

FINAL REPORT

Earth Agency Project: Lizette Pizza Becerra

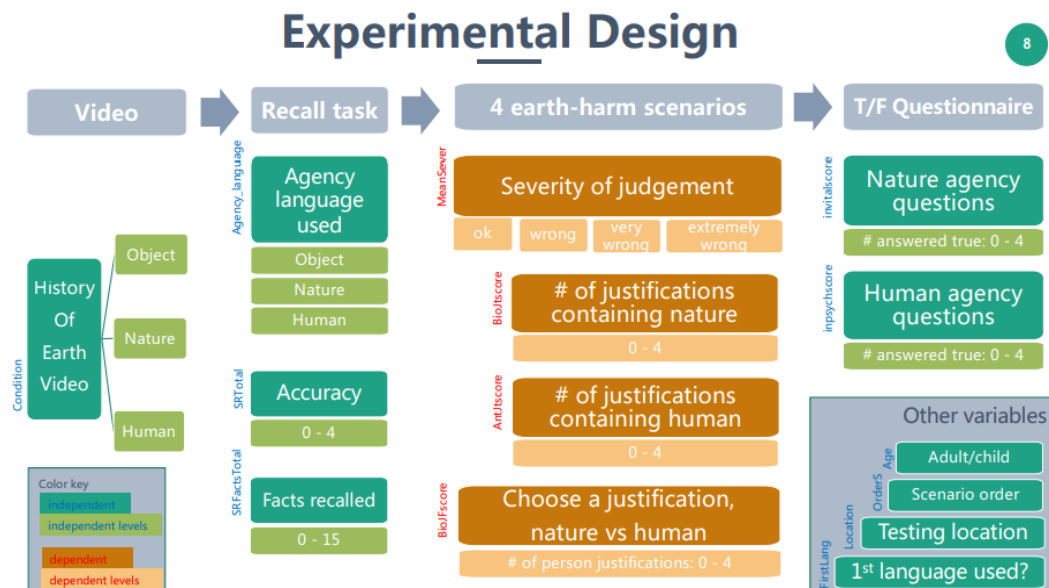
By Zihuan Qiao, Zhen Sha, Rong Li, Congyao Duan, Bruce Mallory

I. Description

Our Client, Lizette Pizza Becerra, is a student from the Psychology department at Boston University working under Advisor Deborah Kelemen. Her research involves various tasks, but her question for us aims to explore the impact of the attributions of agency to the Earth on moral judgements about the harm to nature. The attributions of agency refer to perception of the Earth. The perception can be either vitalist, viewing the earth like an animal that needs water, or psychological, viewing the earth like a person that has feelings. In particular, she is interested in finding which predictor affects the outcome, is there significant difference between different groups, and the power analysis.

II. Experimental Design (and correlation of predictor variables)

The chart below shows our understanding of the variables collected. The green are the independent variables with their levels, and the brown are the four dependent variables. As you have noted, the flow of your experiment design has intertwined the Condition variable with the Agency_language, inpsychscore and invitalscore variables. In particular, since the questionnaire was given after the participants watched the video, it's not clear that the invitalscore and inpsychscore variables are measuring the participants underlying beliefs, or the beliefs expressed in the video that they just watched. Also Agency_language, which is attempting to measure how the participants describe the video, overlaps with the perspective of the video watched. As such it is not clear that Agency_language is descriptive of the participant or of the video they just watched.



Because of our worry about the independence of the independent variables, we checked the correlations between the independent variables. The following chart (which is redundant across the diagonal), shows Pearson product-moment correlations between the numeric variables (SRFactsTotal, invitalscore, inpsychscore), a polychoric correlations between ordinal categorical variables (Condition, Agency_Language, FirstLang and Age), and polyserial correlations between numeric and ordinal variables. 1 or -1 is a strong correlation. 0 is no correlation.

