The Scope Insensitivity Bias: The Effects of Debiasing Interventions and a Range of Factors on How Insensitive We Are to the Size of Problems

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Abstract

The Scope Insensitivity Bias (SIB) causes people to not feel much more concerned about a problem when the scale of a problem (for example number of lives at stake) increases. For instance, we tend to react less than twice as intensely if we find out that twice as many people, animals or square meters of forest were harmed due to an incident. This cognitive bias can lead to suboptimal decision-making in planning processes whose goal it is to improve the well-being of as many people as possible. Therefore, it is crucial for us to have a good understanding of what factors increase and decrease the effects of SIB and what debiasing interventions can make a person less insensitive to the scale of a problem. Prior research on SIB has found several factors and debiasing interventions which make people more/less insensitive to scope, but more replication studies are needed to confirm those findings and to test for additional interventions and variables. This paper tests whether the debiasing information of providing people with information on SIB makes them less insensitive to scope. The online survey (N = 322) I used to test this is partially identical to Karlsson et al. (2020)'s survey, which tested a debiasing intervention called Unit Asking (UA). With UA, people are first asked how much they would be willing to donate to help one unit (one koala/ one forest/ one child) and then their willingness to donate for a higher number of units. My survey asked people about their willingness to donate to help X koalas. It had two control conditions and two conditions with information on SIB. The data allowed me to test (1) if knowledge of SIB affects how insensitive to scope individuals are, (2) how this paper's SIB information debiasing intervention compares to the UA debiasing intervention tested by Karlsson et al. (2020), and (3) how 12 different factors such as sleep, stress, and perceived impact of the donation affect SIB levels. In response to (1), my data show that providing information on SIB decreased how insensitive to scope individuals were. Answering (2), learning about SIB seems to be a similarly effective debiasing method as Unit Asking (UA). Responding to (3), higher perceived impact of a donation, more hours of sleep the night before, and stronger positive & stronger negative emotions towards the charity cause seem to be linked to less scope insensitivity. Additionally, women may be less insensitive to scope than men on average.

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"A single death is a tragedy; a million deaths is a statistic."

-Joseph Stalin

1. Introduction

1.1 Scope Insensitivity Bias

The Scope insensitivity Bias (SIB) (also known as 'scope neglect' or 'compassion fade') entails that, when the scale of a problem (for example number of lives at stake) increases, a person's amount of concern for the problem does not increase equally (Desmeules et al., 2008). A study by Desvouges et al. (2010), for instance, found that participants' willingness to donate to prevent bird deaths was 80$ for 2.000 birds, $78 for 20.000 birds, and $88 for 200.000 birds. In other words, due to SIB, people do not care much more even if the need to care (or damage) rises a lot (Dickert et al., 2015). SIB has been documented in studies where participants were confronted with problems in different domains, including that of human lives, animal conservation and environmental protection (Karlsson et al., 2020). SIB can lead to suboptimal decision-making in places where the goal is to improve the well-being of as many people as possible, but the decisions being made do not reflect this. This can impact many areas, including the public policy field (Dickert et al., 2015).

1.2 Past research

The existence of SIB, first identified by Kahneman (1999), has been well-documented in the academic literature (Butts et al., 2019; Chen & Libgober, 2021; Dickert et al., 2015; Heberlein et al., 2005; Kahneman et al., 1999.; Slovic, 2007). So far, this has mostly been through experimental studies, but there are also a handful of studies documenting the phenomenon in real-world settings (Butts et al., 2019; Hsee et al., 2013; Slovic, 2007). However, an area that still requires further attention is the reasons and mechanisms behind SIB and how SIB can be reduced (Dickert et al., 2015). Gaining knowledge on what increases and decreases the effects of this bias could help improve decision-making in many fields including that of charity or public policymaking. After all, SIB can cloud our judgement and thereby lead to suboptimal allocation of resources.

Factor	Relationship with SIB	Source(s)
Income	Low income ~ higher SIB levels	Gyrd-Hansen et al., 2012; Smith, 2005; Yeung et al., 2003
Chronic stress	High chronic stress ~ higher SIB levels	Li et al., 2019
Emotional involvement	High emotional involvement ~ higher SIB levels & Low emotional involvement ~ higher SIB levels	Araña et al., 2008
Decision-making approach	Decisions based on feelings ~ higher SIB levels & Decisions based on calculations ~ <u>lower</u> SIB levels	Araña et al., 2008; Chang & Pham, 2018; Heberlein et al., 2005; Hsee & Rottenstreich, 2004
Psychological proximity	Increased physical/social/temporal proximity to the issue ~ higher SIB levels	Chang & Pham, 2018; Karlsson et al., 2020

Table 1*: Factors affecting SIB levels*

Past research has found several factors that seem to affect how severe SIB is through a number of empirical studies (see table 1). Firstly, a factor linked to increased SIB levels is low income (Gyrd-Hansen et al., 2012; Smith, 2005; Yeung et al., 2003). Secondly, studies have shown that individuals who are chronically stressed show higher levels of SIB than those who are not due to stress's ability to impair a person's cognition, memory and attention (Li et al., 2019). Thirdly, both relatively high and low emotional involvement regarding the subject that is to be given a value (willingness to donate or pay) has been linked to higher SIB levels (Araña et al., 2008). Moreover, several studies have found that people tend to be more scope insensitive when they make decisions based on feelings rather than on calculations (Araña et al., 2008; Chang & Pham, 2018; Heberlein et al., 2005; Hsee & Rottenstreich, 2004). Chang and Pham (2018) have also proposed this as an explanation for empirical findings which show that people tend to be more scope insensitive when it comes to psychologically proximate issues. This includes issues that are proximate in terms of physical distance, social distance or temporal distance (i.e. in the near future or the recent past) (Chang & Pham, 2018; Karlsson et al., 2020).

SIB-decreasing method	Description	Tested?	Source(s)
Unit Asking (UA)	Ask people first how much they would be willing to donate for one child/animal/etc., then how much for a higher number.	Yes	Dickert et al., 2015; Hsee et al., 2013; Karlsson et al., 2020
Making numbers easier to evaluate	For example by showing statistics to make numbers comparable or descriptive.	No	Dickert et al., 2015; Slovic, 2007
Increasing awareness of SIB and its effects	For example by educating people about SIB.	No (but this paper tests it)	Dickert et al., 2015

Table 2: (Potential) debiasing interventions to decrease Scope Insensitivity Bias levels

Past literature has identified a few different methods of (potentially) decreasing a person's SIB levels (see table 2). One such method is 'Unit Asking' (UA), where people are first asked about what they perceive the value of one unit of something to be (for example how much they would donate to save one koala), and then of a higher number of units. UA has been tested across different domains, including the environment, children and animals and, in the experiments, led to significantly less scope insensitive[1] answers (Dickert et al., 2015; Hsee et al., 2013; Karlsson et al., 2020). Another method to debias people could be to make it easier to evaluate the numbers people are faced with (Dickert et al., 2015; Slovic, 2007). A way to do this could be contextualizing statistics individuals see. You could do this by comparing a problem's numbers to similar cases. This could increase individuals' understanding of whether the figure they see is minor, average, large or terrifyingly huge. Additionally, you could contextualize statistics by comparing the expected impact of different aid interventions or by making statistics more descriptive (for example "this includes X children, X women, X puppies", etc.) (Dickert et al., 2015). However, this has not been empirically tested yet. A third effective method to debias people could be increasing personal and public awareness

[1] I am regularly using a double negative throughout this paper (e.g. 'less insensitive') in order to prevent confusion which can be caused by switching between using 'sensitive' and 'insensitive'.

of SIB and how it undermines effective decision-making (Dickert et al., 2015). Dickert et al. (2015) have hypothesized that an educational intervention informing individuals about SIB could lead to respondents valuing the small amount of good less rather than valuing the larger amount of good more, as this was the pattern that emerged when Small et al. (2006) informed participants of the 'identified victim effect' (which makes us more likely to give to 'George' rather than to a certain unnamed group of people suffering). However, an educational intervention informing people about SIB has not been empirically tested yet. To fill this gap in the literature, this research project will test this potential method of making people less insensitive to scope.

