

# Final Project: An Evaluation of the World Happiness Report

Anna MacFarlane, Edgar Salas, Jerry Fu, Taalin RaoShah

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## INTRODUCTION

CodeStone chose to explore the data from the World Happiness Reports of 2018 and 2019, published by the Sustainable Development Network. According to the WHR, this data is derived from the Gallup World Poll, systematic telephone surveys and in person interviews in over 160 countries whose surveys claim to represent 80%+ of the population [1]. The calls are made via random phone number generation and randomly selecting households [2]. The data sets from each year include 312 cases, each representing the data for a particular country. The original variables in the data set included the overall rank according to happiness score, country name, happiness score, and then 6 variables that were used to calculate the happiness score in the WHR's analysis. These are GDP per capita, social support, healthy life expectancy, freedom to make life choices, generosity, and perceptions of corruption, all of which are expanded upon below. Additionally, we added variables for year as well as region to further our analysis.

### Variable Sources and Definitions

**Happiness Score:** Happiness score is a self-reported measure of overall current life satisfaction. This was measured by asking respondents, "Please imagine a ladder, with steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?" The average of these values represents respective countries and regions [3][4].

**GDP per capita:** PPP (purchasing power parity) is a rate of conversion which attempts to equalize the purchasing power across all different currencies. The World Happiness Report sources its GDP per capita in PPP values from the 2017 and 2018 World Development Indicators respectively. This value is logged. [3][4].

**Social Support:** Social support is a self-reported measure of whether or not the respondent feels they can be helped. Specifically, respondents were asked, "If you were in trouble, do you have relatives or friends you can count on to help you whenever you need them, or not?" and responded with 0 or 1 (no or yes). The average for each respective country or region creates this value [3][4].

**Life Expectancy:** Life expectancy data was extrapolated from the WHO's health observation data up to 2016. Where missing, life expectancy data for certain countries was found using research and government tools [3][4].

**Perceptions of Corruption:** Perception of Corruption is a self-reported measure of whether or not respondents feel there is active corruption within government and business. Specifically, respondents were asked, "Is corruption widespread throughout the government or not?" and "Is corruption widespread within businesses or not?" and responded to both with 0 or 1 (no or yes). The average for each respective country or region creates this value [3][4]. Note: A higher value for this measure represents a lower perception of corruption.

Generally, we want to explore the following question: what factors contribute to the differences in happiness scores between countries in North America versus Western Europe? Both regions are relatively comparable in terms of financial and political structures, but Western Europe contains the Nordic countries which consistently score highest in the World Happiness reports. With this, questions are raised as to what contributes to such happiness in this region of the world.

The countries included in North America for the purposes of this study are the United States, Canada, and Mexico. We altered the original categorizations of regions, in which Mexico was not included but Australia and New Zealand were, to align with more common understandings of the region of North America. The countries included in Western Europe are much more extensive, and were not changed from the original categorization.

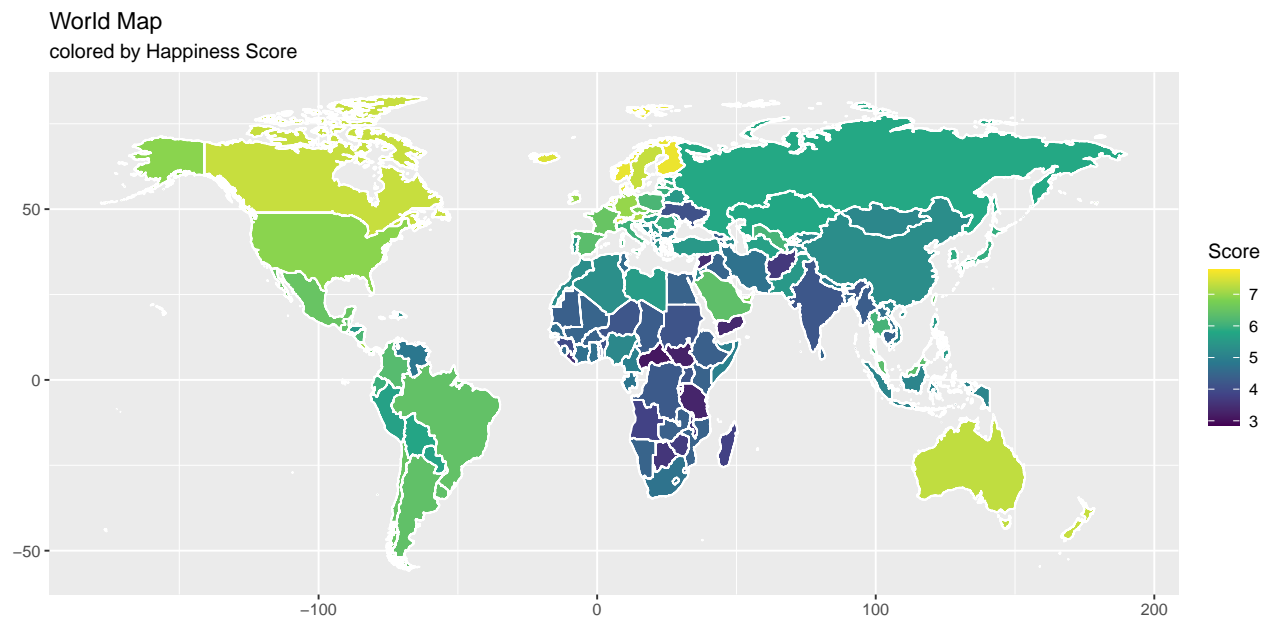
Considering the concerning state of our world in 2020, including the worsening effects of climate change, threats to democracy, and much more, we found it topical and insightful to evaluate what contributes to happiness within nations and between regions across the globe. The first World Happiness Report, published in 2012, presents the report as a means of grappling with the countless contradictions that exist in modern society such as the balance between pursuing economic success versus protecting the environment or the tradeoffs between personal profit and community trust [5]. Eight years later, these paradoxes persist, and the potential solutions are closely linked to definitions of morality, heightening their controversy. Considering the continued debate over such questions, we believe there are grounds for further investigation into trends of happiness over time and the factors that contribute to it.

