IWH
Halle Institute for Economic Research
Member of the Leibniz Association

Discussion Papers

No. 4
January 2023

Oxytocin, Empathy, Altruism and Charitable Giving: Experimental Evidence from Blood Donations

Irena Jukić, Dejan Kovač, Danijela Vuletić Čugalj

Authors

Irena Jukić
Josip Juraj Strossmayer University of Osijek and the Croatian Institute for Transfusion Medicine
E-mail: irena.jukic@hztm.hr

Dejan Kovač
Halle Institute for Economic Research (IWH) – Member of the Leibniz Association, Department of Structural Change and Productivity
E-mail: dejan.kovac@iwh-halle.de
Tel +49 345 7753 862

Danijela Vuletić Čugalj
CERGE-EI – Charles University Prague and the Economics Institute of the Academy of Sciences of the Czech Republic
E-mail: dvuletic@cerge-ei.cz

Editor

Halle Institute for Economic Research (IWH) – Member of the Leibniz Association

Address: Kleine Maerkerstrasse 8
D-06108 Halle (Saale), Germany
Postal Address: P.O. Box 11 03 61
D-06017 Halle (Saale), Germany

Tel +49 345 7753 60
Fax +49 345 7753 820

www.iwh-halle.de

ISSN 2194-2188

Oxytocin, Empathy, Altruism and Charitable Giving: Experimental Evidence from Blood Donations*

Abstract

We conducted a field experiment in the natural setting of blood donations to test how oxytocin relates to empathy and altruism. We randomly assigned blood donors in the Croatian Institute for Transfusion Medicine to three groups with the aim to induce different levels of empathy by showing a neutral video to the donors from the control group and an emotional to the donors from the first and second treatment groups. In addition to watching the emotional video, donors from the second treatment group are given a gift which relates to the emotional story from the video. We find no effect of our treatment on induced levels of oxytocin. Null effects of our treatments could be explained by the above average baseline levels of oxytocin and inability of our treatments to provoke emotional stimuli in blood donors. Nonetheless, for our empathy measures we find the effect of gift exchange on empathic concerns, but not on perspective taking. After our experimental treatments, we followed the return of our blood donors for a whole year. We find that only variable which consistently predicts return for blood donation in stated period is the number of previous donations. From policy perspective it is an important finding. Especially for hospitals and other blood providers when faced with time and resource constraints.

Keywords: altruism, blood donations, charitable giving, field experiment, oxytocin

JEL classification: C93, D64, I10

* This research was supported by research grant no. RRC15+48 from the CERGE-EI Foundation under a program of the Global Development Network. All opinions expressed are those of the author(s) and have not been endorsed by CERGE-EI Foundation or the GDN. Helpful comments from Orley Ashenfelter, Michal Bauer, Vojtech Bartos, Janet Currie, Randall Filer, Patrick Gaule, Stepan Jurajda, Alexandre Mas, John List, Jacob Shapiro are gratefully acknowledged. Special thanks for constructive comments to seminar attendees at Princeton University, CERGE-EI and IWH. IRB approval for the experiment was obtained from the Ethics Committee of the Croatian Institute for Transfusion Medicine under the registry number: 251-541-06/6-16-2 (class: 003/06/16-04/02).

1 Introduction

During the past decade there has been a significant increase in oxytocin studies across variety of scientific fields in natural and social sciences. Social science research in oxytocin has been done on a variety of outcomes: trust (Kosfeld, Heinrichs, Zak, Fischbacher, and Fehr (2005)), emotion recognition (Guastella, Einfeld, Gray, Rinehart, Tonge, Lambert, and Hickie (2010)), generosity (Barraza and Zak (2009)), and cooperation (De Dreu (2012)). Nonetheless, we are far from a consensus on a several important aspects of interdisciplinary oxytocin research. The main reason is lack of a unified method of measurement of oxytocin across disciplines and understanding biological mechanisms in different social contexts. Some domains of science, take a reductionist approach in which researchers seek to explain complex oxytocin interactions in a simpler way neglecting the state-of-the art literature in all fields. A more holistic approach is needed in order to grasp the mechanisms of oxytocin in different social contexts.

Empowered with the recent findings on oxytocin in social science, we wanted to investigate further how oxytocin relates to altruism and empathy. Since most of the evidence of oxytocin on prosocial behavior comes from a lab experiment setup, our study is the first natural field experiment. To validate the oxytocin effect we needed a measurement of oxytocin where it is natural to extract blood samples - a blood donation context. Additionally, the idea for our experiment came from the fact that every country in the world at some point in time has faced with blood supply shortages, so we also measured an important public health outcome - the probability of return for a blood donation. The recent Covid pandemics has show the fragility of health systems worldwide:

"In January 2022, the American Red Cross declared its first-ever national blood crisis due to a severe blood shortage resulting from complications of the COVID-19 pandemic. During that time, hospitals and physicians were forced to make difficult decisions about how to best use the limited available supply of donated blood."[1]

According to WHO, an increase of 10.7 million blood donations from voluntary unpaid donors has been reported from 2008 to 2018. In total, 79 countries collect over 90% of their blood supply from voluntary unpaid blood donors; however, 54 countries collect more than 50% of their blood supply from family/replacement or paid donors (8 high-income countries, 36 middle-income countries and 10 low-income countries).[2] Moreover, according to the American Cancer Society, more than 1.9 million people are diagnosed with cancer in 2022. Many of them will need blood, sometimes daily, during their chemotherapy treatment and just 1 donation can save up to 3 lives.

A body of literature has identified altruism as the primary reason for donating blood (Oswalt (1977); Piliavin and Callero (1991); Glynn, Kleinman, Schreiber, Zuck, Mc Combs, Bethel, Garratty, Williams, and Study (2002)). Therefore, it is very important to understand how to, if possible, induce altruism. In particular what is the source of donors' altruistic behavior. One stream of literature advocates empathy to be the main determinant of prosocial behavior, specifically altruism. In particular, empathy-altruism hypothesis claims that empathic concern felt for a person in need produces altruistic motivation to relieve that need (Batson, Batson, Slingsby, Harrell, Peekna, and Todd (1991); Batson, Ahmad, Lishner, Tsang, Snyder, and Lopez (2002); Batson (2014)). Further, there is evidence from laboratory setting showing the influence of empathic concern on helping behaviors (Batson et al. (1991); Batson et al. (2002)). However, little is known about the influence of other constructs of empathy, such as perspective taking on helping behavior (Einolf (2008)). Especially in case of planned prosocial behavior, such as donating blood and volunteering. Moreover, there is a confining evidence that the experience of oxytocin facilitates empathy. Two studies showed the existence of beneficial effects of oxytocin on trust (Kosfeld et al. (2005)) and social support (Heinrichs, Baumgartner, Kirschbaum, and Ehlert (2003)), several studies tried to test how oxytocin correlates to empathy. In particular, Zak, Stanton, and Ahmadi (2007) find that oxytocin had twofold larger impact on generosity compared to altruism. The closest design to our study, Barraza

[1] https://www.redcross.org/about-us/news-and-events/news/2022/2022-crisis-response-donors-roll-up-their-sleeves-to-end-crisis.html

[2] https://www.who.int/news-room/fact-sheets/detail/blood-safety-and-availability

and Zak (2009) used a lab experiment and found that empathy was associated with a 47% increase in oxytocin from the baseline group.

However, in our study we had a natural setting of blood donors coming to donate blood without being aware of any study being conducted. Using the theoretical predictions mentioned above, we tested in a real setting of blood donation the association between the following three categories: altruism, empathy and oxytocin. Previous studies have not yet quantitatively explored these categories in blood donors or examined how they relate between each other. Thus, we want to understand how to trigger altruism among an (arguably) already altruistic population.

Unlike Barraza and Zak (2009) we find no effect of emotional videos and gift exchange on oxytocin levels. The null effects are not driven by the measurement error which large number of studies have reported Poljak and Sachdev (2021), but rather the combination of two factors - above average baseline levels of oxytocin of blood donors population and the lack of the emotional stimuli of our treatments. For our empathy measures, we find the effect of gift exchange on empathic concerns, but not on perspective taking. Finally, we find no connection between probability of returning in a stated period with perpective taking, empathic concerns, baseline and induced level of oxytocin. Nonetheless, across six different specifications we find that single variable which consistently predicts return for blood donation in a stated period is the number of previous donations. From policy perspective this is a significant finding.

To our knowledge, this is the first study on oxytocin which uses a natural field experiment to test several important interdisciplinary hypothesis.

2 Literature Review

This section is divided into two parts. The first section reviews the literature on charity giving and blood donations. The second chapter provides an in depth analysis of oxytocin research in social and natural sciences. We especially highlight the research gap in interdisciplinary studies of oxytocin.

2.1 Charity Giving and Blood Donations

Why do individuals give/ donate to each other? A question old as humanity, but up until recently we have not ventured into the understanding of main drivers of charity giving and altruism. The last two decades have been abundant in evidence across several disciplines: psychology, economics, sociology etc. Every disciplines has provided evidence on empathy, charity giving and altruism, but we are still scarce on a holistic interdisciplinary approach. Experimental psychologists have studied how emotional and cognitive states of empathy, sympathy, and personal distress correlate with helping behaviors in laboratory settings (Batson et al. (1991), Batson et al. (2002)). In economics there is an existing line of research which investigates charitable giving in many different settings, lab and field experiments. Prosociality is defined as any voluntary behavior intended to benefit other people and economic games have proven useful tools to learn about the nature of social preferences and motivations behind this behavior (e.g., Fehr and Fischbacher (2003)). Levin, Levitt, and List (2016) find persistence in giving patterns for "high capacity donors". The treatment effects are concentrated amongst those donors with the highest giving capacity and those who had given to the institution in the preceding two years. Interestingly, in our study we find a similar analogy. In our experimental setting blood donors with the most donations have higher probability of donating blood. Still the reasons of altruistic behavior are not entirely confirmed across disciplines. DellaVigna, List, and Malmendier (2012) present a theoretical framework that distinguishes two types of motivation: individuals like to give, for example, due to altruism or warm glow, and individuals would rather not give but dislike saying no, for example, due to social pressure.

In the blood donation setting there is lack of evidence on altruistic motives of blood donation, but some evidence on material and/or monetary incentives exists. Goette and Stutzer (2019) test how material incentives affect blood donations. They examine two types of rewards: a lottery ticket and a free cholesterol test. Lottery tickets significantly increase donations during the experiment, in particular among less

motivated donors. We are the first study in a field experiment setting to test altruistic motives of blood donation across several measures - oxytocin, empathy and altruism.

2.2 Oxytocin Studies

Oxytocin studies have been done across variety of fields in both natural and social sciences. Nonetheless, the initial studies of the oxytocin effect on social behavior have not critically assessed the mix findings of studies in the field of natural sciences. Fallacies on measurement of oxytocin and the mechanisms of the oxytocin delivery across different biological systems within a human body have sprung the largest debates. We are not the first study to review the research gap of oxytocin application in social sciences. Quintana, Lischke, Grace, Scheele, Ma, and Becker (2021) provide a critical review of intranasal oxytocin research, Poljak and Sachdev (2021) highlight the importance of a unified and reliable oxytocin assay across different studies and Lefevre, Mottolese, Dirheimer, Mottolese, Duhamel, and Sirigu (2017) provide an astonishing differences in measures of central and peripheral oxytocin across variety of methods. The main reason of large number of reviews is due to a large number of oxytocin studies that use different methods and approaches in different settings.

First element is the difference in how oxytocin is measured. There are three main types of oxytocin measurement: from saliva White-Traut, Watanabe, Pournajafi-Nazarloo, Schwertz, Bell, and Carter (2009) and Sue Carter, Pournajafi-Nazarloo, Kramer, Ziegler, White-Traut, Bello, and Schwertz (2007); from cerebral spinal fluid (CSF) Veening, de Jong, and Barendregt (2010) and from blood plasma Gossen, Hahn, Westphal, Prinz, Schultz, Gründer, and Spreckelmeyer (2012). Besides the methods of measurement, studies largely differ in sample sizes and demographics. The more costly and logistic-heavy methods such as CSF have much smaller samples John and Jaeggi (2021), while blood plasma studies vary between twenty to a hundred. According to Quintana et al. (2021) majority of studies have dominantly men in their samples, hospital patients or student communities. It complicates any comparability of oxytocin levels across studies, since several studies have shown significant differences in oxytocin depending on demographics. For instance, Domes, Lischke, Berger, Grossmann, Hauenstein, Heinrichs, and Herpertz (2010) and Lischke, Gamer, Berger, Grossmann, Hauenstein, Heinrichs, Herpertz, and Domes (2012) show there are significant gender differences across oxytocin studies, which complicates the comparisons even more.

Study which encompasses the most measurement methods on a same sample is Lefevre et al. (2017). Their study compared cerebrospinal fluid (CSF) collected from the brain ventricle with plasma oxytocin after simultaneous blood withdrawal. They used four methods to assay oxytocin concentrations: commercial EIA with/without extraction, laboratory developed EIA with filtration and RIA with extraction. They find a significant relationship between blood plasma and CSF oxytocin with only three methods and within-method differences - with or without extraction. This study has cast doubts on the appropriate methods to measure central and peripheral oxytocin concentrations. Correlating oxytocin from blood plasma with behavioural scales seems to be a suboptimal method to investigate links between the oxytocin system and behaviour, as plasma levels of oxytocin might be a noisy proxy depending on the method used. Similarly, Quintana et al. (2021) highlight a mix evidence whether intranasally administered oxytocin enters the brain via the nose-to-brain route and whether this route leads to functionally relevant increases in central oxytocin levels. After analysing the recent literature they find a converging evidence for functionally relevant effects of the intranasal oxytocin administration route.