1.3 Research questions and hypotheses

I aim to contribute knowledge about SIB in three main ways. Firstly, this paper tests what effect telling people about SIB has on how insensitive to scope they are. Secondly, I will compare the effects of providing information on SIB as an educational intervention with the UA intervention, which has shown promising results in past studies (Hsee et al., 2013; Karlsson et al., 2020). And thirdly, I aim to deepen our understanding of when SIB is stronger and weaker. Section 1.2 describes several factors which have been found to significantly affect SIB levels in past empirical studies. However, most of these studies have never been replicated. In addition to these factors which have been tested before, it would be relevant to evaluate whether a lack of sleep, whose cognitively impairing effects are uncontested, might also lead to stronger levels of SIB (Ståhle et al., 2011). Furthermore, I will test whether how recently participants have eaten affects their scope sensitivity as low blood sugar levels can impair cognitive functioning as well (Ståhle et al., 2011; Taylor & Rachman, 1988).

Research questions:

1. How does providing people with information on SIB affect how insensitive to scope they are?
2. How does the SIB information debiasing intervention tested in this paper do compared to UA?
3. How do factors such as sleep, stress, and perceived impact of the donation affect SIB levels?

My hypotheses for the research questions are as follows:

Null hypotheses:

1. Providing people with information on SIB does not affect how insensitive to scope they are.
2. The UA intervention is more effective at decreasing SIB level than providing people with information about SIB.
3. None of the twelve factors measured significantly affect SIB levels.

Considering the findings of this paper, I will reject the first and the third hypothesis, and do not find enough evidence to reject the second hypothesis. I will very briefly describe the findings below.

Findings:

1. Providing people with information on SIB decreases how insensitive to scope they are.
2. Learning about SIB seems to be a similarly effective debiasing method as Unit Asking (UA).
3. A higher perceived impact of the donation, more hours of sleep the night before, and stronger positive & stronger negative emotions towards the charity cause seem to be linked to less scope insensitivity. Additionally, women may be less insensitive to scope than men on average.

1.4 Roadmap

Before going through the process of answering the research questions above, I will first describe my methodology in section two of this paper. The methods section describes the participants of this research project's survey, the survey itself and its design, how I analyzed the data, and what the limitations of this project's research design are. Following this, the results section (3) will discuss the statistical findings that form the foundation answering my research questions. Then, in the discussion section (4), I will answer my research questions one by one, drawing on the findings from the results section. I will then conclude with section 5, where I summarize my results and make recommendations for future research.

2. Methods

2.1 Participants[2]

This study analyzes responses (N = 322) to an April 2022 anonymous online survey of adults (see section 2.4 Data analysis process). The median age of participants was 30 years. 40.8% identified as male, 58.6% as female, and 0.6% as 'other'. As this study is a partial replication of Karlsson et al. (2020), this study also used an all-American sample. All the surveyed individuals were fluent in English. It took around 3 minutes to complete the survey and each participant was paid a small financial compensation to participate. The participants were recruited via the website Prolific, identical to Karlsson et al.'s (2020) participants. The collection of data through this process was ethical as people under 18 are excluded from using Prolific, participants knew what they were agreeing to participate in and gave their explicit consent, and they were being fairly compensated for their time (above minimum wage).

2.2 Research setup[3]

The survey used a control (no SIB information) and treatment (SIB information) group to compare people's willingness to donate to help either 20 or 800 koalas. This difference in the number of koalas serves to capture whether the debiasing effects of the SIB information intervention works when different numbers of units (koalas) are at stake. I posed the treatment group the same questions as the control group, however, the survey showed the treatment group a paragraph with a simple explanation of SIB before it asked them about their willingness to donate to help either 20 or 800 koalas. As in Karlsson et al.'s (2020) study, the survey explicitly stated that it asked about hypothetical donations, not real donations. Most of the questions in my survey were identical to Karlsson et al.'s (2020) questions in order to allow for a comparison of the surveys' responses. The authors have kindly provided me with a link to access their publicly available survey design and the resulting datasets with responses.[4]

2.3 Survey design

All the participants were recruited through the website Prolific. After finding it on Prolific, people could decide to participate in this study which was named 'a study about decision-making behavior'. Participants were then redirected to the website Qualtrics, which hosted the survey. The name under which the study was promoted was purposely vague in order to prevent self-selection for individuals who are exceptionally charitable. The survey consisted of four segments: (A) consent form, (B) demographic questions, (C) one of the four randomized conditions, followed by (D) exploratory questions. A more detailed description of the segments follows below.

[2] For all the survey responses see Appendix C.

[3] For the full surveys see Appendix A.

[4] Link to Karlsson et al.'s (2020) publicly available survey design and results: https://osf.io/xq89h/.

The consent form explained to participants that the goal of this study is 'to investigate how money is donated to charity', what they should expect from the survey and that participant information will be anonymous and treated confidentially. Participants were then asked demographic questions, which were about their gender, age, level of education, place of residence and personal financial situation. The consent form and demographic questions were identical to Karlsson et al.'s (2020) survey design.

Condition	1	2	3	4
Control/Treatment	Control (No SIB information)		Treatment (SIB information)	
Number of Koalas	20	800	20	800
N participants (322 total)	81	78	80	83

Table 3: *Experiment design*

After providing some pieces of demographic information about themselves, participants were assigned one of four conditions (see table 3). Participants were not aware that there were different conditions. In each of the conditions, participants were shown a text on a fictional donation website, which briefly describes an animal shelter with an X number of rescued koalas in it, which the shelter sustains and tries to reintroduce to the wild. This is followed by a picture of one koala and the question of how much the participant would be willing to donate to help this X number of koalas. Participants were informed that if they would not want to donate, they could enter $0 to the question that would follow. The number of koalas in the animal shelter was 20 for condition 1 and 3 and 800 for condition 2 and 4 (see table 3). Condition 1 was identical to one of Karlsson et al.'s (2020) conditions. Condition 2, 3 and 4 differed from Karlsson et al.'s (2020) survey questions in the number of koalas and/or treatment (see table 3). This treatment ('SIB information') was a paragraph explaining SIB, whereas in Karlsson et al.'s (2020) study the treatment was UA. The SIB information paragraph was inserted right before the question asking how much participants were willing to donate. The paragraph was designed to explain SIB as simply as possible by using examples and excluding jargon.

The final part of the survey consisted of exploratory questions aimed to test whether certain variables affect willingness to donate or SIB levels. These questions covered the perceived impact of one's donation, strength of positive and negative emotions when reading about the charity cause, stress levels, sleep quantity and quality, and when a participant had last eaten anything. Some of these questions were identical to Karlsson et al.'s (2020) questions, and some were new in this study.