	Condition	Agency_Language	SRFactsTotal	invitalscore	inpsychscore	postqs	FirstLang	Age
Condition	1.00	0.86	0.01	0.09	0.17	0.17	0.02	0.03
Agency_Language	0.86	1.00	0.10	0.05	0.26	0.19	0.14	0.18
SRFactsTotal	0.01	0.10	1.00	0.08	-0.33	-0.12	-0.19	-0.52
invitalscore	0.09	0.05	0.08	1.00	0.34	0.80	-0.13	-0.20
inpsychscore	0.17	0.26	-0.33	0.34	1.00	0.83	0.28	0.58
postqs	0.17	0.19	-0.12	0.80	0.83	1.00	0.03	0.17
FirstLang	0.02	0.14	-0.19	-0.13	0.28	0.03	1.00	0.87
Age	0.03	0.18	-0.52	-0.20	0.58	0.17	0.87	1.00

III. Data

The data consists of two separate datasets. One for the adults group, and one for the children group. For each group, we have four dependent variables: Mean Severity, which represents the participants' mean score of judgements in four situations; Spontaneous Biocentric Justification, representing the participants' score based on the presence of biocentric justification in each situation; Spontaneous Anthropocentric Justification, which is the score based on the presence of anthropocentric justifications in each situation, and Biocentric choice, which is the frequency of biocentric choices.

The independent variables of interests include the type of videos that participants were assigned to watch, the amount of accurate facts that participants recalled, participants' score on attribution of life to Earth from a questionnaire, participants' score on attribution of mind to Earth from the same questionnaire, participants' first language(English or not). For the children group, there is an additional variable 'Order' that stands for the two different orders of presentation of the four situations.

IV. Modeling

We combined some levels that are not significant or have a small amount of data and fitted ordinal models for each dependent variable. Here is the final result we got:

Mean Severity: Ordinal model with combined levels

	Value	Std. Error	t value	p value
ConditionNat	0.332	0.323	1.028	0.304
ConditionPer	0.262	0.319	0.822	0.411
SRFactsTotal	0.056	0.047	1.205	0.228
invitalscore	0.000	0.144	-0.002	0.998
inpsychscore	0.028	0.131	0.215	0.830
FirstLang1	-0.780	0.394	-1.979	0.048
AgeChild	2.042	0.363	5.622	0.000
1 2	-0.366	0.521	-0.702	0.483
2 3	1.321	0.529	2.499	0.012
	1 2 3			
1	42 14 9			
2	29 15 30			
3	17 10 54			
prop.correct	65 20 67			
Misclassification error is: 0.4954545				

Biocentric Justification score:Ordinal model with combined levels

	Value	Std. Error	t value	p value
ConditionNat	-0.012	0.359	-0.035	0.972
ConditionPer	0.204	0.360	0.566	0.571
SRFactsTotal	0.161	0.055	2.938	0.003
invitalscore	0.006	0.160	0.040	0.968
inpsychscore	-0.002	0.147	-0.016	0.987
FirstLang1	-0.470	0.472	-0.995	0.320
AgeChild	2.142	0.419	5.113	0.000
1 2	1.870	0.631	2.965	0.003
2 3	3.773	0.678	5.568	0.000
	1 2 3			
1	127 9 0			
2	43 17 1			
3	9 14 0			
prop.correct	93 28 0			
Misclassification error is: 0.3454545				

Anthropocentric Justification score:Ordinal model with combined levels

	Value	Std. Error	t value	p value
ConditionNat	-0.270	0.330	-0.820	0.412
ConditionPer	-0.563	0.336	-1.676	0.094
SRFactsTotal	0.052	0.050	1.047	0.295
invitalscore	0.094	0.152	0.621	0.535
inpsychscore	0.195	0.139	1.401	0.161
FirstLang1	0.356	0.461	0.773	0.440
AgeChild	1.356	0.355	3.818	0.000
1 2	1.550	0.599	2.585	0.010
2 3	3.069	0.627	4.897	0.000
	1 2 3			
1	103 14 2			
2	42 12 7			
3	20 12 8			
prop.correct	87 20 20			
Misclassification error is: 0.4409091				