Striepens, Kendrick, Hanking, Landgraf, Wüllner, Maier, and Hurlemann (2013) have shown that oxytocin levels significantly increased in both plasma and CSF. However, whereas oxytocin plasma concentrations peaked at 15min after intranasal administration and decreased after 75min, CSF concentrations took up to 75min to reach a significant level. Nonetheless, whether it is intravenous or intranasal administration of oxytocin we are still missing a strong evidence on oxytocin mechanisms - from its point of extraction (CSF or plasma) to its behavioral impacts.

The second strand of the literature uses different points od administration or extraction methods. The two main methodologies use a diametric approaches in social science and oxytocin research to estimate a

causal impact. They either use the intranasal oxytocin as treatment to observe effects on social behavior (Kosfeld et al. (2005) and Zak, Kurzban, and Matzner (2005)) or as in Barraza and Zak (2009) and our study administer emotional treatments in order to measure oxytocin. Kosfeld et al. (2005) analyse the impact of intranasally administered oxytocin on individuals' decisions in a trust game. They find subjects given oxytocin show higher levels of trust in the trust game. Similarly, Zak et al. (2005) find that oxytocin levels are higher in subjects who receive a monetary transfer that reflects an intention of trust relative to an unintentional monetary transfer of the same amount. Contrary to prior studies, Zhong, Monakhov, Mok, Tong, Lai, Chew, and Ebstein (2012) observed a significant U-shaped relationship between baseline plasma oxytocin with the level of trust. Thus, the evidence in the replication studies have raised doubts on connections between oxytocin and trust. Nave, Camerer, and McCullough (2015) conducted a critical review of research - "Does Oxytocin Increase Trust in Humans?" and conclude that the cumulative evidence does not provide robust convergent evidence that human trust is reliably associated with oxytocin (or caused by it). The pharmacokinetics of intranasal oxytocin in humans lack concrete evidence of the impact. Researchers lack a way to verify whether the substance indeed reached the human brain following administration. Leng and Ludwig (2016) show that very little of the huge amounts applied intra-nasally appears to reach the cerebrospinal fluid.

The third strand of literature divides studies based on the statistical tools used for inference. Studies wich correlate social behavior with oxytocin levels, lab experiment and natural field experiments. In an observational study, Parker, Garner, Libove, Hyde, Hornbeak, Carson, Liao, Phillips, Hallmayer, and Hardan (2014) compare oxytocin levels across children to find a connection with autism disorder. The "gold standard" in social sciences Kosfeld et al. (2005) use lab experiments to infer causal impacts of oxytocin. The current state of the literature is such that all oxytocin studies have been done in lab experiment setting, due to required measurement of oxytocin. The uniqueness of our study is that the natural setting of blood donation allows us to conduct the first natural field experiment in the field of oxytocin, charitable giving and blood donations. The switch from a lab setting to an natural field experiment should not have a significant impact on measurement of biological markers such as oxytocin, but it creates methodological benefits in other behavioral measurements.

Overall, effects of oxytocin mechanisms in social behavior are far more complex than initially thought. Winterton, Westlye, Steen, Andreassen, and Quintana (2021) outline how the precision of oxytocin research can be improved by the complementary consideration of methodology, theory and reproducibility. Firstly, experimental designs which allow comparability in larger more comparable samples such as in Zhao, Luo, Sindermann, Li, Wei, Zhang, Liu, Le, Quintana, Montag, et al. (2020) and Declerck, Boone, Pauwels, Vogt, and Fehr (2020). Secondly, publication of null results as in Melby, Gråwe, Aamo, Salvesen, and Spigset (2019) and Stauffer, Meinzer, Morrison, Wen, Radanovich, Leung, Niles, O'Donovan, Batki, and Woolley (2019). A more rigorous and holistic methodological practices are needed if we are to understand complex biological, psychological and social interactions of oxytocin.

3 Experimental Design

Our study was conducted in the last semester of 2017 on the sample of 939 blood donors from the Croatian Institute for Transfusion Medicine. Figure 1 depicts a detailed experimental design.[3] Croatian Institute for Transfusion Medicine follows a rigorous ISO standards we could not deviate from, besides adding the experimental part of our research design. Large share of our sample were previous donors, so we kept the standard setting the donors are used to in order to keep the setting of a field experiment. The routine and procedures for blood donations were exactly the same as every other day.

At first stage, donors enter the Croatian Institute for Transfusion Medicine - register and conduct medical checkups. We ask donor if he/she plans to give blood again, if yes, we ask them to define the expected date of the next blood donation. We write down the date of his/her choice to the wallet-size card and we

[3]In order to conduct the experiment we had to go through an IRB process at the Institute and submit a pre-analysis plan. The document is in the supplementary materials.

give that card back to the donor as a reminder. This is our measure of the long-run effect - the probability of return for a blood donation and the probability of commitment to that particular date.
After successfully passing medical examination, doctor asks the donor to sign the written consent on using part of his/her blood donation for measuring bio-chemical parameters i.e. being in our experimental design. If donor signs the consent, he/she becomes part of our sample, if he/she does not, he/she just donates blood in the usual manner and that individual is not included in our study.
The blood donors who come to donate blood are already not a representative sample of Croatia's demographic structure, same as they are not in any other country.[4] The descriptive statistics of our entire sample are shown in the Table 1. 91% of our sample were males with 40.7 average age and close to average 28 previous donations. We randomly selected 198 individuals for our Oxytocin sample and there are no statistical differences between our full and our Oxytocin sample (Table A1).

Stage two starts after a donor signed the consent. Donor will randomly be seated on one of three chairs (three different groups) and will be given tablet with video to watch. Before the video is given we measured the baseline levels of Oxytocin for every donor. The video was played without audio not to have contagion effects but with text connected to every treatment arm.[5] Appendix A Figure 1 and 2 show that it was not possible to have contagion effects because the distance between donors prevented it. The first group is our control group and these donors received only the neutral video. The second and the third groups are our treatment groups and they received an emotional video. Additionally, same as vast literature on th gift exchange (Gneezy and List (2006), DellaVigna, List, Malmendier, and Rao (2022)) we wanted to test for the "gift exchange effect". After watching the video the third group also received an origami shaped heart. We connected the gift with the text and the video from the emotional treatment to induce additional emotional response. At the end of the video kids "hand-in" the origami shaped heart. Both the neutral and the emotional video were identical with duration of below two minutes. The video showed different sequences of two kids making origami. The only difference was in the text. The translated neutral video text from Croatian:
"This is Mateo... and Patricia. We met them in the children's playroom. Like all children their age, Patricija and Mateo like to enjoy themselves in a carefree game, socializing and laughter... Sometimes just through the game learn and develop a lot. It has been scientifically proven that making origami positively affects the development of motor, intellectual and creative abilities in children. Origami comes from the Japanese words "ori" which means to fold and "kami" meaning paper. The tradition of "paper folding" in Japan has existed since the 6th century. Thousands of different objects can be made with origami, from ships and cranes, over the heart, to various mathematical models. Finally, only one square paper is enough as a ticket to travel through the imaginative world of origami."
The translated emotional video text from Croatian:
"This is Mateo... and Patricia. We met them in the playroom of the Srebrnjak Children's Hospital. Like all children of their age, Patricija and Mateo like to enjoy carefree play, hanging out with friends, and laughing. Unfortunately, due to illness, carelessness sometimes replaces fear. Fear of the unknown, fear of pain, fear of separation from loved ones the moment they replace their home bed with a hospital bed. Children with terminally ill organs face even greater fears every day. Some of them are waiting for a life-saving organ transplant. They will need donated blood for transplantation and will get an opportunity for a new life. Let their hearts keep beating!"

Both texts were in Croatian. Average number of words was very low, around 40 words per minute. This allowed enough time to process the information. We kept the same average number of words across neutral and emotional video to have the same amount of informational content across treatments. The text in the emotional video was connected with the blood donation setting and the need for the blood donation. Association Transplant is mentioned at the very end of the video and at the last stage we will

[4] According to the World Health Organisation, Data about the gender profile of blood donors show that globally 33% of blood donations are given by women, although this ranges widely. In 15 of the 113 reporting countries, less than 10% of donations are given by female donors. In our sample female donors are 9%. https://www.who.int/news-room/fact-sheets/detail/blood-safety-and-availability

[5] Videos are added as supplementary materials

connect the voucher-dictator game with donation to the same association.

Individuals were randomised by order of arrival i.e. as they would arrive they would be assigned to one of the three seats. After watching the video we measured the induced levels of Oxytocin from a blood sample. The Oxytocin was measured on a random sample of 198 individuals. In the third stage, after the blood donations, as a standard procedure within the medical check-up, donors are required to stay seated under doctor's supervision. During that short period of time donor is asked to fill in the Interpersonal Reactivity Index questioner to measure empathy levels. Lastly, we conducted a dictator game with every donor. Donor is endowed with 2 vouchers in the amount of 10 HRK (1.35 EUR) to be used in DM-Drogerie Markt store. She/He is than asked if they would like to donate one, both or neither of vouchers to the Association Transplant (related to the video screened).

To summarize all of our outcomes:

- we ask the donors to commit to a future date (a week interval) of the next blood donation
- we measured the baseline oxytocin levels i.e. pre-treatment levels for all three groups
- we measured the induced oxytocin i.e. post-treatment levels for all three groups
- we measured empathy with a self-reported questionnaire
- we measured altruism through voucher donations
- for more than a year after the experiment we tracked the probability of return and the commitment to return during a particular date

As described in Section 2.2. most of the interdisciplinary studies on oxytocin, no matter the field-social or natural science, provide a one-sided, almost to say a reductionist view of a very complex set of interactions. We wanted to provide a more holistic approach which would help us understand the biological, behavioral and psychological components of the mechanism of oxytocin in prosocial interactions. Since we are measuring a large set of outcomes across different disciplines we wanted to keep the field experiment setting to have a more clearer understanding of our findings. Study by Levitt and List (2007) gives a detailed review of factors when we should expect large differences between a lab and a field experiment.

3.1 Measuring Empathy Levels

We measured empathy with the Interpersonal Reactivity Index (IRI) Davis (1980). This established scale measures four dimensions of empathy: empathic concern, personal distress, fantasy, and perspective-taking. In our study we focused on empathic concerns and perspective-taking categories of the questionnaire. The questionnaire was validated by a professional association of psychologists and the document is in the supplemental materials. Empathic concern is an affective dimension of empathy related to the perception of our own feelings when faced with emotions of other people. Simple, empathic concern includes feeling for the other like feelings of sympathy, compassion, and tenderness (Batson and Shaw (1991)). Perspective taking as a cognitive dimension of empathy is defined as the ability to adopt another person's perspective or point of view. We did not measure the fantasy and personal distress in blood donors from our sample due to several reasons. Based on the evidence from the literature, for question on relation to oxytocin, we were particularly interested in empathic concern (EC) and perspective taking (PT) constructs of empathy. The second reason was purely logistical. The questionnaire needed to be short not to distort normal time of blood donation processing, since the Transfusion center opeerated normally as every other day.

3.2 Measuring Oxytocin Levels

In our experiment we had two measurements of Oxytocin. One measurement right before taking out the blood and the second measurement after watching the video. The entire procedure of blood donations

has an average duration of 2.5 minutes. Our videos were shown in the first 3 minutes of the blood donation process, which would give sufficient time to capture any increase of Oxytocin in the blood. As suggested in McCullough, Churchland, and Mendez (2013) and Poljak and Sachdev (2021), we used a sample preparation techniques - the extraction method.

Assay Procedures

Blood samples for oxytocin assay were collected using EDTA tubes, 6 mL, K 2 EDTA (Vacutainer, Becton Dickinson, USA) and refrigerated until the processing phase. In order to isolate plasma, blood samples were centrifuged for 10 min at 2500 rpm within two hours from the blood drawn. The quantification of oxytocin in plasma was done using the competitive assay - Oxytocin ELISA Kit (Cayman Chemical Company, Ann Arbor, USA). Following the manufacturer's instructions, 2 mL of plasma were used immediately after centrifugation for oxytocin solid phase extraction on C18 column. Methanol (Kemika, Croatia) was used for column activation, and ethanol and acetone for washing and elution (Kemika, Croatia). Extract was resuspended in 0.5 mL of ELISA buffer. Additionally, ELISA test was quantified in duplicates.

3.3 Measuring Altruism Levels

In a dictator game, Forsythe, Horowitz, Savin, and Sefton (1994), the proposer is endowed with money or vouchers to divide between himself/herself and the recipient. The recipient is not making any decision, he/she can only accept the offer made by proposer. In the dictator game proposer decisions can be caused by inequality aversion or altruism Croson and Gneezy (2009). Blood donors from our sample were engaged in a blinded, one-shot decision on how to split voucher with which they were endowed after giving blood. The recipient of the vouchers was the Association Transplant - it was made clear to them. This Association provides care in terms of accommodation, medicines and groceries for individuals who are about to have organ transplantation and who live far from Zagreb. Being the capital of Croatia, Zagreb is the only city with the hospital which could obtain complicated surgeries involving organ transplantation. To connect the stories, in the emotional video at the very end we placed information about the Transplant Association - name and their emblem. This way the emotional video groups could connect the video with the dictator game.

4 Experimental Results

This section is divided into subsections depending on the outcome we measured in the experiment. The first section analyzes balancing tests on a large set of variables. The second section analyzes our measurement of Oxytocing and compares it with the state-of-the-art literature. The third section analyzes the categories of perspective taking (PT) and empathic concerns (EC) across all treatments. Additionally we connect these two categories with our measures of Oxytocin and conduct a short summary comparison with other studies. In the next section we analyse our experimental results from the Dicator game i.e. charitable giving within a blood donation setting. Lastly, for more than a year we track the blood donors from our experiment - their probability of return and commitment to return during the period they initally committed to.