2.4 Data analysis process[5]

In this paper, 32 responses were excluded from the data analysis process for one of three reasons: (1) 18 participants had not clicked "I consent" and had thus not agreed to being included in the study, (2) 8 participants had failed an attention check, and (3) 6 participants

[5] For the RStudio coding behind this paper see Appendix B.

had filled out the survey in under 60 seconds for the control conditions or in under 70 seconds for the treatment conditions. I chose these cutoff points based on some tests with a few people in my proximity, which made me conclude that filling out the surveys more quickly than that makes it very likely that they had only partially read the survey questions and/or SIB information paragraph. Additionally, I excluded four participants who either indicated no gender (2 people) or chose 'other' as their gender (2 people) in the part of the analysis where I ran multiple regression models, as their responses were not suitable for a gender dummy variable.

Because nine out of the eleven other measured variables were missing between one and six values, I replaced these missing values with the mean responses of the other candidates to prevent the participants from being excluded in the multiple regression analyses.[6] I analyzed the data using R in RStudio. The relevant coding that was used for this analysis can be found in Appendix B (RStudio coding).

2.5 Research design limitations

There are several ways in which this project's research design is limited. Firstly, using willingness to donate to capture a person's insensitivity to scope is flawed in several ways. Results which show that individuals' donations do not increase linearly with the number of individuals/animals which the donation is targeting do not necessarily show that people value each individual life less. People may also stick to a similar donation when the size of a problem increases because they likely would still help the same number of individuals with their $10 donation. This may give them a sense that they have already 'done their part' by helping for example 2 individuals, regardless of whether 10 or 500 individuals are in need of help.

Furthermore, the use of willingness to donate is flawed because a higher willingness to donate could also be due to people being more charitable rather than less insensitive to scope. Originally, I planned on solving this problem by using the 20-koalas group as a benchmark to assess SIB levels in the 800-koalas group. A stable benchmark would help to tweeze apart charitability and scope insensitivity. However, as 20 koalas is more than 1 koala, SIB already affects the 20-koalas question group as well, which makes it an unsuitable benchmark. Therefore, this study does not mitigate this problem with willingness to donate.

An additional problem with using willingness to donate in this study (and many others) is that the question is posed for a hypothetical example ('how much would you donate'). When individuals would truly be asked to donate, their answers might differ. This effect has been dubbed the 'hypothetical bias', and can make hypothetical estimates of measures such as willingness to donate both higher and lower than actual donations (Champ & Bishop, 2001.; Hensher, 2010). Therefore, it is important that we do not take studies like the current one as the final word on SIB matters, but that we supplement it with other research methods.

A second limitation of this study may be that, depending on how you analyze the data, results vary drastically. One of these influential analysis choices is that I chose to 'winsorize' my data. This means that the values in the bottom 5 percentiles get replaced by the value on the 5th percentile, and the values in the top 5 percentile get reduced to the value

[6] In the Appendix, the variables where I added averages in the place of missing responses, have the addition of '_filled' to the variable name (e.g. 'age_filled').

on the 95th percentile.[7] The advantage of this is that the few individuals who have indicated an extremely high willingness to donate cannot skew the means for the entire sample.

Thirdly, a limitation of this study is that, in answering my third research question which focuses on which factors affect SIB levels, I look at a lot of different variables on a surface level. This means that I rely mostly on self-reporting and on subjective evaluations (for example, I asked 'how well did you sleep', and 'how good is your financial situation?'). Having access to more objective measures like, for example, yearly income or measured data on how well people slept may create more reliable results.

A fourth potential limitation of this research project is that participants had incentive to fill out the survey quickly. The participants from Prolific receive a small fixed fee for each survey they fill out which is calculated based on how long it takes to fill out the survey. If an individual races through a high number of surveys each hour, they can increase their earnings. In the responses to this survey, the average speed was also quite quick, which might mean that participants did not take the time to think about their answers. I tried to address this by excluding participants who had filled out the survey under 60 seconds (for condition 1&2) or 70 seconds (for condition 3&4) as mentioned above.

A fifth limitation of this study could be that how individuals respond to the SIB information intervention in the survey might be vastly different from how they would respond to different types of educational interventions. For instance, the time elapsed between hearing about SIB and deciding how much to donate to a charity might change the effects of such an educational intervention. Furthermore, the way in which an explanation of SIB is formulated may make it easier or harder for people to understand it, which can influence how effective providing this information is as a debiasing intervention. I tried to account for this by formulating the explanation very simply and through examples without using any jargon.

Finally, another limitation of this study is the two different data sources. This paper compares data I collected to data collected by Karlsson et al. (2020). Although I tried my best to minimize any differences between their data collection and this paper's data collection, it would have been optimal to compare data which the same people would have collected and at the same time.

[7] See Appendix B 'RStudio Coding' to view the winsorizing process.

3. Results

3.1 Effects of providing information about the Scope Insensitivity Bias

This section details the statistical analysis that goes behind answering the question "How does providing people with information on SIB affect how scope insensitive people are?" However, to lay the foundation for answering this question, I first need to establish that SIB can indeed be observed in this project's data. I do this here by demonstrating that people were willing to donate less per koala as the number of koalas they were asked about increased. Mean donations per koala in condition 2 (800 koalas) were significantly lower at \$0.02 per koala than in condition 1 (20 koalas) where people were willing to donate an average of \$0.33 per koala ($p < 0.001$) according to a one-tailed z-test. Similarly, a one-tailed z-test also demonstrated that the mean donations per koala for condition 4 (800 koalas, SIB information) were significantly lower at \$0.02 per koala than the mean \$0.83 per koala in condition 3 (20 koalas, SIB information) ($p < 0.001$). These significant decreases in mean donations per koala as the number of koalas goes up confirms that SIB is visible in my data. Having established this, let us shift our attention to the effects of the SIB information intervention.

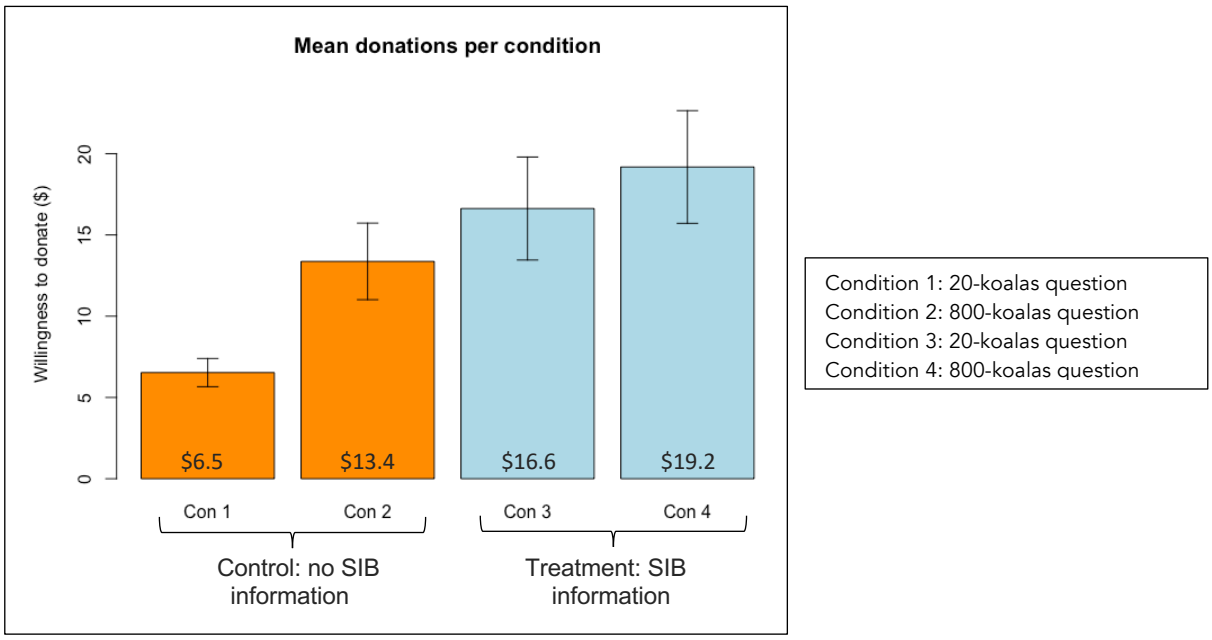

Figure 1: *Mean willingness to donate per condition. Error bars indicate Standard Error*