## METHODOLOGY

### Chi-square test

Is there a relationship between region of the world and happiness score?

Description of chi square test for methodology



<https://www.datanovia.com/en/blog/how-to-create-a-map-using-ggplot2/>

$H_0$ : There is no association between region of the world and happiness score.  $H_a$ : There is an association between region of the world and happiness score.

```
##
## Pearson's Chi-squared test with simulated p-value (based on 2000
## replicates)
##
## data: worldhappiness$Score and worldhappiness$Region
## X-squared = 2562.2, df = NA, p-value = 0.1149
```

Table 1: Figure 1: Mean Scores for World Happiness Report Categories

	Happiness Score	GDP	Social Support	Healthy Life Expectancy	Generosity	Corruption
Western Europe	6.863750	1.343850	1.486825	0.954825	0.22245	0.2176750
North America	6.911167	1.272333	1.423333	0.875000	0.22000	0.1713333

Summary Statistics

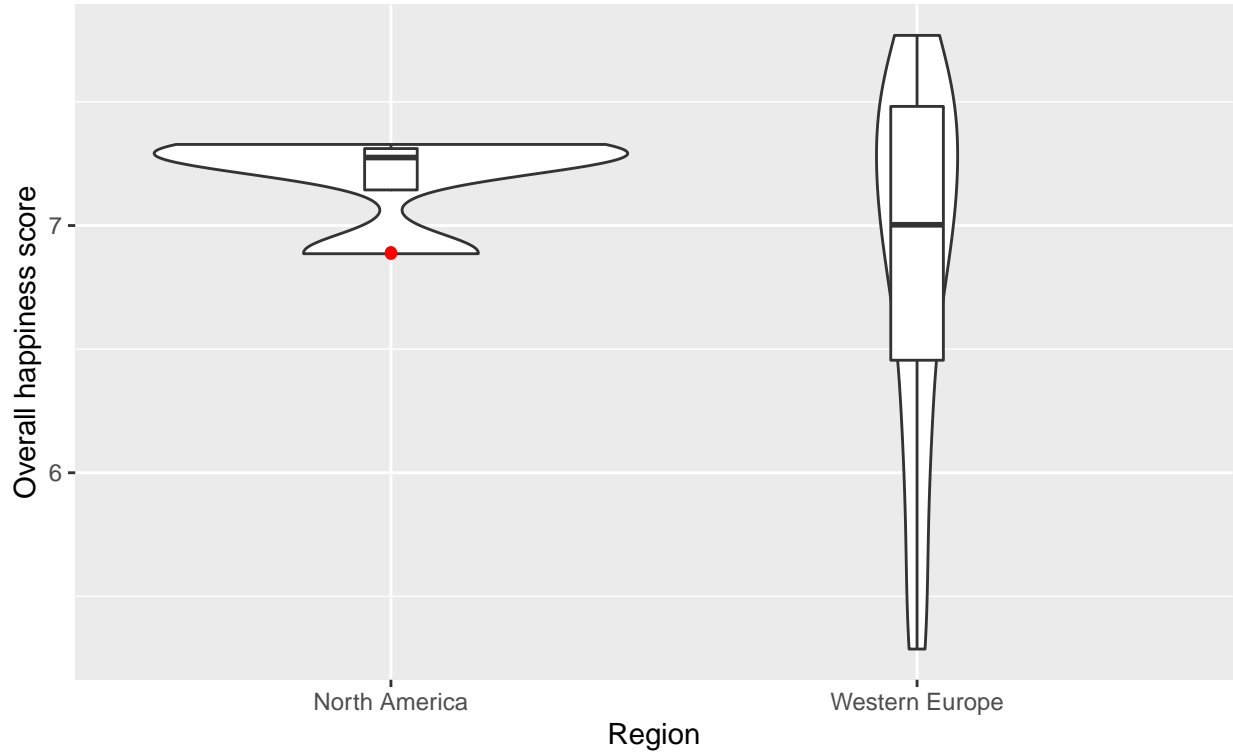
Description of summary statistics for methodology

Violin Plot Visualizations

Description of visualizations for methodology.