4.1 Balancing tests

Our full size sample for the experiment included 939 individuals. Our target was to be close to 1000 and we achieved it. The specifics and the beauty of this experimental design was the ex ante inability to control for the exact sample size. We were constrained by two parameters - number of Oxytocin ELIZA kits and the arrival rate of blood donors to the Institute. Funding limited our Oxytocin sample size close to 200 individuals. We show the main demographic statistics for the full and Oxytocin sample in Table 1. The second part, the arrival rate of blood donors and the success of our randomization procedure was harder to estimate. Therefore, we ran a short pilot study on a smaller sample, to check

whether randomisation procedure of assigning individuals to different treatment group by arrival time produces a valid balance. It did. Last component was to decide, when do we end the experiment, since you cannot precisely estimate the daily number of blood donors and we had to coordinate employees across two full work shifts. We had full access to more than a decade of blood donations at the Institute. Forecasting daily number of individuals was not accurate, only weekly, so we decided on a stop rule - end the experiment on a full day once we get close to a thousand individuals. The added value of this study lies in providing validity of randomisation procedures in a blood donation setting when the ex-ante experimental sample is unknown or hard to forecast. In a standard experimental design a researcher has the full sample and the ability to control the treatment arms. In a blood donation setting the supply of blood donors is unknown, if we want to keep the setting of a field experiment, not a lab experiment, the validity of a randomisation has to be done either on a pilot study or on a forecast. In our experiment we did both.

Next, we had to do a double randomisation. Randomisation of individuals from the full sample to our oxytocin sample and randomisation within each sample into treatment arms. A1 shows the selection from the full sample into the Oxytocin sample. The outcome variable is a binary indicator if individual is in the full or in the Oxytocin sample. Out of 13 control variables, no variable is statistically significant.

We analyse the randomisation into three groups for our two samples - the full sample and the Oxytocin sample. Four tables show the extent to which our three assignment groups are balanced on the observable characteristics. Tables 2 and 3 for the full sample and Tables 4 and 5 for the Oxytocin sample. Each column of the table reports the results from a regressions. On the top of the column is the dependent variable and on the left side are two binary indicators for treatments - emotional and emotional+gift. The baseline category is the control group i.e. neutral video group. For the full sample group our treatments are very well balanced. Out of sixteen different demographic variables across three groups only gender in emotional+gift group was significant at 90% and O negative variable in emotional group at 95%. This is due to low share of females and individuals with 0 negative blood type in the full sample, 8% and 7% respectively. Similarly, in our oxytocin sample, variables age and B+ blood group were significant at 90% within emotional treatment and variable donations within emotional+gift treatment.

4.2 Oxytocin

Figure 2 depicts three measures of oxytocin across our treatment groups: neutral video (control group), emotional video and emotional video + gift. We extracted the oxytocin level before the start of the blood donation and after our video treatments. The third graph on Figure 1 shows the difference between the baseline and induced level Oxytocin for every individual in the experiment. We find no effect on induced levels of Oxytocin across the three groups. Table A2 Oxytocin appendix confirms the results in a regression table. On the top of the column is the dependent variable and on the left side are two binary indicators for treatments - emotional and emotional+gift. The baseline category is the control group i.e. neutral video group. We used both the specifications with and without controls.

"Absence of evidence is not an evidence of absence."
- Carl Sagan

There might be three main reasons why we find no effect. The first reason is that the individuals who are coming for blood donations are already "high" on Oxytocin. The second reason might be that our treatments did not have a sufficient emotional stimuli to trigger a significant oxytocin production in the body. The third reason might be the measurement problems in the literature, which a lot of studies seem to be neglecting and setting aside. In order to shed more light on the mechanism - through suggestive

evidence, we analysed more that 100 oxytocin studies across natural and social sciences.[6]

4.2.1 Are Blood Donors Already High on Oxytocin?

To test this hypothesis, irrespective of treatment arms, we focused on the baseline levels of oxytocin i.e. our measurement before any treatments and induced levels of oxytocin i.e. after video and gift treatments.

As shown in Table A4 the average baseline oxytocin in our sample was 15.47 pg/mL while the average induced oxytocin in our was 16.03 pg/mL. The average difference between the baseline and the induced levels of Oxytocin is 0.56 pg/mL. Our sample had 198 individuals, 92% were males with and average age of 43.4 years. The biggest problem of the literature is to find an oxytocin measurement for an adult population without any health issues. These findings only increase the value of our study and can serve as a benchmark for any future studies. Blood donors by default go through a medical checkup, but we cannot vouch there are not any un-diagnosed disorders or health problems. Nonetheless, in comparison studies the values we used were usually of a neurotypical group i.e. without a disorder.

Althaus, Groen, A Wijers, Noltes, Tucha, Sweep, Calcagnoli, and Hoekstra (2016) had a sample of 61 individuals with autism, 52% were males with and average age of 22.67 years. oxytocin levels for a neurotypical group was 0.67 mean (±0.77) pg/mL. John and Jaeggi (2021) conducted a meta analysis of 31 studies to infer that oxytocin levels tend to be lower in autistic children. Their goal was to test whether the current state of the field supported an overall difference in oxytocin levels between autistic and neurotypical people. To have some comparability, out of these 31, we focused on 4 which were done on adults and used ELISA kits same as ours. The rest were done on children or used other means of oxytocin measurement - saliva or cerebrospinal fluid. Andari, Duhamel, Zalla, Herbrecht, Leboyer, and Sirigu (2010) had a sample of 26 individuals, 85% were males with an average age of 26 years. Oxytocin levels for a neurotypical group was 7.28 mean (±4.49sd) pg/mL. Jansen, Gispen-de Wied, Wiegant, Westenberg, Lahuis, and Van Engeland (2006) had a sample of 24 individuals, 92% were males with an average age of 21.8 years. Oxytocin levels for a neurotypical group was 5.24 mean(±3.24sd) pg/mL. Aita, Mizoguchi, Yamamoto, SeguchI, Yatsuga, Nishimura, Sugimoto, Takahashi, Nishihara, Ueno, et al. (2019) had a sample of 69 individuals, 58% were males with an average age of 45.68 years. Oxytocin levels for a neurotypical group was 61 mean (±51 sd) pg/mL. Munesue, Yokoyama, Nakamura, Anitha, Yamada, Hayashi, Asaka, Liu, Jin, Koizumi, et al. (2010) had a sample of 130 individuals, 61% were males with an average age of 34.1 years. Oxytocin levels for a neurotypical group was 197.97 mean (±247) pg/mL.

Taking the latest advancements on oxytocine measurement it is important to note that the last to studies have a questionable validation of their samples - mean/sd ratio. When we compare our demographics and levels of oxytocin to these studies we find that our blood donors population has higher average levels of oxytocin. At least for those studies which are most comparable to ours.

4.2.2 What Interventions increase Oxytocin levels?

The second reason why we do not see a statistical significant effect might be that the treatments - emotional video and gifts were not enough stimulating to produce a response visible through our measurement. The most common oxytocin approach in social sciences was as established by Kosfeld et al. (2005) and Zak et al. (2005). Analyzing the impact of exogenously administered OT on individuals' decisions in a trust game with real monetary stakes. This experimental design is diametric from ours. Our approach seeks to answer what type of treatment (video or gift) impacts short-run outcomes: induced levels of oxytocin, empathy, altruism; and long-run outcomes: probability of return for blood donation and commitment to a particular period.

The closest design to our study, but in a lab setting was done by Barraza and Zak (2009). Their study study investigated whether the experience of empathy raises oxytocin levels and affects subsequent

[6]Most relevant papers for our topic are included as references. The entire list is in supplementary materials.

generosity toward strangers. Their sample size was 145 college students (48% male, mean age 20.8 years) from the University of California, Los Angeles (UCLA). The treatments were different from ours - three groups: emotional video and ultimatum game, control video and ultimatum game, or emotional video only.

All individuals, using headphones, privately viewed a 2-min long video. Similar to our setting they had emotional and the neutral video. In the emotional video a father explains his current experiences with his 2-year old son who has terminal brain cancer. In the neutral video the father describes a day at the zoo and has no mention of the child's illnes. The context, the length of the video is similar to ours. The only difference is that our videos did not have audio, only the text.

Remarkably, oxytocin levels in their study are a lot higher than in our study and comparable studies from the previous section. The comparison of baseline oxytocin i.e. before the treatments in both studies give us the best insight into difference. The baseline oxytocin in their study was 474.87 pg/mL, SD = 306.75 (the emotional video); baseline OT = 464.96 pg/mL, SD = 341.90 (the control video) and baseline OT = 401.83 pg/mL, SD = 230.06 (the emotional video, no UG). In our study the baseline oxytocin was 15.47 pg/mL, SD=9.95 (the entire sample). The difference in the baseline oxytocin to our study is in 25 to 30 times. Comparing induced levels of oxytocin, which are even higher, would be questionable due to different experimental designs and demographic of the sample.

4.2.3 The Oxytocin Measurement Problem

Barraza and Zak (2009) conducted this study almost ten years before ours. They were the pioneers in the field. From the study it is not clear whether they used the extraction method or not. McCullough et al. (2013) show that commercially available EIA assays without extraction, obtain values that are two orders of magnitude higher than those obtained using conventional RIA methods with extraction. Similarly, Lefevre et al. (2017) compared cerebrospinal fluid (CSF) collected from the brain ventricle with plasma OT after simultaneous blood withdrawal. They used four methods to assay OT concentrations: Commercial EIA with/without extraction, laboratory developed EIA with filtration and RIA with extraction. Figure A2 provides a detailed comparison. They found a significant relationship between Oxytocin measured from CSF and blood plasma with three methods. Most importantly they found that the mean oxytocin value without extraction was 1487.2 pg/mL, SD = 1389.0 and with extraction 18.8 pg/mL, SD =7.4. Three additional studies used liquid chromatography, Zhang, Zhang, Fast, Lin, and Steenwyk (2011); Meziane, Schaller, Bauer, Villard, Matarazzo, Riet, Guillon, Lafitte, Desarmenien, Tauber, et al. (2015); Eliava, Melchior, Knobloch-Bollmann, Wahis, da Silva Gouveia, Tang, Ciobanu, Del Rio, Roth, Althammer, et al. (2016), all reported plasma OT levels, after extraction, within the range of 1–10pg/m.

We used the extraction method with ELISA kits which is by all standards the state-of-the art method in oxytocin measurement from blood plasma. The suggestive evidence from other studies implies two important conclusions. Firstly, blood donors have above average oxytocine levels on the baseline measurement. Secondly, the inability to capture induced levels of oxytocin is not due to measurement, but the joint effect of lack of stimuli from our treatments - videos and gift and above average baseline oxytocin levels for the blood donor population. The effect might exists within a non-donor population.

4.3 Perspective Taking and Empathic Concerns

Empathy was measured using the Interpersonal Reactivity Index as in Davis (1980). We measured two dimensions of empathy: cognitive dimension (the ability to adopt another person's perspective or point of view - perspective taking) and affective dimension (the perception of our own feelings when faced with emotions of other people - empathic concern).

As visible in Table 6 the perspective taking and empathic concern dimensions show no difference across three treatments. The same applies for specifications with or without covariates. We also wanted to test the "gift effect" separately. Table 7 column 3 and 4 show that the gift effect had a positive significant effect on emphatic concerns, but no effect on perspective taking. We find a difference between gift and no gift groups for empathic concerns. The gift group exhibits 0.11 higher results on the empathic concern

scale. Since this is a first study of this kind we do not have a comparable similar study, but the logic is the same as in the entire "gift exchange" literature.

Our main goal was not to test the impact of video treatments and gift on two dimensions of empathy, because the studies have shown mix evidence on these two dimensions as being stable personal traits. One strand of the literature shows that different demographic groups exhibit different levels of empathic concerns and perspective taking.[7] While this strand of literature show these differences on cross-sectional samples, the other strand focuses on longitudinal studies, but mainly on children development.[8] Since a more specialised literature shows a mix evidence, our study's agenda was more general. Our goal was to measure empathy dimension (IRI), biological proxy of trust (oxytocin) and altruism (the dictator game) to see how they correlate with each other and across treatments. In that sense the added value of having four different measures in a single study: altruism and empathy - biological, cognitive and behavioral is of tremendous value.

First, we wanted to test the basic demographic characteristics across perspective taking and empathic concern dimensions. Figure B1 shows how level of perspective taking and empathic concern differ across different gender and age groups. Empathic concern is significantly higher for women in comparison to man. Further, the level of empathic concern and perspective taking increases with the age (the above-mentioned results are consistent with the literature).

Additionally, in Table B1 we find that individuals with higher oxytocin levels have strong positive correlation of empathic concerns. This correlation goes along with our initial hypothesis.

4.3.1 Comparison with Other Studies

Lastly, since blood donors are a selected group of the general population, we wanted to compare our findings with different samples in the literature. Figure B2 from Konrath (2013) serves as a comparison of perspective taking and empathic concern levels for American college students and adults. Our donors do not differ significantly in terms of empathic concern level, but perspective taking level is much higher among blood donors from our sample than among American college students and adults. Konrath (2013) find a curvilinear relationship: middle-aged adult females have the highest EC and PT in US. In our sample we find differences only for EC, not PT. Same as in the US study, females have higher EC, and EC increases with age.

4.4 Dictator game

As a last stage of our experiment, donors are endowed with 2 vouchers in the amount of 10 HRK (1.35 EUR) to be used in DM - Drogerie Markt store. They are asked whether they would donate these vouchers for the Transplant Association - the same association we showed in our two emotional video treatments. They can keep both, donate one or donate both vouchers.

As Figure 3 shows 82% donate both, around 8% donate 1 and only 10% keep both vouchers. With such a large share of donors donating back we did not have a significant statistical effect across our treatments Table 9.