In figure 1, you can see the mean willingness to donate for each of the conditions. To assess whether the increases in willingness to donate from the control to the treatment group could be attributed to the debiasing intervention, I ran a multiple regression analysis.[8] This model assessed which factors correlated to willingness to donate of participants, whilst controlling

[8] Please view the results of the regression analysis in Appendix D (see D.2). This regression excluded the data from four participants who had either reported no gender or had filled out 'other' as their gender.

for all measured variables.[9] It included a dummy variable for whether people had received SIB information or not.[10]

The participants who did not receive information about the SIB were willing to donate an average of $6.5 in condition 1 (20 koalas-question) and $13.4 in condition 2 (800 koalas-question). On the other hand, participants who received information about SIB were willing to donate significantly more ($p < 0.01$) with a mean willingness to donate of $16.6 in condition 3 (20 koalas-question) and $19.2 in condition 4 (800 koalas-question).

3.2 Scope Insensitivity Bias information intervention vs. Unit Asking intervention

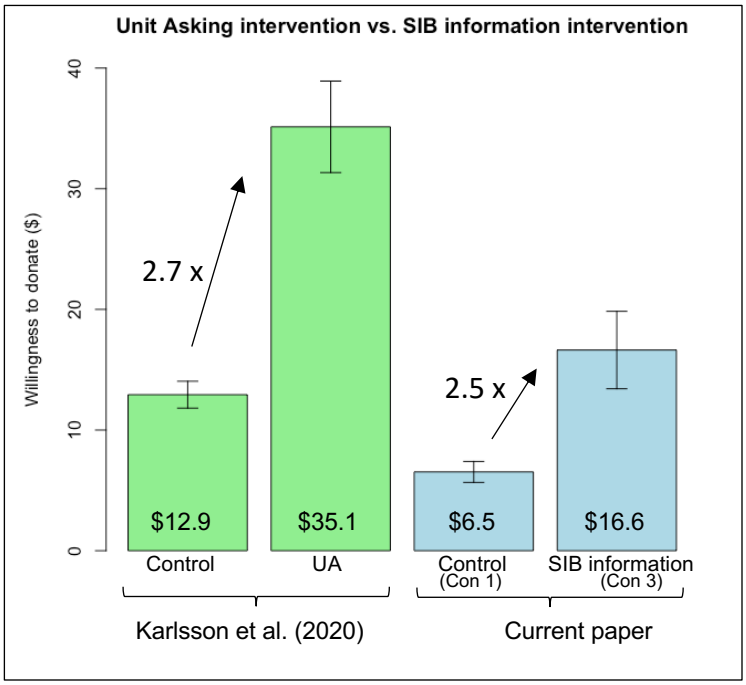

Figure 2: *The effects on mean donations of Unit Asking (UA) (as measured by Karlsson et al. (2020)) vs. of providing information on Scope Insensitivity Bias (SIB) (as measured by the current paper). Error bars indicate Standard Error*

This section focuses on the statistical outcomes comparing how the SIB information debiasing intervention tested in this paper compares to UA as tested by Karlsson et al. (2020). Both the UA intervention and the SIB information intervention show significant results. Karlsson et al.'s (2020) control group (no UA), on average, donated $12.9 to help 20 koalas, whereas their treatment group (UA) were willing to donate a statistically significant higher average of $35.1 (see figure 2) as determined by a two-tailed z-test ($p < 0.001$). This means that people, on average, were willing to donate 2.7 x more in the UA intervention group than in the control group. As mentioned in section 3.1, the SIB information treatment also significantly increased willingness to donate to help 20 koalas, as once again confirmed by a two-tailed z-test ($p < 0.002$). The mean donations went from $6.5 in the control group (no SIB information) to $16.6

[9] Controlled-for variables: gender, age, level of education, type of living environment (urban-rural), personal financial situation, perceived impact of donation, strength of positive and negative emotions, stress-levels, hours of sleep and sleep quality the night before, and when participants last ate anything.

[10] In the appendices, this dummy variable is named 'Ed' (as in Education).

in the treatment group (SIB information), which is equal to a 2.5x increase in willingness to donate (see figure 2).

3.3 Factors affecting Scope Insensitivity

This section investigates whether various factors such as sleep, stress, and perceived impact of the donation affect SIB levels. For this part of the analysis, I will only focus on the 'control group' of my data (i.e. condition 1 + 2, N = 157). This is the group of participants who did not receive information about SIB. The variables I asked participants about in the survey were:

- gender,
- age,
- highest level of completed education,
- type of living environment (urban-rural),
- their assessment of personal financial situation,
- how big of an impact they expected their donation would have made,
- how strong their positive emotions were when reading about the charity cause,
- how strong their negative emotions were when reading about the charity cause,
- how stressed they feel,
- how well they slept last night,
- for how many hours they slept last night,
- when they last ate anything.

I ran a multiple regression model which tested for each variable whether it is significantly correlated to willingness to donate - whilst controlling for all of the other measured variables. This multiple regression model contained two dummy variables: one was for gender, and the second was to correct for the difference in donations for the 20-koalas vs. 800-koalas question.[11]

As you can see in table 4 (see the next page), the regression model shows that four of the factors the survey measured were significantly correlated with willingness to donate. These are (1) gender ($p < 0.05$), (2) perceived impact ($p < 0.01$), (3) strength of positive emotions ($p < 0.01$), and (4) strength of negative emotions ($p < 0.001$). This suggests that, on average, willingness to donate was higher for women, for people who expected their donation to be more impactful, and for people who felt stronger emotions towards the charity cause (either positive or negative).

In addition, a variable which had a positive correlation with willingness to donate and which the model showed to be close to statistically significant was the reported number of hours of sleep the participants had had the night before ($p < 0.1$). This may indicate that people who had slept more the night before, on average, had a higher willingness to donate.

[11] This regression excluded the data from four participants who had either reported no gender or had filled out 'other' as their gender.

Factor	Correlation coefficient	*p*-value
Gender	4.78	0.045 *
Age	0.07	0.508
Completed level of education	-0.41	0.719
Living environment (on a scale from urban to rural)	-2.47	0.257
Personal financial situation	1.94	0.333
Perceived impact of donation	2.29	0.006 **
Positive emotions (when reading about the charity cause)	1.87	0.004 **
Negative emotions (when reading about the charity cause)	2.23	0.0004 ***
Stress levels	-0.44	0.516
Sleep quality night before	-1.57	0.207
Hours of sleep night before	1.71	0.093 •
Hours since last eaten	0.47	0.472

Not statistically significant (>10% confidence level)
• Close to statistically significant (at 10% confidence level)
* Statistically significant (at 95% confidence level)
** Statistically significant (at 99% confidence level)
*** Statistically significant (at 99.9% confidence level)

Table 4: *Correlations of measured factors with willingness to donate (con 1 & 2)*[12]

[12] For full regression outputs, please view Appendix D (D.1).

4. Discussion

4.1 Effects of providing information about the Scope Insensitivity Bias

The debiasing intervention of telling participants about SIB significantly increased the average willingness to donate to help koalas (controlling for all other measured variables). This suggests that informing individuals about SIB makes them less insensitive to scope.