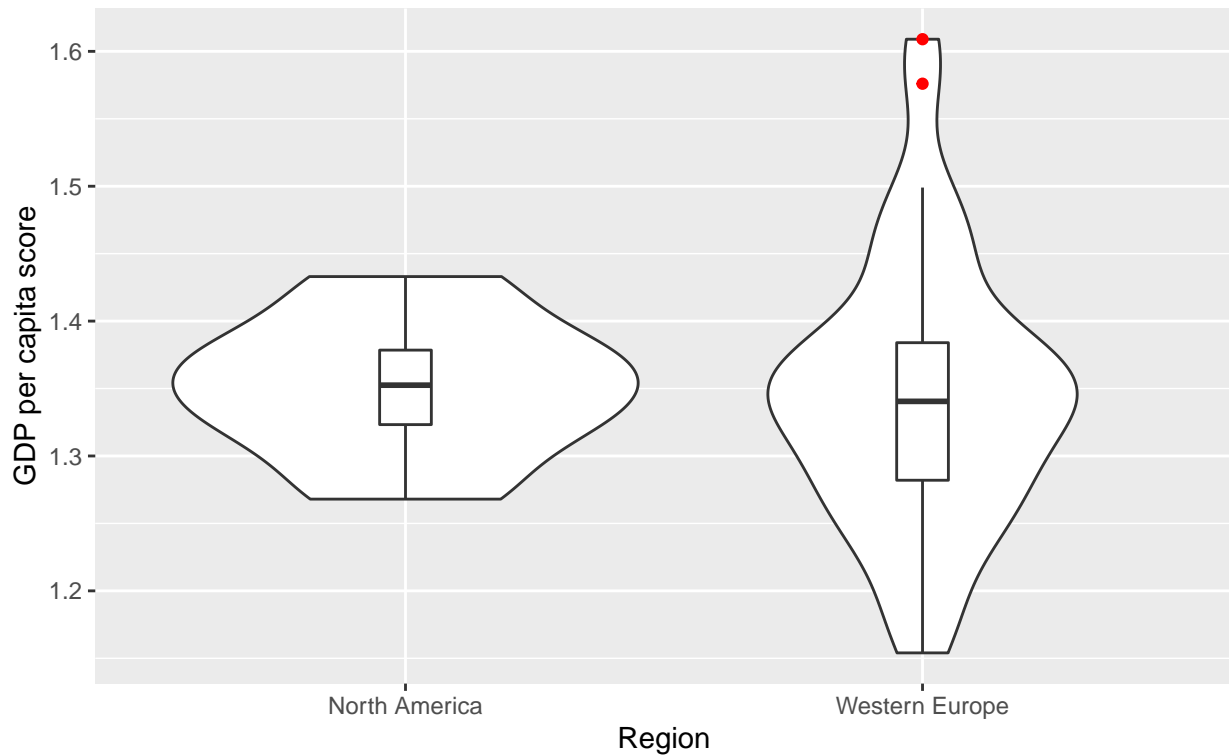
Distributions of overall happiness scores by region

Red points denoting outliers



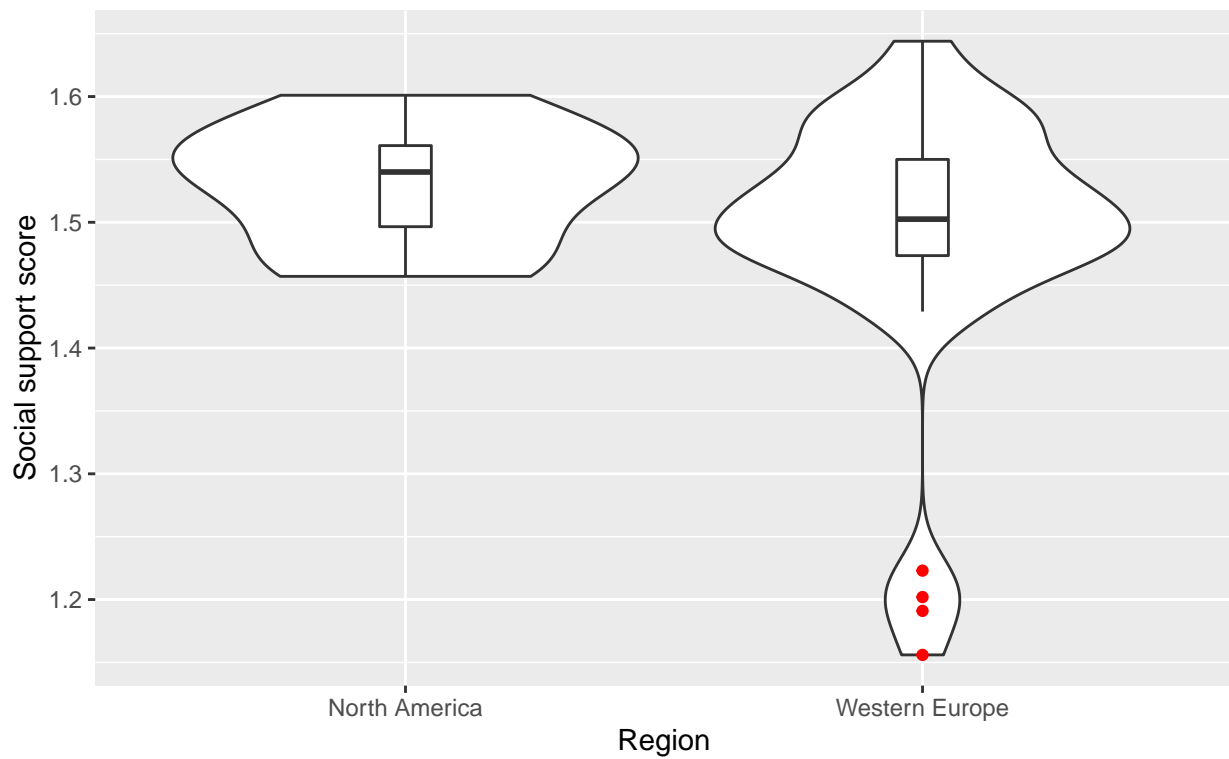
### Distributions of GDP per capita scores by region