The uniqueness of our study was in the setting. The Law prevents monetary incentives for blood donations. As already mentioned, it makes it an ideal setting to test the altruistic motives of blood donations, but it prevented us to provide monetary incentives donations with larger amounts.

Initially, our goal for a study was to introduce a market through monetary incentives, but that was not possible due to Law and institution level constraints. Croatia's law and institutional setting does not

[7] O'brien, Konrath, Grühn, and Hagen (2013) find that middle-aged adults have higher empathy than both young adults and older adults. Also that women have higher empathy than men.

[8] Farrell and Vaillancourt (2021) measured self-report measures of empathy annually from grades 7 to 10 and find that the majority of individuals reflected a joint trajectory of moderate stable empathic concern and moderate increasing perspective taking. Van der Graaff, Carlo, Crocetti, Koot, and Branje (2018) conducted a 6-wave longitudinal study investigated the development of prosocial behavior across adolescence, and examined longitudinal associations with perspective taking and empathic concern.

allow for monetary incentivized blood donations. An extension study in a country which also does not uses monetary incentives would be to vary the amount given. This would allow measuring a threshold amount when altruism changes to a market transaction.

4.5 Returnees for Blood Donation

After our experimental treatments we followed the return of our blood donors for a year. We wanted to test for the long-run effect that may have policy recommendations. During the next year, 98% returned to donate blood again and 55% out of them returned in a period they committed on their reminder cards. The main results i.e. commitment to return to periods choose themselves is not statistically significant across our treatments.

Lastly, we wanted to test whether long-run return is connected to our measures of empathy and Oxytocin. Appendix Table D1 - we find no connection between probability of returning in a stated period with PT, EC, baseline and induced level of oxytocin. Nonetheless, across six different specifications we find that only variable which consistently predicts return for blood donation in stated period is number of previous donations. It seems similarly as in charitable giving Levin et al. (2016), individuals in blood donation tend to form persistence of habits, especially those who have a habit of donating. From policy perspective this is a significant finding. Targeting the donors with higher number of donations gives a higher return rates. This is especially important for hospitals and other blood providers when faced with time and resource constraints.

5 Conclusion

The measurement of oxytocin is costly and logistically intensive. Requires a lab, well trained and educated personnel. We had both during our experiment, nevertheless, as visible, there are unforeseen field events which researchers need to take into account if we are to push the frontiers of knowledge further. In order to fully grasp our findings, there are several novelties in the research design and suggestive evidence our research can help future oxytocin studies.

The lab experiment of Barraza and Zak (2009) was the closest study to ours. In a blood donation setting we were able to conduct a natural field experiment and as described in Levitt and List (2007) remedy any differences in outcomes. It potentially might have an effect on differences in behavioral, empathy and altruism outcomes, but not on the measurement of oxytocin. Unlike Barraza and Zak (2009) we did not find the effect of emotional videos and gifts on induced level of oxytocin. After analysing the most recent findings we provide two main suggestive evidence on not having an effect. Once compared to the most similar studies in terms of demographics of the sample and the method of measurement of oxytocin we conclude that the blood donor population has 1.5 to 2 times higher baseline levels of oxytocin. Secondly, there is a big variation in measurement of oxytocin depending on the method, cerebrospinal fluid or blood plasma, and with or without extraction. We used blood plasma with the extraction method. The success of our randomisation provides evidence that the null effects are not driven by the measurement error, but rather the combination of two factors - above average baseline levels of oxytocin and the lack of the emotional stimuli of our treatments.

Perspective taking and empathic concern dimensions show no difference across three treatments. Comparing two groups with emotional videos - with/without gift, we find a strong positive effect. Interestingly, we find the effect of gift exchange on empathic concerns, but not on perspective taking. The definitions and the differences in the two categories provide insights into validity of these results. Empathic concern is an affective dimension of empathy related to the perception of our own feelings when faced with emotions of other people. The literature on gift exchange confirms our findings.

Our main goal was not to test the impact of video treatments and gift on two dimensions of empathy, because the studies have shown mix evidence on these two dimensions as being stable personal traits. Our goal was to measure empathy dimension (IRI), biological proxy of trust (oxytocin) and altruism (the dictator game) to see how they correlate with each other and across treatments. In that sense the added value of having four different measures in a single study: psychological, biological, cognitive and behavioral is of tremendous value. Consistent with the literature, we find that empathic concern is significantly higher for females in comparison to males. Further, the level of empathic concern and perspective taking increases with the age. Lastly, we find that individuals with higher oxytocin levels have strong positive correlation of empathic concerns, but not with perpective taking.

As a last stage of our experiment, donors are endowed with 2 vouchers in the amount of 10 HRK (1.35 EUR) to be used in DM - Drogerie Markt store. 82% donate both, around 8% donate 1 and only 10% keep both vouchers. With such a large share of donors donating back we did not have a significant statistical effect across our treatments. Due to Law and the institutional constraints we were not able to provide real monetary stakes, nor create treatments of different monetary stakes. Future studies might incorporate this variation in their design. It would allow us to identify a threshold amount when altruism changes to a market transaction in a blood donation setting. This would be a very significant finding, because 54 countries (8 high-income countries, 36 middle-income countries and 10 low-income countries) collect more than 50% of their blood supply from family/replacement or paid donors.

After our experimental treatments, we followed the return of our blood donors for a year. During the next year, 98% returned to donate blood again and 55% out of them returned in a period they committed on their reminder cards. Both results, the probability of return and commitment to return to periods choose themselves is not statistically significant across our treatments. That is mainly explained by the high returnee rates. To have a policy recommendation and to provide a holistic insight of oxytocin research in social sciences we estimated correlation of all our outcomes. We find no connection between probability of returning in a stated period with perpective taking, empathic concerns, baseline and in-

duced level of oxytocin. Nonetheless, across six different specifications we find that only variable which consistently predicts return for blood donation in stated period is number of previous donations. From policy perspective this is a significant finding. Targeting the donors with higher number of donations gives a higher return rates. This is especially important for hospitals and other blood providers when faced with time and resource constraints. Blood transfusion saves lives, but many patients requiring transfusion do not have timely access to adequate blood supplies.

Overall, over the past decade there has been a significant increase in oxytocin studies across natural and social sciences. A significant share of interdisciplinary papers provide a reductionist view of a complex mechanisms of oxytocin in social sciences. The two main reasons are the the oxytocin measurement method and understanding the experimental results in different social settings. The difference in oxytocin measurement methods not only that it reduces comparability across studies, but it can also provide unclear treatment effects. In a very similar research design to ours, Barraza and Zak (2009), the baseline oxytocin levels were 25 to 30 times higher than in our study. Next, different experimental settings in social sciences even if they measure a similar outcomes such as prosocial behavior, have very different biological mechanisms of oxytocin. The "gold standard" in economics Kosfeld et al. (2005) and Zak et al. (2005) have a very different biological mechanism when compared to Barraza and Zak (2009) or our study. Intranasal oxytocin administration in natural sciences Quintana et al. (2021), may have a questionable uptake rates in brain, same as oxytocin levels in blood plasma show different measurement from cerebrospinal fluid or blood plasma Lefevre et al. (2017). The operating channels of oxytocin in both types of studies still need a significant validation of their mechanisms. In order to have a coherent understanding of these interactions a more holistic approach is needed. Comparability and replicability of the state-of-the art research in both social and natural science are important for reaching a consensus on an optimal method of measurement of oxytocin and the mechanisms of the effect.

References

Chie Aita, Yoshito Mizoguchi, Miwako Yamamoto, Yasuhisa SeguchI, Chiho Yatsuga, Taisuke Nishimura, Yoshiki Sugimoto, Daiki Takahashi, Reiko Nishihara, Takefumi Ueno, et al. Oxytocin levels and sex differences in autism spectrum disorder with severe intellectual disabilities. *Psychiatry research*, 273:67–74, 2019.

Monika Althaus, Yvonne Groen, Albertus A Wijers, Henriette Noltes, Oliver Tucha, Fred C Sweep, Federica Calcagnoli, and Pieter J Hoekstra. Do blood plasma levels of oxytocin moderate the effect of nasally administered oxytocin on social orienting in high-functioning male adults with autism spectrum disorder? *Psychopharmacology*, 233(14): 2737–2751, 2016.

Elissar Andari, Jean-René Duhamel, Tiziana Zalla, Evelyn Herbrecht, Marion Leboyer, and Angela Sirigu. Promoting social behavior with oxytocin in high-functioning autism spectrum disorders. *Proceedings of the National Academy of Sciences*, 107(9):4389–4394, 2010.

Jorge A Barraza and Paul J Zak. Empathy toward strangers triggers oxytocin release and subsequent generosity. *Annals of the New York Academy of Sciences*, 1167(1):182–189, 2009.

C Daniel Batson. *The altruism question: Toward a social-psychological answer*. Psychology Press, 2014.

C Daniel Batson and Laura L Shaw. Evidence for altruism: Toward a pluralism of prosocial motives. *Psychological inquiry*, 2(2):107–122, 1991.

C Daniel Batson, Judy G Batson, Jacqueline K Slingsby, Kevin L Harrell, Heli M Peekna, and R Matthew Todd. Empathic joy and the empathy-altruism hypothesis. *Journal of personality and social psychology*, 61(3):413, 1991.

C Daniel Batson, Nadia Ahmad, David A Lishner, J Tsang, CR Snyder, and SJ Lopez. Empathy and altruism. *The Oxford handbook of hypo-egoic phenomena*, pages 161–174, 2002.

Rachel Croson and Uri Gneezy. Gender differences in preferences. *Journal of Economic literature*, 47(2):448–74, 2009.

Mark H Davis. Interpersonal reactivity index. 1980.

Carsten KW De Dreu. Oxytocin modulates cooperation within and competition between groups: an integrative review and research agenda. *Hormones and behavior*, 61(3):419–428, 2012.

Carolyn H Declerck, Christophe Boone, Loren Pauwels, Bodo Vogt, and Ernst Fehr. A registered replication study on oxytocin and trust. *Nature Human Behaviour*, 4(6):646–655, 2020.

Stefano DellaVigna, John A List, and Ulrike Malmendier. Testing for altruism and social pressure in charitable giving. *The quarterly journal of economics*, 127(1):1–56, 2012.

Stefano DellaVigna, John A List, Ulrike Malmendier, and Gautam Rao. Estimating social preferences and gift exchange at work. *American Economic Review*, 112(3):1038–74, 2022.

Gregor Domes, Alexander Lischke, Christoph Berger, Annette Grossmann, Karlheinz Hauenstein, Markus Heinrichs, and Sabine C Herpertz. Effects of intranasal oxytocin on emotional face processing in women. *Psychoneuroendocrinology*, 35(1):83–93, 2010.

Christopher J Einolf. Empathic concern and prosocial behaviors: A test of experimental results using survey data. *Social Science Research*, 37(4):1267–1279, 2008.

Marina Eliava, Meggane Melchior, H Sophie Knobloch-Bollmann, Jérôme Wahis, Miriam da Silva Gouveia, Yan Tang, Alexandru Cristian Ciobanu, Rodrigo Triana Del Rio, Lena C Roth, Ferdinand Althammer, et al. A new population of parvocellular oxy-

tocin neurons controlling magnocellular neuron activity and inflammatory pain processing. *Neuron*, 89(6):1291–1304, 2016.

Ann H Farrell and Tracy Vaillancourt. Adolescent empathic concern and perspective taking: Heterogeneous developmental trajectories and childhood social and psychological factors. *Journal of Personality*, 89(4):672–688, 2021.

Ernst Fehr and Urs Fischbacher. The nature of human altruism. *Nature*, 425(6960):785–791, 2003.

Robert Forsythe, Joel L Horowitz, Nathan E Savin, and Martin Sefton. Fairness in simple bargaining experiments. *Games and Economic behavior*, 6(3):347–369, 1994.

Simone A Glynn, Steven H Kleinman, George B Schreiber, Thomas Zuck, Suzanne Mc Combs, James Bethel, George Garratty, Alan E Williams, and Retrovirus Epidemiology Donor Study. Motivations to donate blood: demographic comparisons. *Transfusion*, 42(2):216–225, 2002.

Uri Gneezy and John A List. Putting behavioral economics to work: Testing for gift exchange in labor markets using field experiments. *Econometrica*, 74(5):1365–1384, 2006.

Lorenz Goette and Alois Stutzer. Blood donations and incentives: Evidence from a field experiment. 2019.

A Gossen, A Hahn, L Westphal, S Prinz, RT Schultz, G Gründer, and KN Spreckelmeyer. Oxytocin plasma concentrations after single intranasal oxytocin administration–a study in healthy men. *Neuropeptides*, 46(5):211–215, 2012.

Adam J Guastella, Stewart L Einfeld, Kylie M Gray, Nicole J Rinehart, Bruce J Tonge, Timothy J Lambert, and Ian B Hickie. Intranasal oxytocin improves emotion recognition for youth with autism spectrum disorders. *Biological psychiatry*, 67(7):692–694, 2010.

Markus Heinrichs, Thomas Baumgartner, Clemens Kirschbaum, and Ulrike Ehlert. Social support and oxytocin interact to suppress cortisol and subjective responses to psychosocial stress. *Biological psychiatry*, 54(12):1389–1398, 2003.

Lucres Jansen, Christine C Gispen-de Wied, Victor M Wiegant, Herman GM Westenberg, Bertine E Lahuis, and Herman Van Engeland. Autonomic and neuroendocrine responses to a psychosocial stressor in adults with autistic spectrum disorder. *Journal of autism and developmental disorders*, 36(7):891–899, 2006.