4.2 Scope Insensitivity Bias information intervention vs. Unit Asking intervention

Both the UA intervention and the SIB information intervention significantly increased individuals' willingness to donate to help 20 koalas. Willingness to donate increased a similar amount for both debiasing interventions: UA (as tested by Karlsson et al., 2020) showed a 2.7x increase in mean donations, and providing information on SIB was tied to a 2.5x increase (see figure 2). The comparable increases in willingness to donate suggest that both debiasing interventions reduce the effects of SIB by roughly the same amount.

4.3 Factors affecting Scope Insensitivity

I found that several factors have a statistically significant relationship with willingness to donate (see table 4). The following relationships in my data are statistically significant when controlling for all other measured variables:

- Women tended to be willing to donate more than men. This could suggest that women have lower SIB levels than men.
- A higher perceived impact of the donation correlated to a higher willingness to donate. This may indicate that SIB is less strong when individuals think the impact of their donation is larger.
- Stronger positive emotions and stronger negative emotions were both related to a higher willingness to donate. This may suggest that heightened emotional involvement may correlate with decreased SIB levels. Interestingly, this is the opposite of what Araña et al. (2008) found. However, this difference can be explained through flaws in the current paper's research methods (see section 2.5 'Limitations').
- The data showed a close to statistically significant correlation between having slept more hours the night before and a higher willingness to donate. This could indicate that increased sleep quantity decreases SIB levels.

The other eight variables measured in the surveys did not turn out to be statistically significant. Although (as discussed in section 1.2) earlier studies found that income levels and chronic stress may affect how insensitive to scope individuals are, I have not found statistically significant results to confirm this (Li et al., 2019; Smith, 2005). However, although they were insignificant, the relationships between those two variables and SIB levels did point in the same direction in this research project's data (more stress ~ higher SIB levels & worse financial situation ~ higher SIB levels). The fact that these factors were not significant in this paper but that they were in others can have several reasons. One may be the way in which participants were asked about them. For instance, Li et al. (2019) used 14 questions to gauge chronic

stress levels. Another explanation for the differences could be the different sets of variables that were controlled for in the statistical analysis.

5. Conclusion & future research

In conclusion, this paper found that informing people about the Scope Insensitivity Bias (SIB) made them less insensitive to scope as it increased their willingness to donate to help X koalas ($p < 0.01$). The second finding of this paper is that learning about SIB seems to be a similarly effective debiasing method as the Unit Asking (UA) intervention (2.7 x increase in mean donations for UA ($p < 0.001$), 2.5 x increase in mean donations for SIB education ($p < 0.002$)). However, in this paper, this effect could only be compared when participants were asked about a low number of units (20 koalas), so it is unclear how these two interventions compare when more units are at stake. This paper's third finding is that four of the twelve measured variables turned out to have a statistically significant relationship with willingness to donate. Higher perceived impact of the donation ($p < 0.01$), stronger positive ($p < 0.01$) & stronger negative ($p < 0.001$) emotions towards the charity cause, and more hours of sleep the night before ($p < 0.1$) were linked to a higher willingness to donate, thus suggesting lower SIB levels. Furthermore, women tended to be willing to donate more money than men, suggesting that women are less scope insensitive than men.

More research on SIB, what causes it, what affects it, and what can reduce it is needed. Below I give a set of specific examples of what research avenues I would encourage others to pursue. Firstly, more research into different debiasing interventions' effects would be a valuable addition to the SIB literature. Regarding the SIB information debiasing intervention this paper focused on, additional research could test how different types of educational SIB information interventions would affect SIB. For instance, what changes when a different type of description of SIB is provided? Or if more time elapses between informing people about SIB and when they would need to make a decision that could be affected by SIB?

A practical addition to this type of research more generally would be to test the effects of debiasing interventions when different types of units (for example people, animals, km^2 of forest) and numbers of units (for example 20, 800, 5000, 1 million) are at stake. This could help establish whether these interventions work when people are asked about a low number of (for example) koalas, or also when the size of a problem entails hundreds, thousands, or millions. Furthermore, researching a range of debiasing interventions in one research project could give valuable insights into how different debiasing methods compare. This would make for robust comparisons of different debiasing interventions as all the data would be collected by the same people and at the same time (as opposed to for instance this paper's data & Karlsson et al. (2020)'s data)

This brings me to a more general criticism of this paper's and other papers' methods of measuring scope insensitivity which motivates me to propose an adjustment to this method. Using willingness to donate to capture the strength of SIB in the way that, for instance, Karlsson et al. (2020), Hsee et al. (2013), or I did, is flawed as differences in willingness to donate for X units (here: koalas) can be interpreted in two ways: (1) a higher willingness to donate means these individuals were less biased, or (2) a higher willingness to donate means these individuals were more charitable. We choose to interpret it in the first way. However, this is not very robust. In order to make a good comparison and to be able to monitor the strength of SIB (instead of accidentally simply measuring charitability) as the number of units people are asked about goes up, I would propose asking a control group about their willingness to donate to help one unit (here: koala). This number could then be used as a

benchmark to see how the average donations per unit changes as the number of units goes up.

To get a better view of which factors affect SIB levels, future research projects could adjust different parameters in their experiments. This could include the temporal or geographical proximity of a charity cause, or the way in which the charity cause is described. Moreover, papers could test the effects of more (demographic) variables, or focus on testing (one of the) factors that this paper tested more thoroughly. This could be done, for instance, by asking more questions on one factor or measuring rather than relying on self-reporting. Additionally, measuring SIB changes with real donations rather than fictional ones could provide further important insights. Furthermore, different types of participants in experiments might garner different results. Thus, testing people with a range of nationalities, and backgrounds would help to make SIB research more generalizable. Specifically, finding out how insensitive to scope political decision-makers are, and how this insensitivity could be reduced seems like a neglected but potentially impactful research avenue.

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8. Appendices

Appendix A: Survey questions

Survey overview:

A. Consent form
B. Demographic questions
C. One of the randomized conditions (koala question)
    1. 20 koalas, no SIB information
    2. 800 koalas, no SIB information
    3. 20 koalas, SIB information
    4. 800 koalas, SIB information
D. Exploratory questions (how they felt, how stressed they are etc.)

PART A (Consent form)

This is a study on decision making regarding charitable causes. The purpose of the study is to investigate how money is donated to charity. In the study, you will make a decision related to charity. You will also be asked to answer some questions about yourself.

1. Participation in the study takes place anonymously and your answers are treated confidentially. The results will be used for scientific purposes and will only be presented at group level. Participation in the study is voluntary and you can cancel your participation at any time (by closing down the page). Do you agree to participate in the study?

O Yes. I have read the information above and agree to participate. I understand that I have the right to withdraw from the study whenever I want.
O No, I would not like to participate.