Red points denoting outliers



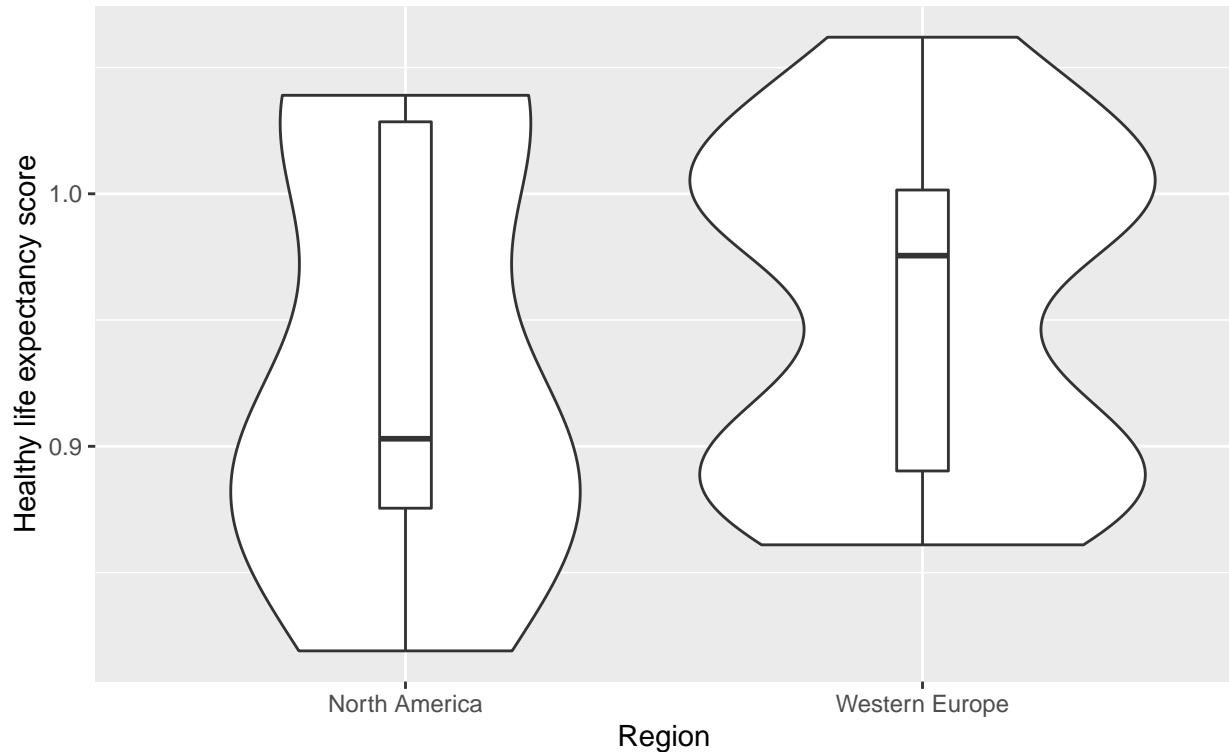
### Distributions of social support scores by region

Red points denoting outliers



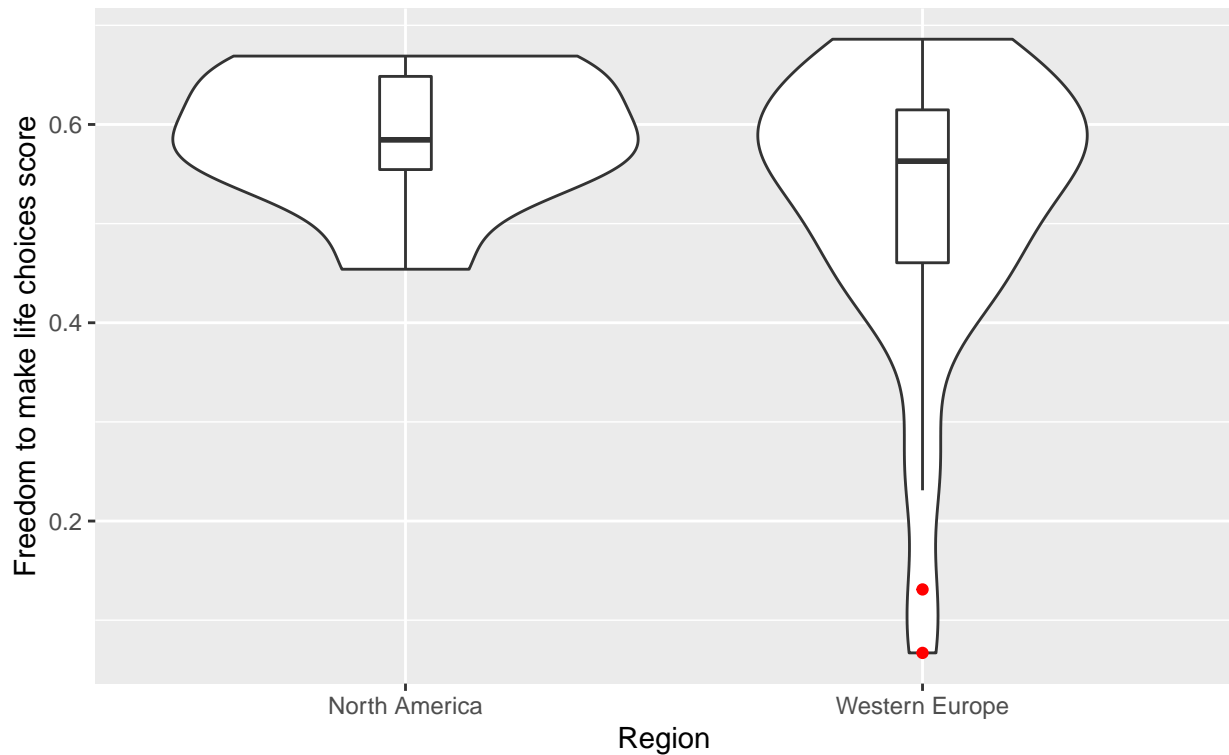
## Distributions of healthy life expectancy scores by region