Simon John and Adrian V Jaeggi. Oxytocin levels tend to be lower in autistic children: A meta-analysis of 31 studies. *Autism*, 25(8):2152–2161, 2021.

Sara H Konrath. Critical synthesis package: interpersonal reactivity index (iri). 2013.

Michael Kosfeld, Markus Heinrichs, Paul J Zak, Urs Fischbacher, and Ernst Fehr. Oxytocin increases trust in humans. *Nature*, 435(7042):673–676, 2005.

Arthur Lefevre, Raphaëlle Mottolese, Manon Dirheimer, Carmine Mottolese, Jean-René Duhamel, and Angela Sirigu. A comparison of methods to measure central and peripheral oxytocin concentrations in human and non-human primates. *Scientific Reports*, 7(1): 1–10, 2017.

Gareth Leng and Mike Ludwig. Intranasal oxytocin: myths and delusions. *Biological psychiatry*, 79(3):243–250, 2016.

Tova Levin, Steven D Levitt, and John A List. A glimpse into the world of high capacity givers: Experimental evidence from a university capital campaign. Technical report, National Bureau of Economic Research, 2016.

Steven D Levitt and John A List. On the generalizability of lab behaviour to the field. *Canadian Journal of Economics/Revue canadienne d'économique*, 40(2):347–370, 2007.

Alexander Lischke, Matthias Gamer, Christoph Berger, Annette Grossmann, Karlheinz Hauenstein, Markus Heinrichs, Sabine C Herpertz, and Gregor Domes. Oxytocin increases

amygdala reactivity to threatening scenes in females. *Psychoneuroendocrinology*, 37(9): 1431–1438, 2012.

Michael E McCullough, Patricia Smith Churchland, and Armando J Mendez. Problems with measuring peripheral oxytocin: can the data on oxytocin and human behavior be trusted? *Neuroscience & Biobehavioral Reviews*, 37(8):1485–1492, 2013.

Katrine Melby, Rolf W Gråwe, Trond O Aamo, Øyvind Salvesen, and Olav Spigset. Effect of intranasal oxytocin on alcohol withdrawal syndrome: A randomized placebo-controlled double-blind clinical trial. *Drug and Alcohol Dependence*, 197:95–101, 2019.

Hamid Meziane, Fabienne Schaller, Sylvian Bauer, Claude Villard, Valery Matarazzo, Fabrice Riet, Gilles Guillon, Daniel Lafitte, Michel G Desarmenien, Maithé Tauber, et al. An early postnatal oxytocin treatment prevents social and learning deficits in adult mice deficient for magel2, a gene involved in prader-willi syndrome and autism. *Biological psychiatry*, 78(2):85–94, 2015.

Toshio Munesue, Shigeru Yokoyama, Kazuhiko Nakamura, Ayyappan Anitha, Kazuo Yamada, Kenshi Hayashi, Tomoya Asaka, Hong-Xiang Liu, Duo Jin, Keita Koizumi, et al. Two genetic variants of cd38 in subjects with autism spectrum disorder and controls. *Neuroscience research*, 67(2):181–191, 2010.

Gideon Nave, Colin Camerer, and Michael McCullough. Does oxytocin increase trust in humans? a critical review of research. *Perspectives on Psychological Science*, 10(6):772–789, 2015.

Robert M Oswalt. A review of blood donor motivation and recruitment. *Transfusion*, 17(2): 123–135, 1977.

Ed O'brien, Sara H Konrath, Daniel Grühn, and Anna Linda Hagen. Empathic concern and perspective taking: Linear and quadratic effects of age across the adult life span. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 68(2):168–175, 2013.

Karen J Parker, Joseph P Garner, Robin A Libove, Shellie A Hyde, Kirsten B Hornbeak, Dean S Carson, Chun-Ping Liao, Jennifer M Phillips, Joachim F Hallmayer, and Antonio Y Hardan. Plasma oxytocin concentrations and oxtr polymorphisms predict social impairments in children with and without autism spectrum disorder. *Proceedings of the National Academy of Sciences*, 111(33):12258–12263, 2014.

Jane Allyn Piliavin and Peter L Callero. *Giving blood: the development of an altruistic identity.* Johns Hopkins University Press, 1991.

Anne Poljak and Perminder Sachdev. The need for a reliable oxytocin assay. *Molecular Psychiatry*, 26(11):6107–6108, 2021.

Daniel S Quintana, Alexander Lischke, Sally Grace, Dirk Scheele, Yina Ma, and Benjamin Becker. Advances in the field of intranasal oxytocin research: lessons learned and future directions for clinical research. *Molecular Psychiatry*, 26(1):80–91, 2021.

Christopher S Stauffer, Nathan K Meinzer, Tyler Morrison, Jin-Hui Wen, Lily Radanovich, David Leung, Andrea Niles, Aoife O'Donovan, Steven L Batki, and Joshua D Woolley. Effects of oxytocin administration on cue-induced craving in co-occurring alcohol use disorder and ptsd: a within-participant randomized clinical trial. *Alcoholism: Clinical and Experimental Research*, 43(12):2627–2636, 2019.

Nadine Striepens, Keith M Kendrick, Vanessa Hanking, Rainer Landgraf, Ullrich Wüllner, Wolfgang Maier, and René Hurlemann. Elevated cerebrospinal fluid and blood concentrations of oxytocin following its intranasal administration in humans. *Scientific reports*, 3(1):1–5, 2013.

C Sue Carter, Hossein Pournajafi-Nazarloo, Kristin M Kramer, Toni E Ziegler, Rosemary

White-Traut, Deborah Bello, and Dorie Schwertz. Oxytocin: behavioral associations and potential as a salivary biomarker. *Annals of the New York Academy of Sciences*, 1098 (1):312–322, 2007.

Jolien Van der Graaff, Gustavo Carlo, Elisabetta Crocetti, Hans M Koot, and Susan Branje. Prosocial behavior in adolescence: Gender differences in development and links with empathy. *Journal of youth and adolescence*, 47(5):1086–1099, 2018.

Jan G Veening, Trynke de Jong, and Henk P Barendregt. Oxytocin-messages via the cerebrospinal fluid: behavioral effects; a review. *Physiology & behavior*, 101(2):193–210, 2010.

Rosemary White-Traut, Kaoru Watanabe, Hossein Pournajafi-Nazarloo, Dorie Schwertz, Aleeca Bell, and C Sue Carter. Detection of salivary oxytocin levels in lactating women. *Developmental Psychobiology: The Journal of the International Society for Developmental Psychobiology*, 51(4):367–373, 2009.

Adriano Winterton, Lars T Westlye, Nils Eiel Steen, Ole A Andreassen, and Daniel S Quintana. Improving the precision of intranasal oxytocin research. *Nature Human Behaviour*, 5(1): 9–18, 2021.

Paul J Zak, Robert Kurzban, and William T Matzner. Oxytocin is associated with human trustworthiness. *Hormones and behavior*, 48(5):522–527, 2005.

Paul J Zak, Angela A Stanton, and Sheila Ahmadi. Oxytocin increases generosity in humans. *PloS one*, 2(11):e1128, 2007.

Guodong Zhang, Yizhong Zhang, Douglas M Fast, Zhaosheng Lin, and Rick Steenwyk. Ultra sensitive quantitation of endogenous oxytocin in rat and human plasma using a two-dimensional liquid chromatography–tandem mass spectrometry assay. *Analytical biochemistry*, 416(1):45–52, 2011.

Weihua Zhao, Ruixue Luo, Cornelia Sindermann, Jialin Li, Zhenyu Wei, Yingying Zhang, Congcong Liu, Jiao Le, Daniel S Quintana, Christian Montag, et al. Oxytocin modulation of self-referential processing is partly replicable and sensitive to oxytocin receptor genotype. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, 96:109734, 2020.

Songfa Zhong, Mikhail Monakhov, Helen P Mok, Terry Tong, Poh San Lai, Soo Hong Chew, and Richard P Ebstein. U-shaped relation between plasma oxytocin levels and behavior in the trust game. *PloS one*, 7(12):e51095, 2012.

Acknowledgements

We would like to specially thank Vanja Lončar for her expertise and the entire staff of the Transfusion center on their help and professionalism.

Competing interests

The author(s) has/have no competing interests to declare.

Tables

Table 1: Summary Statistics for Full Sample and Oxytocin Sample

(a) Full Sample

	mean	sd	min	max	count
Gender	0.91	0.29	0	1	937
Age	40.74	11.59	18	69	939
Schooling	7.10	5.87	0	12	939
Previous Donations	27.61	25.33	1	192	939
Children	1.28	1.13	0	5	939
N	939				

(b) Oxytocin Sample

	mean	sd	min	max	count
Gender	0.92	0.27	0	1	196
Age	43.40	11.66	18	69	197
Schooling	7.43	5.78	0	12	198
Previous Donations	33.32	27.43	2	150	189
Children	1.46	1.13	0	5	196
N	198				

Notes: All variables are measured at the individual level. Gender is a binary variable =1 for male, =0 for female; Age is measured in years; Schooling is number of years of schooling. Previous Donation is a number of blood donations prior the experiment. Children is the number of children of an individual.

Table 2: Balance of Observable Pre-Treatment Variables Relative to Control Group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Gender	Age	Children	Schooling	Donations	October	November	December
Emotional	-0.00474	0.0497	0.0485	0.700	-0.0936	0.00999	0.0236	-0.0336
	(0.0216)	(0.906)	(0.0895)	(0.458)	(2.022)	(0.0332)	(0.0381)	(0.0381)
Emotionalgift	-0.0439*	0.301	-0.0615	0.318	-2.344	0.0364	0.0131	-0.0495
	(0.0245)	(0.935)	(0.0892)	(0.472)	(2.005)	(0.0346)	(0.0388)	(0.0387)
Constant	0.920***	40.66***	1.275***	6.777***	28.39***	0.229***	0.369***	0.403***
	(0.0146)	(0.629)	(0.0613)	(0.317)	(1.372)	(0.0225)	(0.0258)	(0.0263)
Observations	937	937	936	939	929	939	939	939
R-squared	0.004	0.000	0.001	0.002	0.002	0.001	0.000	0.002
F-test	1.757	0.0577	0.719	1.168	0.841	0.572	0.194	0.868
Prob $>$ F	0.173	0.944	0.487	0.311	0.432	0.565	0.824	0.420

Notes: Significant at 1%***, 5%**, and 10%*. Emotional is a binary indicator =1 if an individual received the emotional video and =0 otherwise; Emotionalgift is a binary indicator =1 if an individual received the emotional video + the gift and =0 otherwise; The baseline category is the neutral video group i.e. the control group. October, November and December are binary indicators whether individual donated blood in a particular month =1 and =0 otherwise. We used robust SE.

Table 3: Balance of Observable Pre-Treatment Variables Relative to Control Group - Blood Groups

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	O+	O-	A+	A-	B+	B-	AB+	AB-
Emotional	0.0121	-0.0428**	0.0150	0.0237	-0.0109	0.00125	-0.00362	0.00491
	(0.0357)	(0.0194)	(0.0371)	(0.0192)	(0.0257)	(0.0138)	(0.0192)	(0.00922)
Emotionalgift	-0.0200	-0.0108	0.0149	0.00511	-0.00136	-0.00669	0.0191	-0.000828
	(0.0358)	(0.0220)	(0.0379)	(0.0181)	(0.0267)	(0.0131)	(0.0212)	(0.00834)
Constant	0.289***	0.0886***	0.331***	0.0514***	0.129***	0.0314***	0.0657***	0.0114**
	(0.0243)	(0.0152)	(0.0252)	(0.0118)	(0.0179)	(0.00934)	(0.0133)	(0.00569)
Observations	939	939	939	939	939	939	939	939
R-squared	0.001	0.005	0.000	0.002	0.000	0.000	0.001	0.000
F-test	0.380	2.804	0.109	0.794	0.104	0.203	0.609	0.205
Prob > F	0.684	0.0611	0.897	0.452	0.901	0.817	0.544	0.814

Notes: Significant at 1%***, 5%**, and 10%*. Emotional is a binary indicator =1 if an individual received the emotional video and =0 otherwise; Emotionalgift is a binary indicator =1 if an individual received the emotional video + the gift and =0 otherwise; The baseline category is the neutral video group i.e. the control group. October, November and December are binary indicators whether individual donated blood in a particular month =1 and =0 otherwise. We used robust SE.

Table 4: Balance of Observable Pre-Treatment Variables Relative to Control Group - Oxytocin Sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Gender	Age	Children	Schooling	Donations	October	November	December
Emotional	0.0448	-3.647*	-0.160	-0.384	-5.241	-0.0184	0.0110	0.00735
	(0.0443)	(1.964)	(0.200)	(1.012)	(5.176)	(0.0857)	(0.0844)	(0.0752)
Emotionalgift	-0.0168	-2.617	-0.268	0.114	-11.98***	-0.0242	-0.0249	0.0491
	(0.0527)	(2.094)	(0.208)	(1.001)	(4.307)	(0.0852)	(0.0831)	(0.0769)
Constant	0.909***	45.46***	1.606***	7.522***	39.03***	0.403***	0.358***	0.239***
	(0.0357)	(1.442)	(0.156)	(0.699)	(3.178)	(0.0604)	(0.0590)	(0.0525)
Observations	196	197	196	198	189	198	198	198
R-squared	0.009	0.018	0.009	0.001	0.032	0.000	0.001	0.002
F-test	1.050	1.789	0.833	0.130	3.909	0.0438	0.0966	0.231
Prob > F	0.352	0.170	0.436	0.879	0.0217	0.957	0.908	0.794

Notes: Significant at 1%***, 5%**, and 10%*. Emotional is a binary indicator =1 if an individual received the emotional video and =0 otherwise; Emotionalgift is a binary indicator =1 if an individual received the emotional video + the gift and =0 otherwise; The baseline category is the neutral video group i.e. the control group. October, November and December are binary indicators whether individual donated blood in a particular month =1 and =0 otherwise. We used robust SE.