2. Please enter your Prolific ID (if it is not entered automatically)
…….

PART B (Demographic questions)

3. Gender
O male
O female
O other

4. Age (you must be at least 18 years old, please close this tab if you are under 18):

5. Completed level of education

O No schooling
O Elementary school
O High school
O College
O Bachelor's degree
O Master's degree
O Doctoral degree

6. Place of residence
O Big city or suburb
O Small city or town
O Village farm or country house

7. Personal economic situation
O Bad
O Fair
O Good

PART C (randomized conditions)

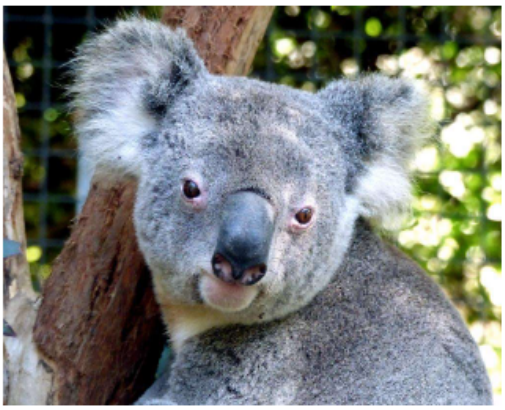
CONDITION 1 (20 koalas, no SIB information)

DONATION WEBSITE:
Thanks for visiting our website. Please read the following carefully and answer the ensuing questions. Even if you are not willing to make a donation, please still answer the questions; you may simply enter $0. You can revise your answers and your answers will not be recorded until you move on to the next page.
Our animal shelter currently has 20 koalas (like the one pictured below), they are all victims of the forest fires and they can no longer live in the forest. We hope you can make a donation, so we can use the money to care for them and, when possible, reintroduce them to the wild. Even a few dollars will help!

Please think about all 20 of these koalas. How much are you willing to donate to help these 20 koalas? Please enter the amount of money you decide and agree to donate:
…….

CONDITION 2 (800 koalas, no SIB information)

DONATION WEBSITE:
Thanks for visiting our website. Please read the following carefully and answer the ensuing questions. Even if you are not willing to make a donation, please still answer the questions; you may simply enter $0. You can revise your answers and your answers will not be recorded until you move on to the next page.
Our animal shelter currently has 800 koalas (like the one pictured below), they are all victims of the forest fires and they can no longer live in the forest. We hope you can make a donation, so we can use the money to care for them and, when possible, reintroduce them to the wild. Even a few dollars will help!



Please think about all 800 of these koalas. How much are you willing to donate to help these 800 koalas? Please enter the amount of money you decide and agree to donate:
…….

CONDITION 3 (20 koalas, SIB information)

DONATION WEBSITE:
Thanks for visiting our website. Please read the following carefully and answer the ensuing questions. Even if you are not willing to make a donation, please still answer the questions; you may simply enter $0. You can revise your answers and your answers will not be recorded until you move on to the next page.
Our animal shelter currently has 20 koalas (like the one pictured below), they are all victims of the forest fires and they can no longer live in the forest. We hope you can make a donation, so we can use the money to care for them and, when possible, reintroduce them to the wild. Even a few dollars will help!

Before you decide how much to donate to help these 20 koalas, please be aware of the following: people tend to find it difficult to care three times as much about a problem when three times more people or animals are affected by it. One of the studies which shows this asked people how much they are willing to donate to save one certain number of birds in an oil spill. The participants, on average, were willing to donate roughly the same amount of money to save 2.000 birds, 20.000 birds, or 200.000 birds. In short, people find it difficult to care more about a larger number of victims.

Please think about all 20 of these koalas. How much are you willing to donate to help these 20 koalas? Please enter the amount of money you decide and agree to donate:
…….

CONDITION 4 (800 koalas, SIB information)

DONATION WEBSITE:
Thanks for visiting our website. Please read the following carefully and answer the ensuing questions. Even if you are not willing to make a donation, please still answer the questions; you may simply enter $0. You can revise your answers and your answers will not be recorded until you move on to the next page.
Our animal shelter currently has 800 koalas (like the one pictured below), they are all victims of the forest fires and they can no longer live in the forest. We hope you can make a donation, so we can use the money to care for them and, when possible, reintroduce them to the wild. Even a few dollars will help!

Before you decide how much to donate to help these 800 koalas, please be aware of the following: people tend to find it difficult to care three times as much about a problem when three times more people or animals are affected by it. One of the studies which shows this asked people how much they are willing to donate to save one certain number of birds in an oil spill. The participants, on average, were willing to donate roughly the same amount of money to save 2.000 birds, 20.000 birds, or 200.000 birds. In short, people find it difficult to care more about a larger number of victims.

Please think about all 800 of these koalas. How much are you willing to donate to help these 800 koalas? Please enter the amount of money you decide and agree to donate:

PART D (Exploratory questions)

If you were to make this donation in reality, how big of an impact do you think your individual contribution would have made?
Where 0 is no contribution and 7 is a significant impact.
0 1 2 3 4 5 6

How strong positive and negative emotions did you feel when reading about the previously described charity cause?
Where 0 is neutral and 7 is strong emotions.
Positive emotions: 0 1 2 3 4 5 6 7
Negative emotions: 0 1 2 3 4 5 6 7

I feel stressed
Where 0 is never and 7 is always.
0 1 2 3 4 5 6 7

Did you sleep well last night?
O Definitely not
O Probably not
O Maybe
O Probably yes
O Definitely yes

For around how many hours did you sleep last night?

Around how long ago did you last eat anything?

O less than an hour ago
O 1 – 2 hours ago
O 2 - 3 hours ago
O 3 - 4 hours ago
O 5 - 6 hours ago
O 6+ hours ago

Appendix B: RStudio coding

Note: in this file, 'Ed' is used to refer to education which, in the main document I describe as ' SIB information'.

#----------DATASETS: DETACHING AND ATTACHING

```
>data = read.csv(file.choose("cleanedup_thesis survey_unvalidresponsesdeleted02-05"))
>attach(data)
>detach(data)

>WinsorizedData = read.csv(file.choose("thesis survey cleanedup and winsorized 03-
05.csv"))
>attach(WinsorizedData)
>detach(WinsorizedData)

>dataKarlsson = read.csv(file.choose("DATA_Karlsson_ UnitAsking.csv"))
>attach(dataKarlsson)
>detach(dataKarlsson)

>WinsorizedDataKarlsson =
read.csv(file.choose("DATA_Karlsson_UnitAsking.koalaswinsorized.csv"))
>attach(WinsorizedDataKarlsson)
>detach(WinsorizedDataKarlsson)
```

#----------WINSORIZING DATA at the 5%-95% interval

```
install.packages('robustHD')

#need to know 5% quantile to set as minval, and 95% quantile to set as maxval
>quantile(Con1.20koalas.NoEd, probs = seq(0, 1, 1/20), na.rm = TRUE)
  #-> at 5th percentile quantile = 0.0
  #-> at 95th percentile quantile = 25

>quantile(Con2.800koalas.NoEd, probs = seq(0, 1, 1/20), na.rm = TRUE)
  #-> at 5th percentile quantile = 0.0
  #-> at 95th percentile quantile = 78.75

>quantile(Con3.20koalas.Ed, probs = seq(0, 1, 1/20), na.rm = TRUE)
#-> at 5th percentile quantile = 0.0
#-> at 95th percentile quantile = 100.00

>quantile(Con4.800koalas.Ed, probs = seq(0, 1, 1/20), na.rm = TRUE)
#-> at 5th percentile quantile = 0.0
#-> at 95th percentile quantile = 100.00

#Manually changed all values above the 95th percentile of that condition
```

```
#to the value of the 95th percentile. (5th) percentile was already fine at 0
#And made it into separate dataset

#--- WINSORIZING KARLSSON
>quantile(Karlsson_Koalas_Control_WTD, probs = seq(0, 1, 1/20), na.rm = TRUE)
#-> at 5th percentile quantile = 0.0
#-> at 95th percentile quantile = 50

>quantile(Karlsson_Koalas_Total_WTD, probs = seq(0, 1, 1/20), na.rm = TRUE)
#-> at 5th percentile quantile = 0.0
#-> at 95th percentile quantile = 200

#Again: manually changed all values above the 95th percentile of that condition
#to the value of the 95th percentile. (5th) percentile was already fine at 0
#And made it into separate dataset
```