Red points denoting outliers



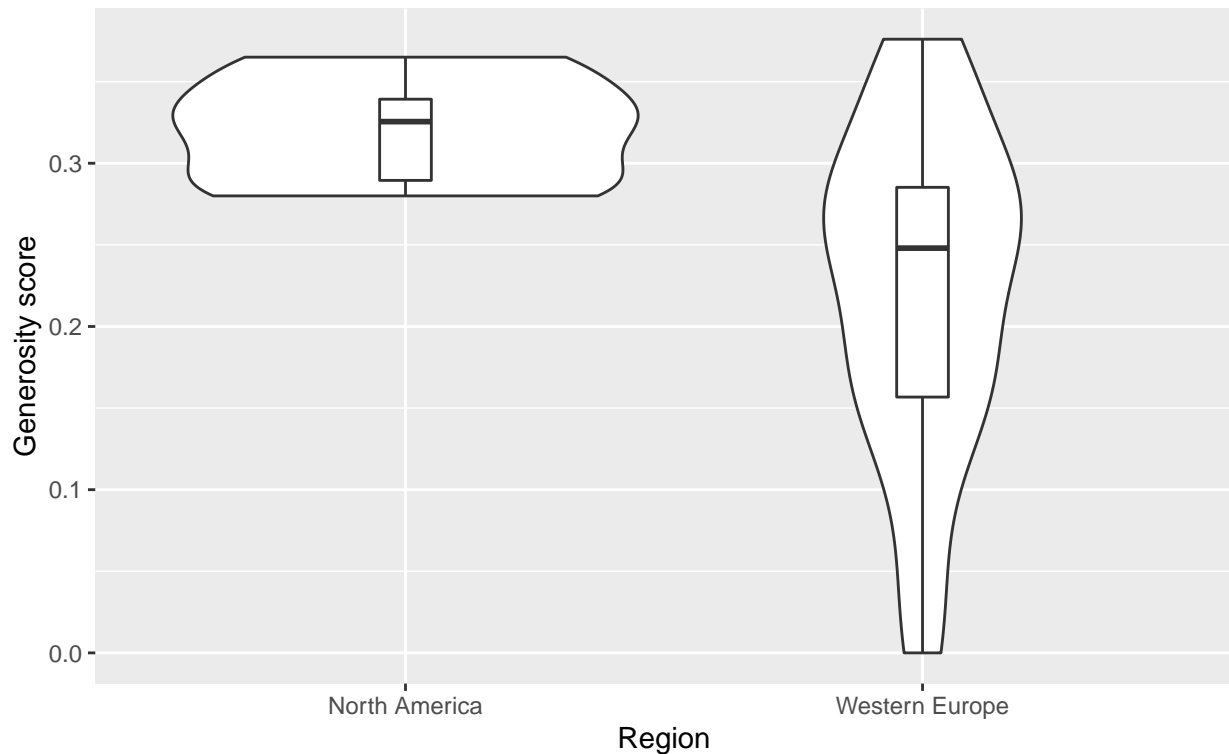
## Distributions of freedom to make life choices scores by region

Red points denoting outliers



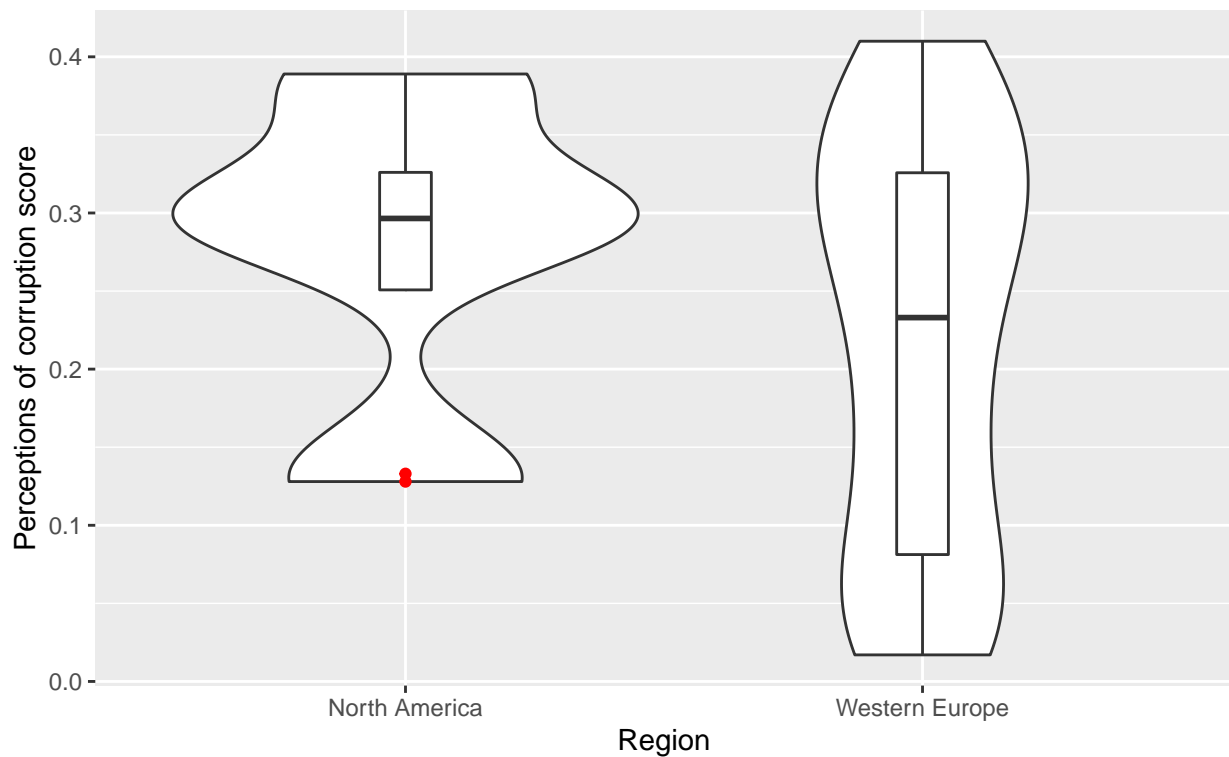
### Distributions of generosity scores by region

Red points denoting outliers



### Distributions of perceptions of corruption scores by region

Red points denoting outliers



### Simulation based hypothesis testing

Next, we conducted simulation-based hypothesis tests for each of the variables contributing to overall happiness score to evaluate whether there is a statistically significant difference the regions of Western Europe and North America.

Each of the simulation-based hypothesis tests used to evaluate the variables contributing to overall happiness score will be evaluated at the  $\alpha = 0.05$  level.