Table 5: Balance of Observable Pre-Treatment Variables Relative to Control Group - Blood Groups - Oxytocin Sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	O+	O-	A+	A-	B+	B-	AB+	AB-
Emotional	0.0549	-0.0434	0.0852	-0.0135	-0.102*	0.0163	-0.0135	0.000459
	(0.0811)	(0.0439)	(0.0809)	(0.0392)	(0.0607)	(0.0336)	(0.0392)	(0.0214)
Emotionalgift	0.00430	-0.0441	0.0647	0.0161	-0.0425	-0.0299	0.0312	0.000226
	(0.0789)	(0.0436)	(0.0800)	(0.0439)	(0.0659)	(0.0209)	(0.0461)	(0.0213)
Constant	0.284***	0.0896**	0.269***	0.0597**	0.194***	0.0299	0.0597**	0.0149
	(0.0555)	(0.0352)	(0.0546)	(0.0292)	(0.0487)	(0.0209)	(0.0292)	(0.0149)
Observations	198	198	198	198	198	198	198	198
R-squared	0.003	0.008	0.006	0.003	0.014	0.015	0.006	0.000
F-test	0.277	0.608	0.621	0.250	1.500	2.564	0.513	0.000229
Prob $>$ F	0.759	0.545	0.539	0.779	0.226	0.0796	0.600	1

Notes: Significant at 1%***, 5%**, and 10%*. Emotional is a binary indicator =1 if an individual received the emotional video and =0 otherwise; Emotionalgift is a binary indicator =1 if an individual received the emotional video + the gift and =0 otherwise; The baseline category is the neutral video group i.e. the control group. October, November and December are binary indicators whether individual donated blood in a particular month =1 and =0 otherwise. We used robust SE.

Table 6: Perspective Taking and Empathic Concerns

VARIABLES	(1) Perspective Taking	(2) Perspective Taking	(3) Empathic Concerns	(4) Empathic Concerns
Emotional	-0.0646	-0.0294	-0.0383	-0.0294
	(0.0496)	(0.0549)	(0.0538)	(0.0579)
Emotionalgift	-0.00560	-0.00927	0.0728	0.0628
	(0.0516)	(0.0557)	(0.0550)	(0.0573)
Employed		0.121		-0.0567
		(0.104)		(0.102)
NotEmployed		0.137		-0.109
		(0.171)		(0.189)
Age		0.00580**		0.0126***
		(0.00270)		(0.00283)
O pos		-0.158		-0.120
		(0.156)		(0.178)
O neg		-0.124		-0.0885
		(0.167)		(0.192)
A pos		-0.107		-0.121
		(0.155)		(0.178)
A neg		-0.175		0.0159
		(0.173)		(0.196)
B pos		-0.174		-0.0298
		(0.165)		(0.184)
B neg		-0.270		-0.204
		(0.185)		(0.209)
AB pos		-0.172		-0.101
		(0.166)		(0.194)
Gender		-0.0816		-0.356***
		(0.0794)		(0.0749)
PreviousDonationsAdjusted		0.00271		-0.00180
		(0.00802)		(0.00915)
Children		0.0167		-0.00251
		(0.0263)		(0.0261)
Constant	4.294***	4.119***	3.972***	3.941***
	(0.0347)	(0.248)	(0.0376)	(0.257)
Observations	904	770	899	764
R-squared	0.002	0.017	0.004	0.077
F-test	1.011	0.982	2.048	4.594
Prob > F	0.364	0.472	0.130	1.88e-08

Notes: Significant at 1%***, 5%**, and 10%*. Perspective taking is a measure of perspective taking dimension. Empathic concerns is a measure of empathic concerns dimension. Emotional is a binary indicator =1 if an individual received the emotional video and =0 otherwise; Emotionalgift is a binary indicator =1 if an individual received the emotional video + the gift and =0 otherwise; The baseline category is the neutral video group i.e. the control group. October, November and December are binary indicators whether individual donated blood in a particular month =1 and =0 otherwise. We used robust SE.

Table 7: Perspective Taking and Empathic Concerns Across Gift Treatment

VARIABLES	(1) Perspective Taking	(2) Perspective Taking	(3) Empathic Concerns	(4) Empathic Concerns
Gift	0.0660	0.0295	0.115**	0.100*
	(0.0519)	(0.0571)	(0.0556)	(0.0582)
Employed		0.163		0.0500
		(0.125)		(0.131)
NotEmployed		0.224		-0.308
		(0.236)		(0.251)
Age		0.00470		0.0136***
		(0.00357)		(0.00345)
O pos		-0.194		0.0515
		(0.183)		(0.199)
O neg		-0.106		0.275
		(0.202)		(0.208)
A pos		-0.111		0.0895
		(0.180)		(0.199)
A neg		-0.195		0.239
		(0.202)		(0.225)
B pos		-0.295		0.115
		(0.199)		(0.208)
B neg		-0.358		0.0264
		(0.227)		(0.227)
AB pos		-0.263		0.0543
		(0.194)		(0.219)
Gender		-0.0588		-0.371***
		(0.108)		(0.0928)
PreviousDonationsAdjusted		0.00623		0.00253
		(0.00902)		(0.0111)
Children		0.0461		0.00413
		(0.0295)		(0.0309)
Constant	4.230***	4.066***	3.934***	3.584***
	(0.0355)	(0.309)	(0.0384)	(0.306)
Observations	568	483	565	480
R-squared	0.003	0.035	0.008	0.100
F-test	1.613	1.369	4.290	3.793
Prob > F	0.205	0.164	0.0388	4.28e-06

Notes: Significant at 1%***, 5%**, and 10%*. Perspective taking is a measure of perspective taking dimension. Empathic concerns is a measure of empathic concerns dimension. Gift is a binary indicator =1 if an individual received the emotional video + the gift and =0 if only received the emotional video; The baseline category is the emotional video group. October, November and December are binary indicators whether individual donated blood in a particular month =1 and =0 otherwise. We used robust SE.

Table 8: Return For The Next Blood Donation

VARIABLES	(1) Difference in dates	(2) Difference in dates	(3) Return	(4) Return
Emotional	-1.348	-1.418	-0.0385	-0.0507
	(3.346)	(3.686)	(0.0392)	(0.0421)
Emotionalgift	-0.983	-0.488	-0.0359	-0.0268
	(3.710)	(3.989)	(0.0400)	(0.0432)
Employed		-13.48***		-0.0901
		(5.084)		(0.0836)
NotEmployed		-8.795		-0.0641
		(8.884)		(0.125)
Age		0.129		0.00271
		(0.183)		(0.00194)
O pos		3.469		-0.124
		(14.07)		(0.134)
O neg		14.28		-0.105
		(14.50)		(0.146)
A pos		13.30		-0.0340
		(13.85)		(0.133)
A neg		6.114		-0.143
		(15.29)		(0.148)
B pos		15.30		-0.0536
		(14.10)		(0.138)
B neg		9.941		-0.232
		(15.32)		(0.165)
AB pos		16.61		-0.0203
		(14.82)		(0.145)
Gender		1.621		0.0615
		(5.552)		(0.0658)
PreviousDonationsAdjusted		-0.968		-0.0297**
		(0.797)		(0.0148)
Children		-0.731		-0.0129
		(1.714)		(0.0178)
Constant	-19.41***	-22.04	0.575***	0.640***
	(2.298)	(18.41)	(0.0266)	(0.199)
Observations	766	661	926	788
R-squared	0.000	0.027	0.001	0.039
F-test	0.0866	1.690	0.610	1.750
Prob > F	0.917	0.0485	0.543	0.0378

Notes: Significant at 1%***, 5%**, and 10%*. Difference in dates is the difference between actual arrival for the first blood donation after the experiment and the date blood donors chose during the experiment. Emotional is a binary indicator =1 if an individual received the emotional video and =0 otherwise; Emotionalgift is a binary indicator =1 if an individual received the emotional video + the gift and =0 otherwise; The baseline category is the neutral video group i.e. the control group. We used robust SE.

Table 9: The Dictator Game - Number of Vouchers Donated

	(1)	(2)	(3)	(4)
VARIABLES	Vouchers donated	Vouchers donated	Vouchers donated	Vouchers donated
Emotional	-0.0667	-0.0243	0.0805	-0.158
	(0.199)	(0.220)	(0.485)	(0.537)
Emotionalgift	0.166	0.178	-0.177	-0.199
	(0.212)	(0.234)	(0.459)	(0.527)
Employed		-0.278		-0.129
		(0.484)		(0.955)
NotEmployed		-0.0845		15.85
		(0.724)		(2,705)
Age		-0.00775		-0.0102
		(0.0101)		(0.0242)
O pos		0.208		0.328
		(0.600)		(1.226)
O neg		0.593		0.585
		(0.683)		(1.412)
A pos		0.594		0.399
		(0.600)		(1.226)
A neg		0.370		0.389
		(0.686)		(1.448)
B pos		0.822		1.348
		(0.645)		(1.405)
B neg		0.445		16.86
		(0.799)		(3,237)
AB pos		1.125		0.233
		(0.721)		(1.434)
Gender		-0.507		-1.020
		(0.391)		(1.123)
Children		0.0496		-0.155
		(0.0937)		(0.203)
BaselineOlevel			0.0154	0.0301
			(0.0234)	(0.0278)
InducedOlevel			-0.0139	-0.0189
			(0.0158)	(0.0206)
Constant	-2.132***	-2.659***	-2.541***	-3.752*
	(0.151)	(0.999)	(0.523)	(2.271)
Observations	936	807	198	173

Notes: Significant at 1%***, 5%**, and 10%*. Vouchers donated is a binary =1 if any vouchers were donated and =0 otherwise. Emotional is a binary indicator =1 if an individual received the emotional video and =0 otherwise; Emotionalgift is a binary indicator =1 if an individual received the emotional video + the gift and =0 otherwise; The baseline category is the neutral video group i.e. the control group. We used robust SE.