#---MEANS OF CONDITIONS

```
#--(winsorized) Means and medians of the 4 different conditions

>WinMeanC1 <- mean(Con1.20koalas.NoEd, na.rm = TRUE)
>WinMeanC1 #6.530864
>WinMedianC1 <- median(Con1.20koalas.NoEd, na.rm = TRUE)
>WinMedianC1 #5
>WinMeanC1 / 20 #per koala = 0.3265432
>WinSdCon1 <- sd(Con1.20koalas.NoEd, na.rm = TRUE) #7.815188

>WinMeanC2 <- mean(Con2.800koalas.NoEd, na.rm = TRUE)
>WinMeanC2 #13.37179
>WinMedianC2 <- median(Con2.800koalas.NoEd, na.rm = TRUE)
>WinMedianC2 #5
>WinMeanC2 / 800 #per koala =0.01671474
>WinSdCon2 <- sd(Con2.800koalas.NoEd, na.rm = TRUE) #20.80443

>WinMeanC3 <- mean(Con3.20koalas.Ed, na.rm = TRUE)
>WinMeanC3 #16.625
>WinMedianC3 <- median(Con3.20koalas.Ed, na.rm = TRUE)
>WinMedianC3 #5
>WinMeanC3 / 20 #per koala = 0.83125
>WinSdCon3 <- sd(Con3.20koalas.Ed, na.rm = TRUE) #28.34211

>WinMeanC4 <- mean(Con4.800koalas.Ed, na.rm = TRUE)
>WinMeanC4 #19.18072
>WinMedianC4 <- median(Con4.800koalas.Ed, na.rm = TRUE)
>WinMedianC4 #5
>WinMeanC4 / 800 # per koala = 0.0239759
>WinSdCon4 <- sd(Con4.800koalas.Ed, na.rm =TRUE) #31.58376
```

#--- For Karlsson's data (winsorized)

```
>MeanKarlssonKoalasControlwins <- mean(Karlsson_Koalas_Control_WTD, na.rm = TRUE)
>MeanKarlssonKoalasControlwins #12.93391

>MeanKarlssonKoalasUATotalWins <- mean(Karlsson_Koalas_Total_WTD, na.rm = TRUE)
>MeanKarlssonKoalasUATotalWins #35.13218
```

#--Z-TEST COMPARING KARLSSON CONTROL VS. TREATMENT (20 KOALAS) (WINSORIZED)

```
#--Step 1: hypothesis
#null-hypothesis: there is NO statistically significant difference in means between
#control group and treatment group
#alternative hypothesis: there is a statistically significant difference between mean of
control and treatment group

#Karlsson control vs. treatment (ua) is a two-tailed test
#is that the mean for treatment is either higher or lower than control.

#--Step 2: population variances (needed as inputs for two-sample independent (=not paired)
Z-test)

>N.Karlsson.control <- 174
>N.Karlsson.treatment <- 174

#--population variance for karlsson control group
>popvar.Karlsson.control.wins <- var(Karlsson_Koalas_Control_WTD, na.rm = T) *
(N.Karlsson.control-1)/N.Karlsson.control #=214.4626= population variance
#-- population variance for karlsson treatment group
>popvar.Karlsson.treatment.wins <- var(Karlsson_Koalas_Total_WTD, na.rm = T) *
(N.Karlsson.treatment-1)/N.Karlsson.treatment #= 2485.62= population variance

#--Step 3: function for two-sample z-test (z.test2sam)
#a is variable 1, b is variable 2, var means population variance of .., n.a is how many
observations a has
>z.test2sam = function(a, b, var.a, var.b, n.a, n.b){
  zeta = (mean(a, na.rm = T) - mean(b, na.rm = T)) / (sqrt(var.a/n.a + var.b/n.b))
  return(zeta)
}

#-- Step 4: doing z-test and interpreting results
>ZvalueCon1vsCon3perkoala <- z.test2sam(Karlsson_Koalas_Control_WTD,
Karlsson_Koalas_Total_WTD, popvar.Karlsson.control.wins,
popvar.Karlsson.treatment.wins, N.Karlsson.control, N.Karlsson.treatment)
# z-value = -5.635148
# -5.635148 < -3.291
```

#SO difference in means between karlsson's control and treatment group is STATISTICALLY SIGNIFICANT at alpha < 0.001, 99.9% confidence
#-CONCLUSION: statistically significant difference

#----SIZE OF INCREASE DONATIONS WITH UA KARLSSON (WINSORIZED)
#increase for 20 koalas from 12.9 without UA to 35 with. How big?
>35.13218 / 0.1293391 # -> around 2.7 times increase

#----------Z-TEST COMPARING means C1 AND C2 (per koala) winsorized
#--Step 1: hypothesis & alpha/z-value/ right or left-tailed
#null-hypothesis: there is NO statistically significant difference in the proportion
#of the control group's donations and the treatment group's donations.
#alternative hypothesis: the mean for C2 is lower than for C1

#Con1 vs Con2 is a right-tailed test because my alternative hypothesis (what I suspect)
#is that the mean for C2 is lower than for C1.
#Looking at z-table, to say this with 95% confidence interval, i.e. alpha = 0.05,
#I can reject null hypothesis (and say my results are significant)
#if Z-value is higher than 1.645 with alpha 0.05 and one-tailed test. more confidence also possible

#--Step 2: population variances (needed as inputs for two-sample independent (=not paired) Z-test)

```
>Con1donationsperkoalawins <- Con1.20koalas.NoEd / 20

>Con2donationsperkoalawins <- Con2.800koalas.NoEd / 800

#--population variance for C1 below
>popvarcon1perkoalawins <- var(Con1donationsperkoalawins, na.rm = T) * (Ncon1-1)/Ncon1 #=0.1508078 = population variance
#-- population variance for C2 below
>popvarcon2perkoalawins <- var(Con2donationsperkoalawins, na.rm = T) * (Ncon2-1)/Ncon2 # = 0.0006676175 = population variance
```

#--Step 3: making a function for two-sample z-test (z.test2sam)
#a is variable 1, b is variable 2, var means population variance of .., n.a is how many observations a has

```
z.test2sam = function(a, b, var.a, var.b, n.a, n.b){
  zeta = (mean(a, na.rm = T) - mean(b, na.rm = T)) / (sqrt(var.a/n.a + var.b/n.b))
  return(zeta)
}
```

#-- Step 4: doing z-test and interpreting results

```
>ZvalueCon1vsCon2perkoalaWins <- z.test2sam(Con1donationsperkoalawins,
Con2donationsperkoalawins, popvarcon1perkoalawins, popvarcon2perkoalawins, Ncon1,
Ncon2)
# =  7.164006
#  7.164006 > 3.090 SO difference in means between C1 and C2 per koala is STATISTICALLY
SIGNIFICANT at 99.9% confidence level
#-CONCLUSION: statistically significant difference, alpha < 0.001
```