Generally, our null hypothesis states that the mean score for a particular variable in Western Europe equal to the mean score for that same variable in North America. Our alternative hypothesis therefore is that the mean score for a particular variable in Western Europe is not equal to that of the mean score for that variable in North America.

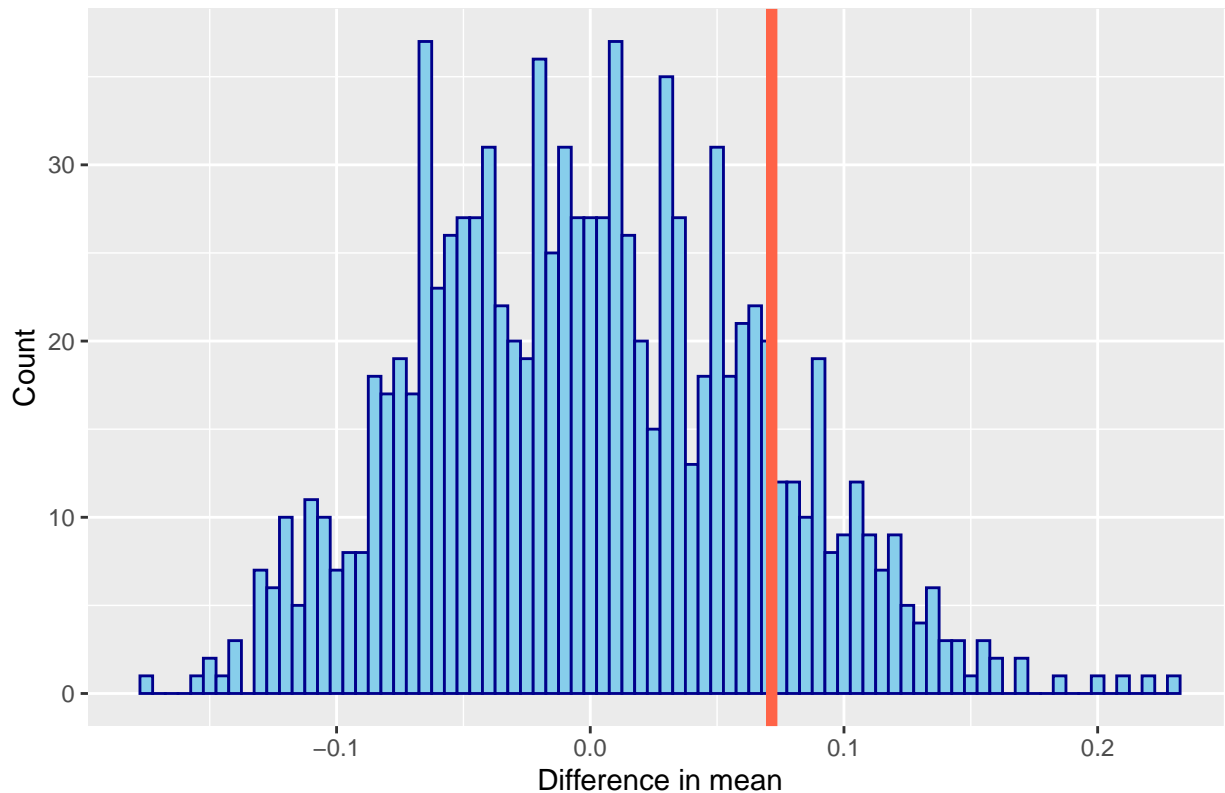
$$H_0: \mu_{WE} = \mu_{NA}$$

$$H_A: \mu_{WE} \neq \mu_{NA}$$

### GDP per capita

```
## p_val
## 1 0.145
```

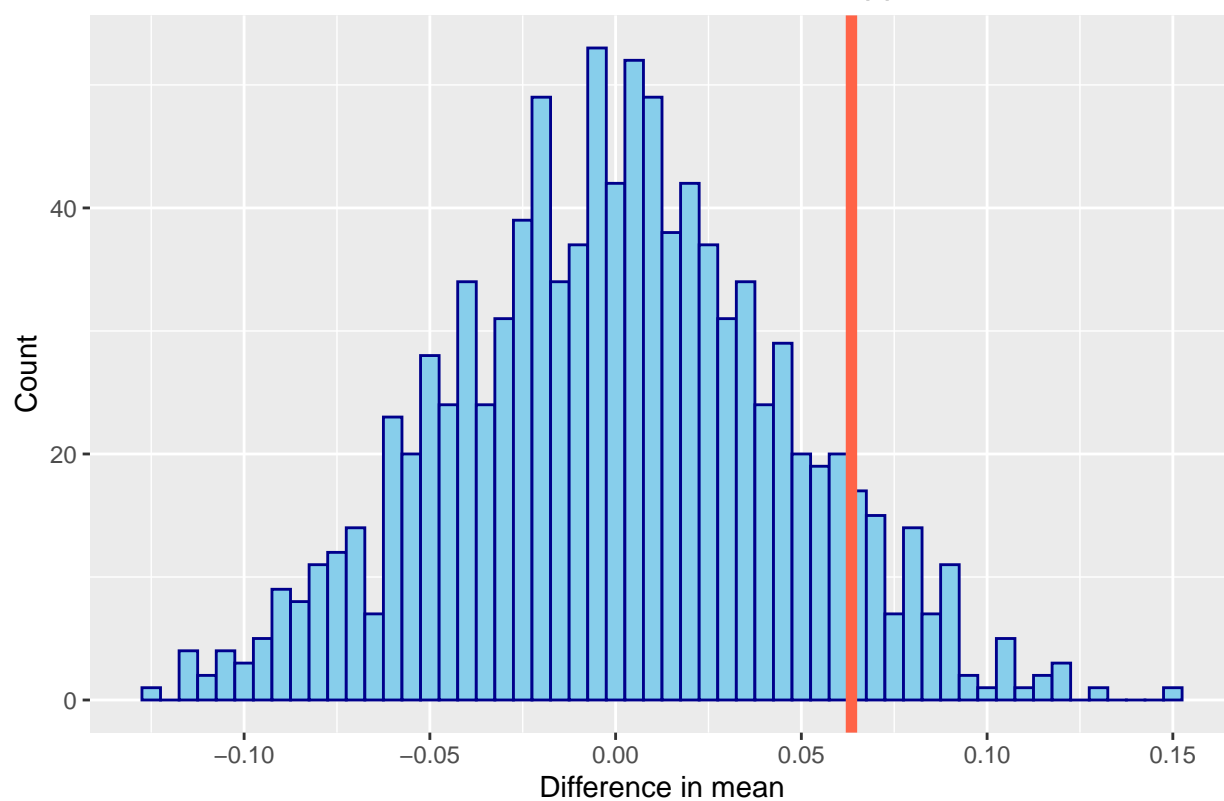
Simulated null distribution of difference in GDP per capita