Figures

Figure 1: The Experimental Design

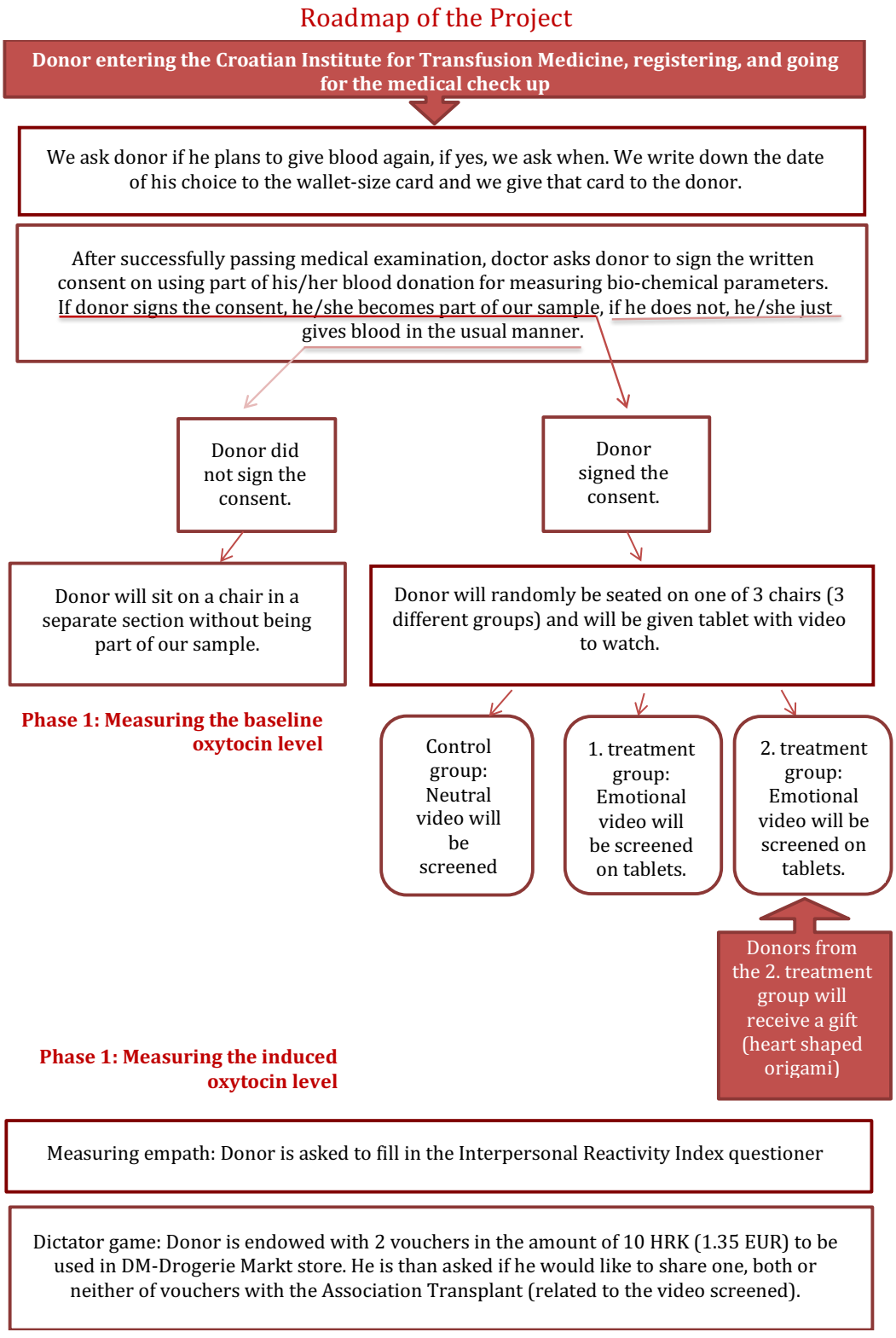
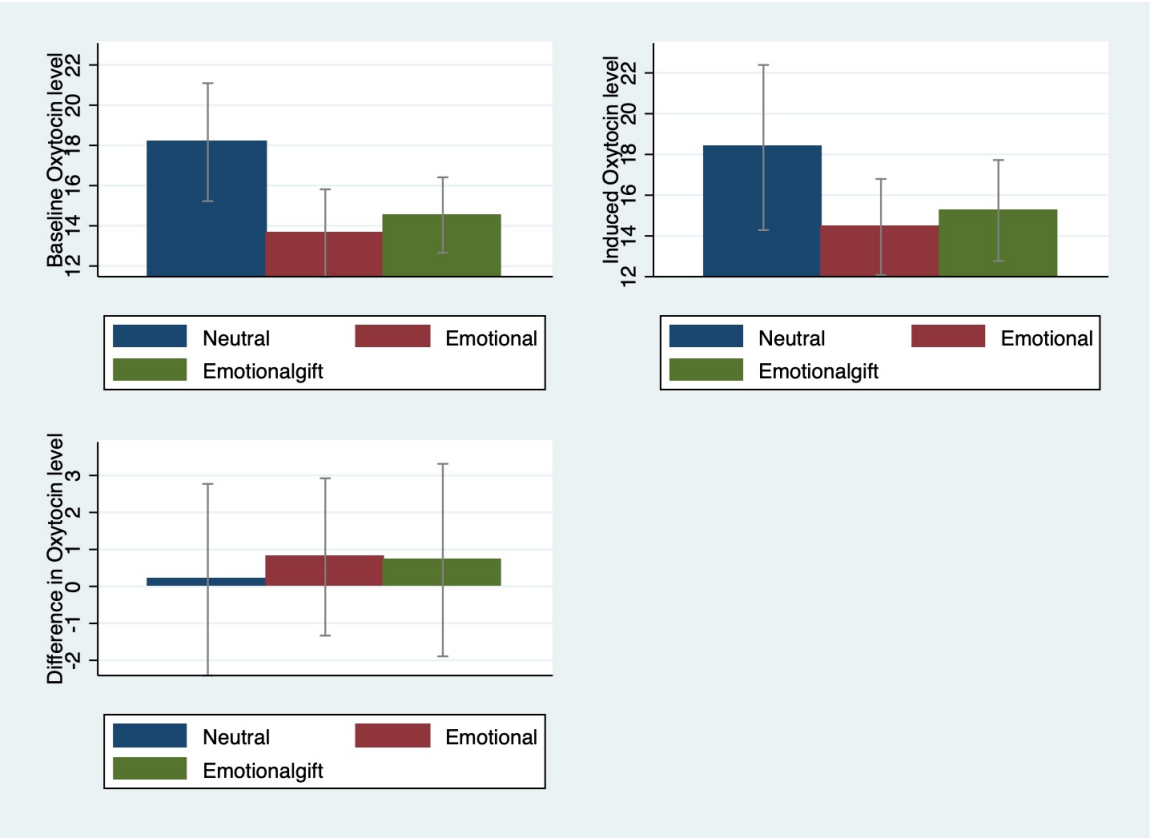
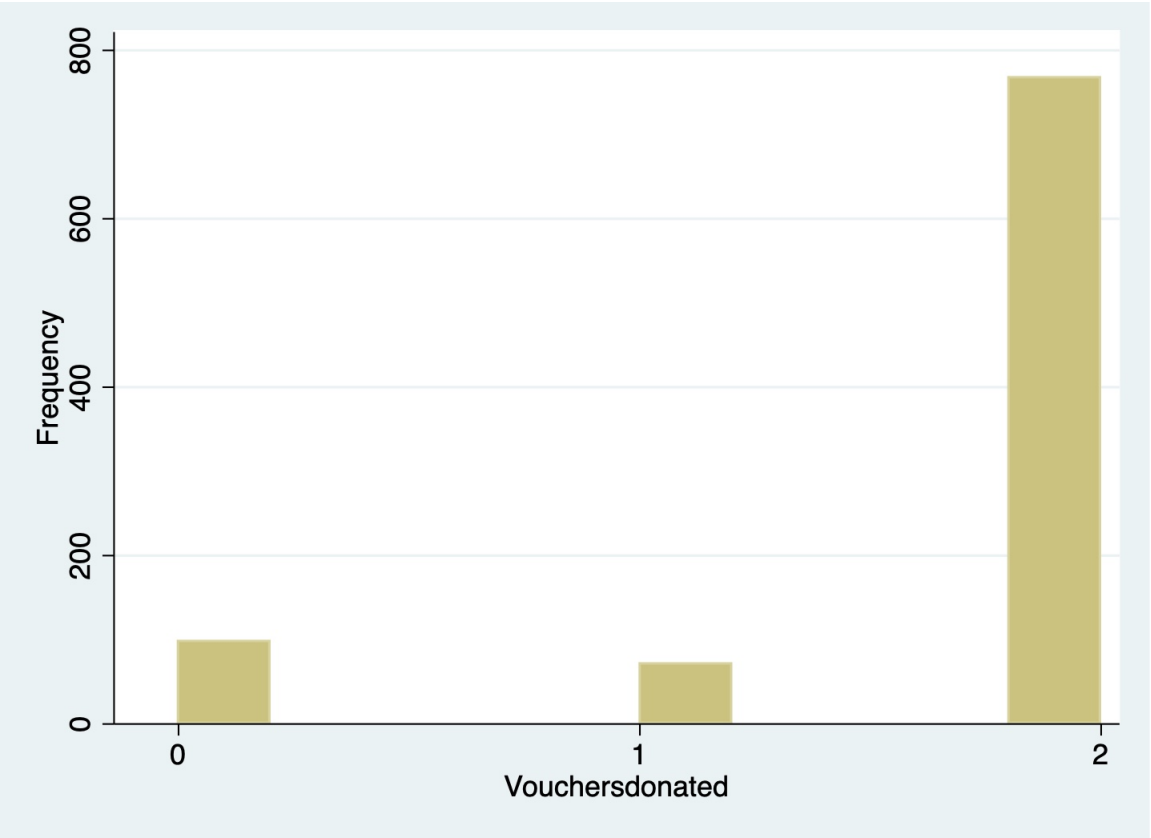


Figure 2: Baseline, Induced and the Difference in Oxytocin Levels



Notes: Each figure presents mean values across three experimental treatments - neutral video, emotional video and emotional video + gift. Each figure at the y axis has corresponding value: baseline oxytocin, induced oxytocin and the difference between the two. The confidence intervals are 95%. We used robust SE.

Figure 3: Number of Donated Vouchers



Notes: The y axis is the number of donors and the x axis the number of donated vouchers. Number of donated vouchers from the dictator game is 0, 1 or 2.

A Appendix - Oxytocin

Figure A1: The Setting of the Experiment

Figure A2: Comparison of Oxytocin Measurement across Different Methods

	N	Mean	SD	Min	Max
OTc RIA	22	5.7	3.3	2.3	15.9
OTp RIA	22	4.9	2.5	2.0	10.1
OTc Lg	22	2.1	0.6	1.0	3.3
OTp Lg	22	1.3	0.3	1.0	2.0
OTc ELS	24	12.4	8.2	3.1	32.2
OTp ELS	25	1487.2	1389.0	75.3	5568.6
OTc M	12	16.2	7.0	6.4	27.2
OTp M	12	18.8	7.4	10.8	34.1

All values are in pg/ml (except N). N=number of samples, SD=Standard Deviation, Min=minimum and Max=maximum, RIA=RadioImmunoassay with extraction[18], Lg=laboratory Enzyme Immunoassay with filtration[28], ELS=commercial EIA (Enzo Life Science) without extraction, M (on monkey samples) =commercial EIA (Enzo Life Science) with extraction, c=CSF and p=plasma.

Source: Lefevre et al. (2017); Online link:
https://www.nature.com/articles/s41598-017-17674-7/tables/1

Table A1: The Double Randomisation - Selection of Individuals into Oxytocin Sample

VARIABLES	(1) Oxytocin measured or not
Gender	0.00884
	(0.0431)
Age	0.00163
	(0.00166)
Children	0.0156
	(0.0140)
YearsofSchooling	0.00275
	(0.00226)
PreviousDonations	0.00112
	(0.000729)
Opositive	-0.121
	(0.257)
Onegative	-0.147
	(0.259)
Apositive	-0.140
	(0.256)
Anegative	-0.147
	(0.260)
Bpositive	-0.105
	(0.258)
Bnegative	-0.145
	(0.265)
ABpositive	-0.153
	(0.259)
ABnegative	-0.0981
	(0.287)
Constant	0.187
	(0.263)
Observations	923
R-squared	0.020

Notes: Significant at 1%***, 5%**, and 10%*. Oxytocin measured or not is a binary indicator =1 if an individual was selected for Oxytocin measurement = 0 otherwise. We used robust SE.

Table A2: The Effect of Videos and Gift Treatment on Oxytocin Levels

VARIABLES	(1) Baseline	(2) Baseline + covariates	(3) Induced	(4) Induced + covariates	(5) Difference	(6) Difference + covariates
Emotional	-4.516**	-3.672*	-3.900	-5.600**	0.616	-1.929
	(1.851)	(1.884)	(2.377)	(2.698)	(1.700)	(1.874)
Emotionalgift	-3.623**	-1.896	-3.092	-0.992	0.531	0.903
	(1.766)	(1.546)	(2.409)	(2.113)	(1.863)	(1.884)
Employed		-1.741		1.210		2.951
		(2.405)		(2.531)		(2.081)
NotEmployed		1.951		-0.487		-2.437
		(3.264)		(3.174)		(2.964)
Age		0.0559		0.0346		-0.0213
		(0.0764)		(0.104)		(0.0861)
Opositive		-8.572		-8.947		-0.375
		(5.469)		(5.728)		(1.931)
Onegative		-8.879		-7.926		0.953
		(5.525)		(5.705)		(1.915)
Apositive		-7.333		-3.380		3.954*
		(5.550)		(5.877)		(2.311)
Anegative		-8.246		-9.116		-0.870
		(5.776)		(5.939)		(2.669)
Bpositive		-9.592*		-7.702		1.889
		(5.522)		(5.913)		(2.210)
Bnegative		3.303		19.61		16.30*
		(11.23)		(20.31)		(9.823)
ABpositive		-5.811		-9.447		-3.636
		(6.243)		(6.120)		(3.272)
Gender		7.045***		5.924**		-1.120
		(1.634)		(2.616)		(2.595)
Children		-0.535		-0.634		-0.0986
		(0.629)		(1.004)		(0.927)
Constant	18.16***	18.14***	18.34***	17.21**	0.180	-0.933
	(1.488)	(6.926)	(2.055)	(8.462)	(1.314)	(5.452)
Observations	198	173	198	173	198	173
R-squared	0.039	0.143	0.018	0.207	0.001	0.138

Notes: Significant at 1%***, 5%**, and 10%*. Emotional is a binary indicator =1 if an individual received the emotional video and =0 otherwise; Emotionalgift is a binary indicator =1 if an individual received the emotional video + the gift and =0 otherwise; The baseline category is the neutral video group i.e. the control group. We used robust SE.

Table A3: The Effect of Videos and Gift Treatment on Oxytocin Levels - Measurement Sample

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Baseline	Baseline + covariates	Induced	Induced + covariates	Difference	Difference + covariates
Emotional	-3.403	-2.030	-2.345	-3.778**	1.058	-1.749
	(2.065)	(1.838)	(2.076)	(1.856)	(1.619)	(1.617)
Emotionalgift	-4.400**	-2.563	-4.607**	-3.622**	-0.207	-1.059
	(1.963)	(1.757)	(1.869)	(1.738)	(1.562)	(1.614)
Employed		-0.297		0.408		0.706
		(2.597)		(2.468)		(1.933)
NotEmployed		-0.840		-1.932		-1.091
		(3.356)		(3.315)		(2.800)
Age		0.112		0.0126		-0.0993*
		(0.0770)		(0.0698)		(0.0540)
Opositive		-6.924		-5.760		1.164
		(5.621)		(5.495)		(1.858)
Onegative		-8.760		-7.776		0.984
		(5.700)		(5.477)		(1.944)
Apositive		-3.758		-0.649		3.109
		(5.795)		(5.593)		(2.077)
Anegative		-2.410		-5.149		-2.739
		(5.808)		(5.873)		(3.761)
Bpositive		-6.148		-5.011		1.137
		(5.702)		(5.740)		(2.278)
Bnegative		-7.508		-1.309		6.199*
		(6.881)		(8.706)		(3.206)
ABpositive		-7.299		-8.456		-1.157
		(6.295)		(6.093)		(3.286)
Gender		9.379***		9.767***		0.388
		(2.018)		(2.338)		(1.889)
Children		-0.612		-0.364		0.249
		(0.744)		(0.813)		(0.774)
Constant	19.77***	11.72*	19.42***	14.40**	-0.343	2.675
	(1.565)	(7.035)	(1.512)	(6.776)	(1.327)	(3.988)
Observations	133	117	133	117	133	117
R-squared	0.043	0.186	0.044	0.250	0.005	0.112

Notes: Significant at 1%***, 5%**, and 10%*. Emotional is a binary indicator =1 if an individual received the emotional video and =0 otherwise; Emotionalgift is a binary indicator =1 if an individual received the emotional video + the gift and =0 otherwise; The baseline category is the neutral video group i.e. the control group. We used robust SE.