#-------MAKING all THE FIGURES

#----------BARPLOTS FOR **MEAN DONATIONS IN DIFFERENT CONDITIONS (figure 1)**

```
#------winsorized
>meansconditionswins <- c(WinMeanC1, WinMeanC2, WinMeanC3, WinMeanC4)

>barplot.Win.means.con1234 <- barplot(meansconditionswins, col = c("darkorange",
"darkorange", "lightblue", "lightblue"),
      main = "Mean donations per condition",
      names.arg = c("Con 1", "Con 2", "Con 3", "Con 4"), ylim = c(0,24), ylab = "Willingness to
donate ($)")

>sd(Con1.20koalas.NoEd, na.rm = T) #7.815188
>Ncon1 #81
>SE.Con1 <- 7.815188 / sqrt(81) #SE = 0.8683542

>sd(Con2.800koalas.NoEd, na.rm = T) #20.80443
>Ncon2 #78
>SE.Con2 <- 20.80443 / sqrt(78) #SE = 2.355638

>sd(Con3.20koalas.Ed, na.rm = T) #28.34211
>Ncon3 #80
>SE.Con3 <- 28.34211 / sqrt(80) #SE = 3.168744

>sd(Con4.800koalas.Ed, na.rm = T) #31.58376
>Ncon4 #83
>SE.Con4 <- 31.58376 / sqrt(83) #SE = 3.466768


#input variables for
>SE.con1234.win <- c(SE.Con1, SE.Con2, SE.Con3, SE.Con4)
>means.con1234.win <- c(WinMeanC1, WinMeanC2, WinMeanC3, WinMeanC4)

#the barplot with SE built in (ylim set to 22 so top of SE bar visible)
>arrows(x0 = barplot.Win.means.con1234,
     y0= means.con1234.win + SE.con1234.win,
     y1 = means.con1234.win - SE.con1234.win,
     angle = 90,
     code = 3,
     length = 0.1)
```

#--------GRAPH COMPARING **UA VS. SIB INFORMATION (figure 2)**

```
#start with base barplot
>Karlsson.control.mean.wins <- 12.93
>Karlsson.treatment.mean.wins <- 35.13
>Control.con1.mean.wins <- 6.53
>Treatment.con3.mean.wins <- 16.63


>barplot.UA.vs.SIBinfo.numbers <- c(Karlsson.control.mean.wins,
Karlsson.treatment.mean.wins, Control.con1.mean.wins, Treatment.con3.mean.wins)
barplot.UA.vs.SIBinfo <- barplot(barplot.UA.vs.SIBinfo.numbers, col = c("lightgreen",
"lightgreen", "lightblue", "lightblue"),
                    main = "Unit Asking intervention vs. SIB information intervention",
                    names.arg = c(" "), ylim = c(0, 40), ylab = "Willingness to donate ($)")

>sd(Karlsson_Koalas_Control_WTD, na.rm = T) #14.68681
>N.Karlsson.control #174
>SE.Karlsson.control.wins <- 14.68681 / sqrt(174) #SE = 1.113404

>sd(Karlsson_Koalas_Total_WTD, na.rm = T) #49.99988
>N.Karlsson.treatment #174
>SE.Karlsson.treatment.wins <- 49.99988 / sqrt(174) #SE = 3.790481

>sd(Con1.20koalas.NoEd, na.rm = T) #7.815188
>Ncon1 #81
>SE.con1.wins <- 7.815188 / sqrt(81) #SE = 0.8683542

>sd(Con3.20koalas.Ed, na.rm = T) #28.34211
>Ncon2 #78
>SE.con3.wins <- 28.34211 / sqrt(78) #SE = 3.209112

#input variables for
>SE.Karlsson.2x.and.con1and3 <- c(SE.Karlsson.control.wins, SE.Karlsson.treatment.wins,
SE.con1.wins, SE.con3.wins)
>means.Karlsson.2x.and.con1and3 <- c(Karlsson.control.mean.wins,
Karlsson.treatment.mean.wins, Control.con1.mean.wins, Treatment.con3.mean.wins)

#the barplot with SE built in (ylim set to 22 so top of SE bar visible)
>arrows(x0 = barplot.UA.vs.SIBinfo,
    y0= means.Karlsson.2x.and.con1and3 + SE.Karlsson.2x.and.con1and3,
    y1 = means.Karlsson.2x.and.con1and3 - SE.Karlsson.2x.and.con1and3,
    angle = 90,
    code = 3,
    length = 0.1)
```

Appendix C: Multiple regression outputs

C.1 Multiple regression output willingness to donate conditions 1 & 2

```
#Residuals:
# Min        1Q      Median      3Q      Max
#-22.307    -7.967   -2.557      4.628   62.275

#Coefficients:
#                                    Estimate Std.  Error        t value     Pr(>|t|)
#(Intercept)                         -17.61703     11.49290     -1.533      0.127535
#Gender                               4.77577      2.35739      2.026       0.044651 *
#Age_filled                           0.06821      0.10285      0.663       0.508247
#CompletedEducationLevel_filled      -0.40897      1.13263     -0.361       0.718578
#PlaceOfResidence_filled             -2.47101      2.17139     -1.138       0.257044
#EconomicSituation_filled             1.93863      1.99667      0.971       0.333235
#PerceivedImpact_filled               2.29024      0.82806      2.766       0.006434 **
#PositiveEmotionsStrength_filled      1.87307      0.64190      2.918       0.004097 **
#NegativeEmotionsStrength_filled      2.23403      0.61964      3.605       0.000431 ***
#StressLevels_filled                 -0.44005      0.67600     -0.651       0.516119
#SleepQuality                        -1.57271      1.24034     -1.268       0.206884
#HoursOfSleep_filled                  1.71314      1.01416      1.689       0.093373 •
#HoursSinceLastEaten                  0.47286      0.65541      0.721       0.471803
#koalas800                            6.30005      2.31176      2.725       0.007235 **
#  ---
#  Signif. codes:  0    '***' 0.001    '**' 0.01    '*' 0.05    '•' 0.1    ' ' 1

#Residual standard error: 14.19 on 142 degrees of freedom
#(163 observations deleted due to missingness)
#Multiple R-squared:  0.2829,    Adjusted R-squared:  0.2172
#F-statistic: 4.308 on 13 and 142 DF,  p-value: 4.466e-06
```

C.2 Multiple regression output willingness to donate conditions 1, 2, 3, 4

```
#Residuals:
#Min          1Q      Median     3Q          Max
#-35.362     -11.734   -3.842     3.956       89.199

#Coefficients:
#                                    Estimate Std. Error   t value   Pr(>|t|)
#(Intercept)                         -20.22981  11.82941  -1.710  0.08827 •
#Gender                               2.64886   2.61728   1.012   0.31232
#Age_filled                           0.01059   0.10758   0.098   0.92166
#CompletedEducationLevel_filled       0.58807   1.17204   0.502   0.61621
#PlaceOfResidence_filled              0.83540   2.31311   0.361   0.71823
#EconomicSituation_filled             1.66938   2.02253   0.825   0.40980
#PerceivedImpact_filled               4.75626   0.85993   5.531   6.9e-08 ***
#PositiveEmotionsStrength_filled      2.01983   0.67273   3.002   0.00290 **
#NegativeEmotionsStrength_filled      1.57329   0.68021   2.313   0.02140 *
#StressLevels_filled                  0.02330   0.73223   0.032   0.97463
#SleepQuality                        -1.40563   1.31411  -1.070   0.28563
#HoursOfSleep_filled                  0.62147   1.05749   0.588   0.55718
#HoursSinceLastEaten                  0.22998   0.66394   0.346   0.72930
#koalas800                            5.44704   2.53879   2.146   0.03271 *
#Ed                                   7.78793   2.53798   3.069   0.00235 **
#  ---
#  Signif. codes:  0    '***' 0.001    '**' 0.01    '*' 0.05    '•' 0.1    ' ' 1

#Residual standard error: 22.16 on 302 degrees of freedom
#(2 observations deleted due to missingness)
#Multiple R-squared:  0.2197,    Adjusted R-squared:  0.1835
#F-statistic: 6.073 on 14 and 302 DF,  p-value: 1.327e-10
```