### Social Support

```
## p_val
## 1 0.083
```

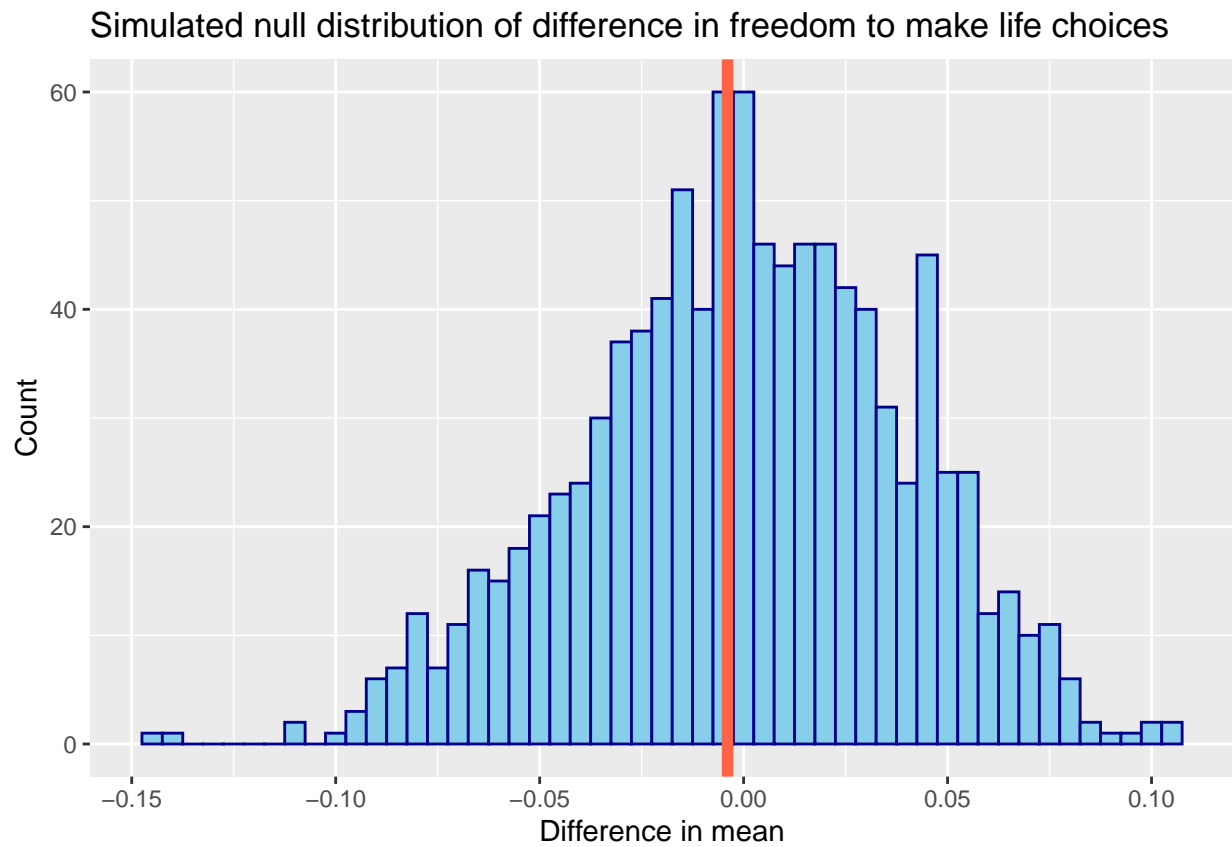
Simulated null distribution of difference in social support