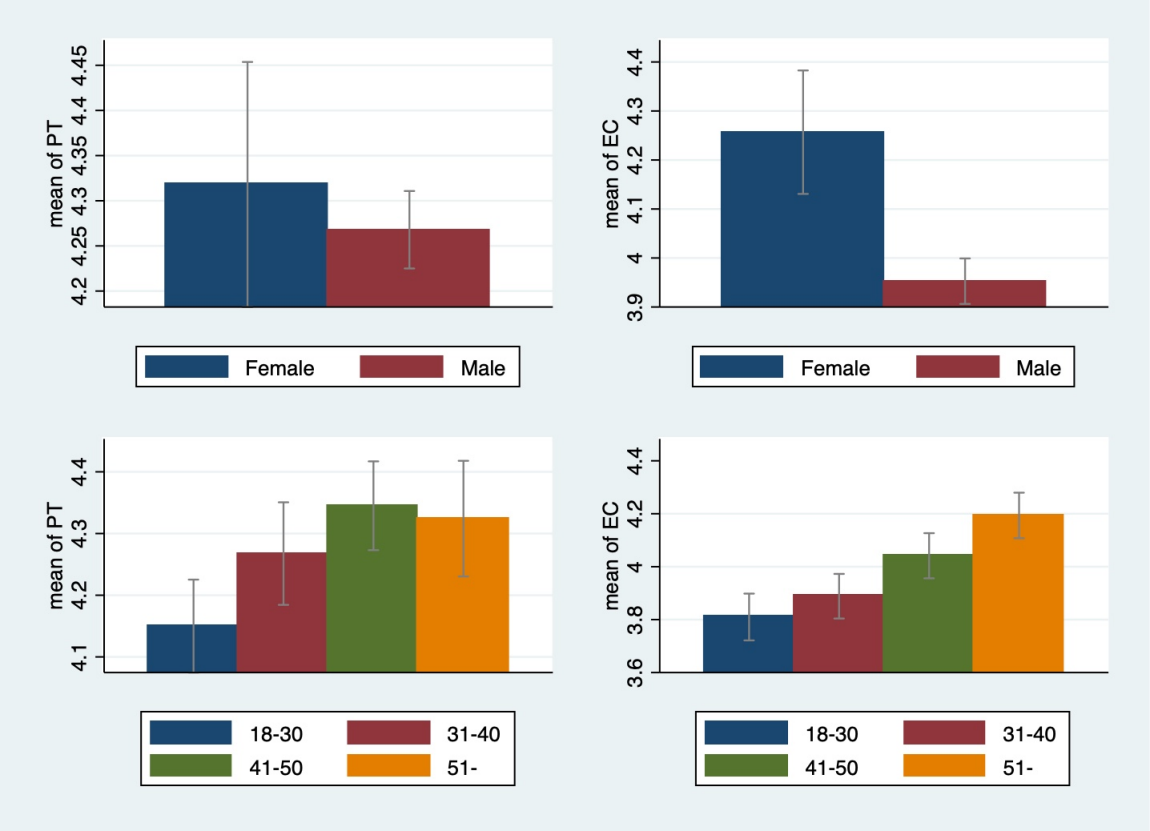
Table A4: Summary Statistics of Oxytocin Levels - Baseline, Induced and the Difference

	mean	sd	p25	p50	p75	min	max	count
Baseline oxytocin levels	15.47	9.95	8	13	21	1	67	198
Induced oxytocin levels	16.03	12.73	8	14	21	1	124	198
Difference in oxytocin levels	0.56	10.07	-4	-0	4	-32	67	198
N	198							

Notes: Oxytocin is measured in pg/mL. We ussed assay - Oxytocin ELISA Kit (Cayman Chemical Company, Ann Arbor, USA-) Following the manufacturer's instructions, 2 mL of plasma were used immediately after centrifugation for oxytocin solid phase extraction on C18 column. Methanol (Kemika, Croatia) was used for column activation, and ethanol and acetone for washing and elution (Kemika, Croatia). Extract was resuspended in 0.5 mL of ELISA buffe

B Appendix - Perspective Taking and Empathic Concerns

Figure B1: Perspective Taking, Empathic Concerns across Demographics



Notes: The y axis is the mean value of perspective taking and empathic concerns across different demographic subgroups.

Figure B2: Literature Review - Mean Scores for US College Students and Adults

Instrument details	Population characteristics	Mean scores	Findings
Empathic Concern (EC) and Perspective Taking (PT) subscales[14]	General Social Survey (GSS: 2002 and 2004 combined): Nationally representative US adult N=2,694; 52.9% Female -Mean age = 46.29 -80.3% White -13.1% African-American (AA) -6.6% Other Online: General US adult N=81,754; 42.6% Female -Mean age = 38.56 -86.1% White -2.2% AA -6.0% Asian -2.1% Hispanic -2.8% Other	GSS: EC overall: 3.99 (0.70) Males: 3.81 (0.68) Females: 4.15 (0.67) Online: EC overall: 3.77 (0.78) Males: 3.56 (0.80) Females: 4.06 (0.64) PT overall: 3.66 (0.75) Males: 3.58 (0.77) Females: 3.77 (0.69)	We examined age-related changes in empathy, finding a curvilinear relationship: middle-aged adult females have the highest EC and PT in US.
All four subscales[15]	US college students N=13,737; 63.1% Female -Mean age = 20.3 -67.0% White	EC: 3.80 (0.65) PT: 3.46 (0.68) FS: 3.45 (0.80) PD: 2.66 (0.71)	We examined changes over time in empathy, finding that Empathic Concern and Perspective Taking scores declined from 1980 to 2009.

Source: Konrath, S. H. (2013). Critical synthesis package: interpersonal reactivity index (IRI).

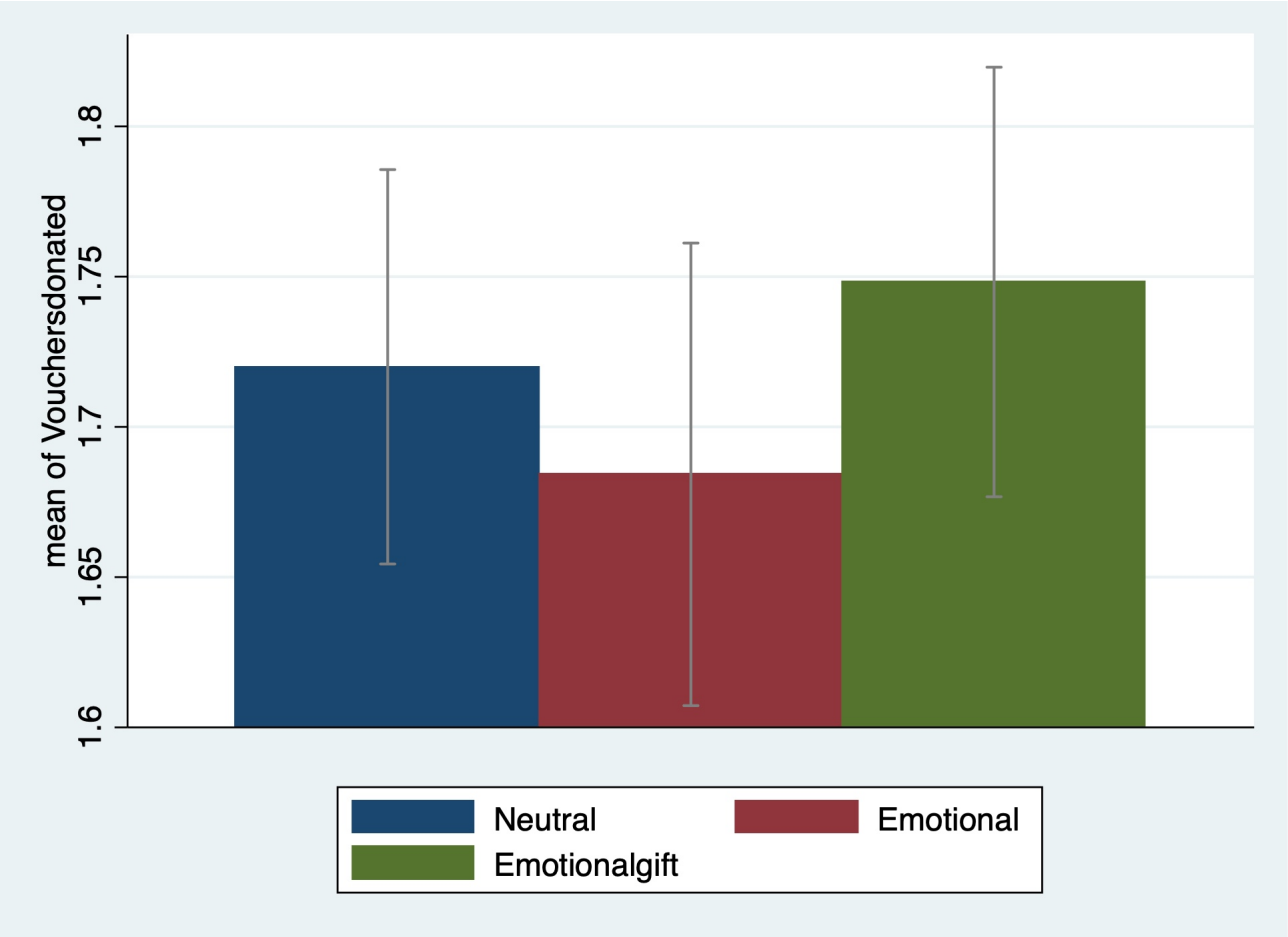
Table B1: Perspective Taking, Empathic Concerns and Oxytocin

	(1)	(2)	(3)	(4)
VARIABLES	Perspective Taking	Perspective Taking	Empathic Concerns	Empathic Concerns
BaselineOlevel	-0.000895	-0.00336	0.00402	0.0134*
	(0.00573)	(0.00730)	(0.00710)	(0.00763)
Gender		-0.342		-0.579***
		(0.215)		(0.177)
Age		0.00981		0.0145**
		(0.00737)		(0.00709)
Children		0.00778		0.0725
		(0.115)		(0.0997)
Opositive		-0.512*		-0.337**
		(0.274)		(0.155)
Onegative		-0.305		-0.292
		(0.340)		(0.301)
Apositive		-0.261		-0.602***
		(0.305)		(0.210)
Anegative		-0.927***		-0.329
		(0.336)		(0.330)
Bpositive		-0.543*		-0.308
		(0.294)		(0.204)
Bnegative		-0.671*		-0.351
		(0.378)		(0.245)
ABpositive		-0.416		-0.579**
		(0.294)		(0.282)
October		-0.0870		-0.207
		(0.230)		(0.213)
November		-0.181		-0.382***
		(0.148)		(0.141)
Monday		-0.364		-0.439
		(0.347)		(0.323)
Tuesday		-0.197		-0.237
		(0.228)		(0.268)
Wednesday		-0.241		-0.120
		(0.278)		(0.305)
Thursday		-0.0907		-0.139
		(0.280)		(0.308)
Friday		0.229		-0.438
		(0.297)		(0.323)
Constant	4.262***	4.863***	3.971***	4.458***
	(0.130)	(0.494)	(0.146)	(0.420)
Observations	127	123	126	122
R-squared	0.000	0.138	0.003	0.266

Notes: Significant at 1%***, 5%**, and 10%*. We used robust SE.

C Appendix - Dictator Game

Figure C1: Dictator Game - Vouchers Donated across Treatments



Notes: Significant at 1%***, 5%**, and 10%*. Neutral video group is a binary indicator =1 if an individual received neutral video and =0 otherwise. Emotional is a binary indicator =1 if an individual received the emotional video and =0 otherwise; Emotionalgift is a binary indicator =1 if an individual received the emotional video + the gift and =0 otherwise; We used robust SE.

D Appendix - Returnees for Blood Donation

Table D1: Previous Donations, Perspective Taking, Empathic Concerns and Oxytocin

VARIABLES	(1) Return	(2) Return	(3) Return	(4) Return	(5) Return	(6) Return
Donations	0.00366***	0.00421***				
	(0.000670)	(0.000897)				
Employed		-0.0758		-0.0945		-0.0178
		(0.0861)		(0.0853)		(0.156)
NotEmployed		-0.0574		-0.0170		0.00521
		(0.124)		(0.131)		(0.222)
Age		-0.00301		0.00323		0.00768**
		(0.00226)		(0.00200)		(0.00384)
		(0.142)		(0.152)		(0.294)
Gender		0.0272		0.127*		0.106
		(0.0630)		(0.0652)		(0.150)
Children		-0.00789		-0.0196		-0.130***
		(0.0178)		(0.0183)		(0.0348)
PT3			0.0220	0.0359		
			(0.0288)	(0.0310)		
EC3			0.00730	-0.00347		
			(0.0270)	(0.0298)		
BaselineOlevel					-0.000398	-0.00551
					(0.00455)	(0.00542)
InducedOlevel					0.00127	0.00393
					(0.00334)	(0.00399)
Constant	0.450***	0.666***	0.431***	0.334	0.573***	0.326
	(0.0248)	(0.191)	(0.131)	(0.241)	(0.0639)	(0.376)
Observations	916	788	881	756	194	169
R-squared	0.033	0.049	0.001	0.024	0.001	0.086
F-test	29.74	3.221	0.469	1.514	0.0987	1.297

Notes: Significant at 1%***, 5%**, and 10%*. Variables donation is measured in number of donations at the individual level. PT3 is perspective taking measure. EC3 is empathic concern measure. Controls included in regressions are blood types, but excluded due to size of the table. We used robust SE.

Halle Institute for Economic Research –
Member of the Leibniz Association

Kleine Maerkerstrasse 8

D-06108 Halle (Saale), Germany

Postal Adress: P.O. Box 11 03 61

D-06017 Halle (Saale), Germany

Tel +49 345 7753 60

Fax +49 345 7753 820

www.iwh-halle.de

ISSN 2194-2188

Leibniz
Association