Biocentric choice score: Ordinal model with combined levels

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              Value Std. Error t value p value
ConditionNat  0.040      0.402   0.099  0.921
ConditionPer -0.246      0.405  -0.606  0.545
SRFactsTotal  0.197      0.065   3.046  0.002
invitalscore  0.371      0.185   2.006  0.045
inpsychscore -0.390      0.174  -2.237  0.025
FirstLang1    0.966      0.517   1.868  0.062
AgeChild     -1.073      0.433  -2.477  0.013
1|2          -1.690      0.657  -2.570  0.010
2|3          -0.134      0.634  -0.211  0.833

      1  2  3
1      3  6 12
2      0  5 36
3      1  2 155
prop.correct 14 12 98
Misclassification error is: 0.2590909

```

V. Effects

We did anova test to find out which variables make a significant difference .If the p-value of the anova test is smaller than 0.05,we can say that this variable makes a significant difference.The table below shows the p-values we got from the anova test:

`polr(<outcome> ~ Condition + SRFactsTotal + invitalscore + inpsychscore + FirstLang + Age)`

<outcome>	Age	Condition	orderS(children)
MeanSever	p = .0000	p = .5521	p= .0334
BioJtscore	p = .0000	p = .7918	p= .0677
BioJFtotal	p = .0058	p = .7410	p= .6769
AntJtscore	p = .0006	p = .2413	p= .6204
Air_Trash	p= .0000	p= .9396	p= .5104
Forest_Water	p= .0000	p= .5356	p= .0004

The anova test of two types of situations(Air_Trash/Forest_Water):

`clmm(situation ~ Condition + SRFactsTotal +invitalscore + inpsychscore + FirstLang + Age + type+ (1|id))`

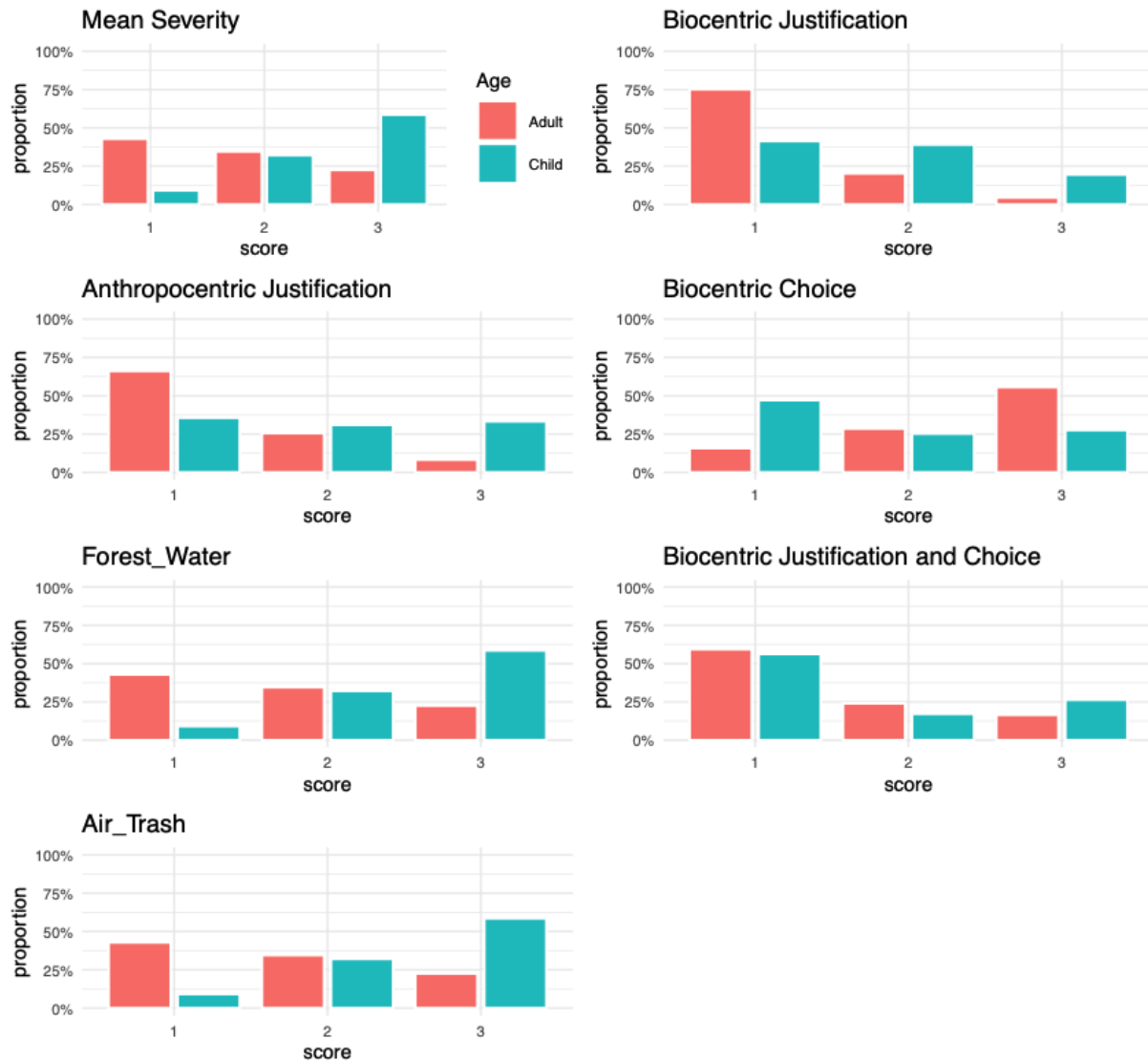
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Likelihood ratio tests of cumulative link models:

      no.par   AIC  logLik LR.stat df Pr(>Chisq)
mixed1    14 1584.6 -778.32
mixed2    15 1586.6 -778.30  0.0318  1    0.8584

