
1. Yes
2. No

Final message:
Thank you again for your time and collaboration.
Let us hope that, together, we can overcome these times in the best way, with calm, responsibility, and solidarity.
Thank you very much for your time!