```

You can see the difference in the plots of the dependent variables colored by Age. Note: none of the other predictor variables are included in this visualization.



VI. Conclusion

1. Take the mean of judgments in the four situations, presence of biocentric justifications, anthropocentric justifications and biocentric choice as response variables, condition, SRFactorsTotal, invitalscore, inpsychscore, firstLang and age as predictors, does each predictor have an impact on each response variable?

According to the p-values of four ordinal models and the anova test. If the p-values in both results are less than 0.05, we believe that this predictor have an impact on response variable. The table below will show the result:

Response variable	Predictors that have an impact on response
Mean Severity	FirstLang, age
Biocentric Justification	SRFactsTotal, age
Anthropocentric Justification	age
Biocentric Choice	SRFactsTotal, invitalscore, inpsychscore, age

For biocentric choice, although in the anova test the p-value of age is larger than 0.05, it is only slightly larger than 0.05. And the p-value of age in regression is less than 0.05. We can conclude that the age has an impact on biocentric choice.

2. **Is the result significantly different for adults and children? The study settings are the same for adults and children except that children were asked 4 person-related questions and 3 animal-related questions while adults were asked 5 questions for each.**

Yes. The results of four dependent variables are significantly different for adults and children.

3. **Does the order of showing 4 situations make any difference to participants' moral judgements about harm to Earth? In the study, there are 2 different versions of order of showing children 4 situations. 4 situations were shown in random order for adults.**

No. It makes no difference to participants' moral judgements about harm to Earth.

4. **Among 4 situations, 2 are related to ocean & air and the other two are related to animals. Are participants' moral judgements significantly different for two types of situations?**

Since the p-value is much larger than 0.05, participants' moral judgements are not significantly different for two types of situations.

5. **There were 133 children and 91 adults took the study. How is the power of the analysis?**

The effect size obtained from the study is an extremely noisy estimate of effect size, and will lead to a very noisy estimate of the power. Thus, post-hoc power calculation is not recommended. Calculating the power by simulation is an alternative approach, however, it's not trivial to get it to work. We believe it's beyond the scope of this limited-duration consulting service.