Freedom to make life choices

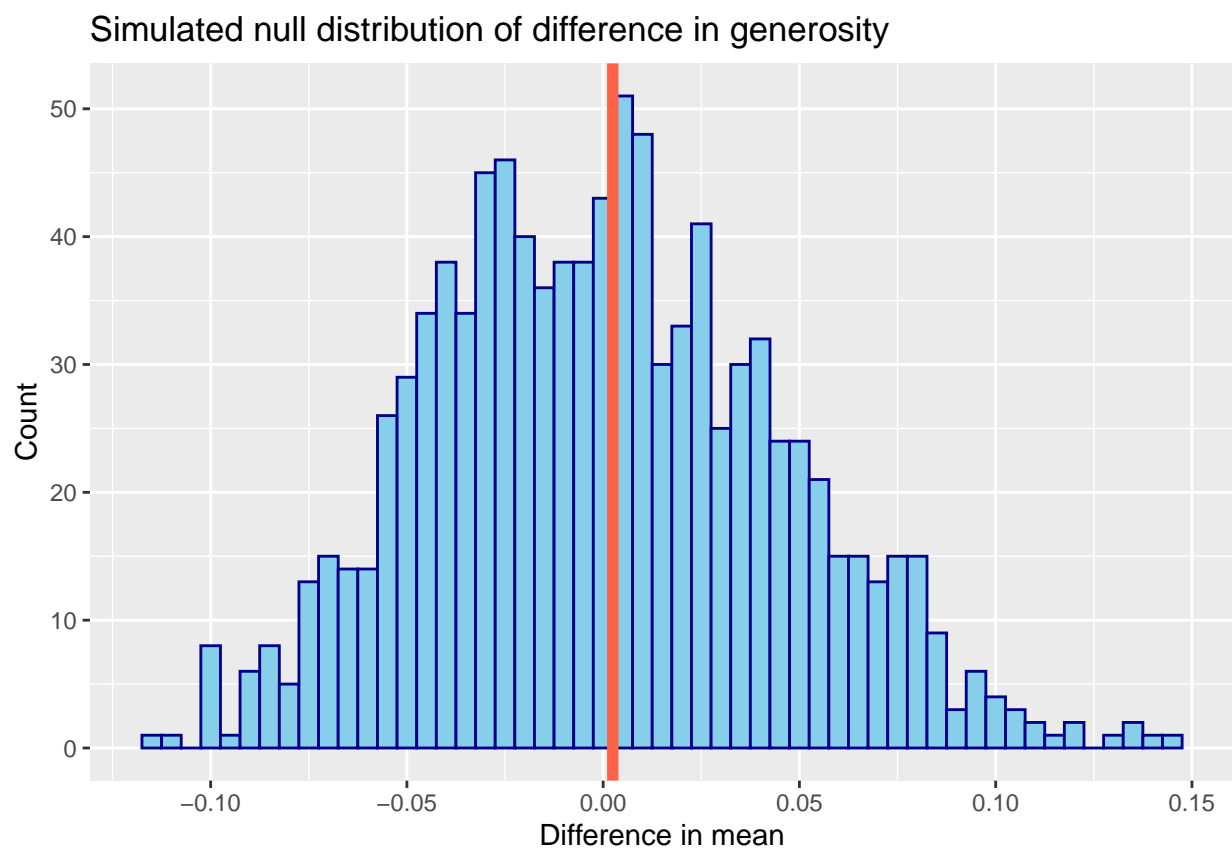
```
## p_val
## 1 0.556
```





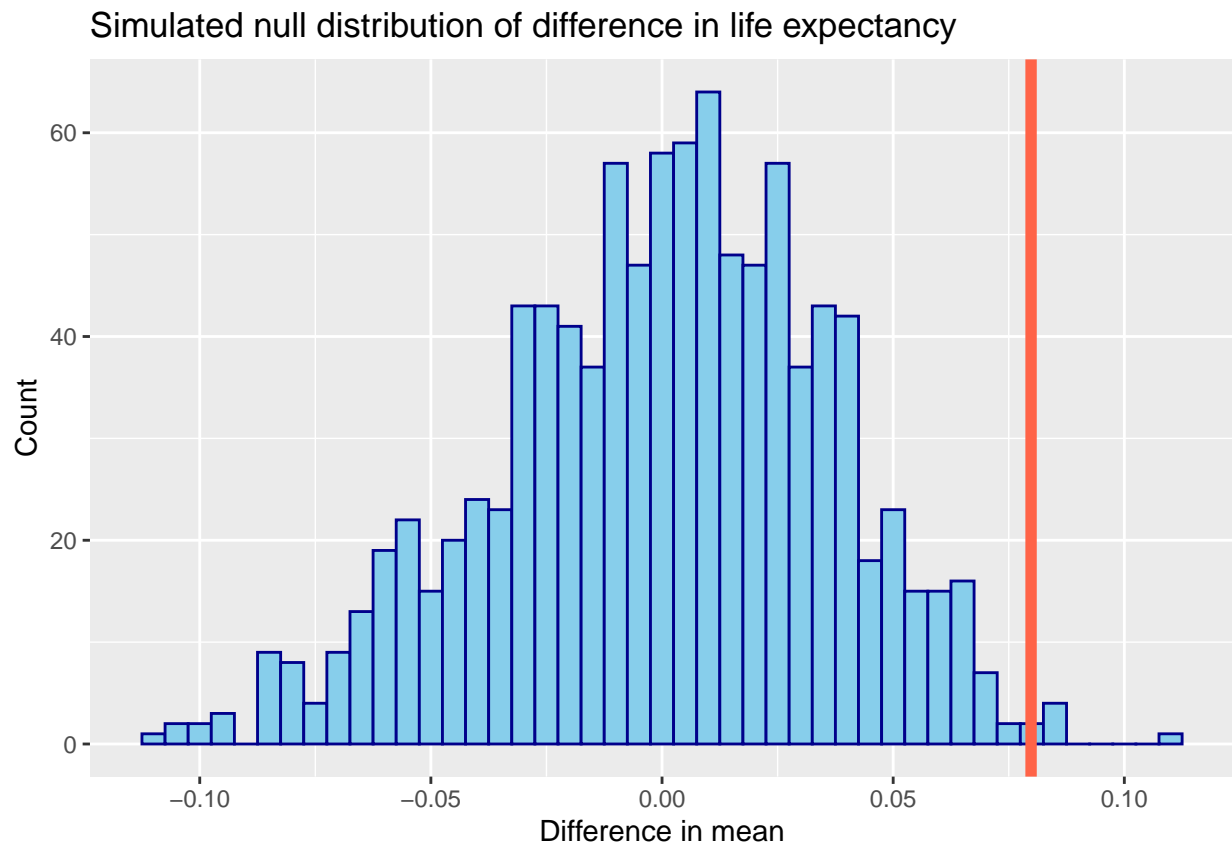
Generosity

```
##  p_val
## 1 0.468
```



Life Expectancy

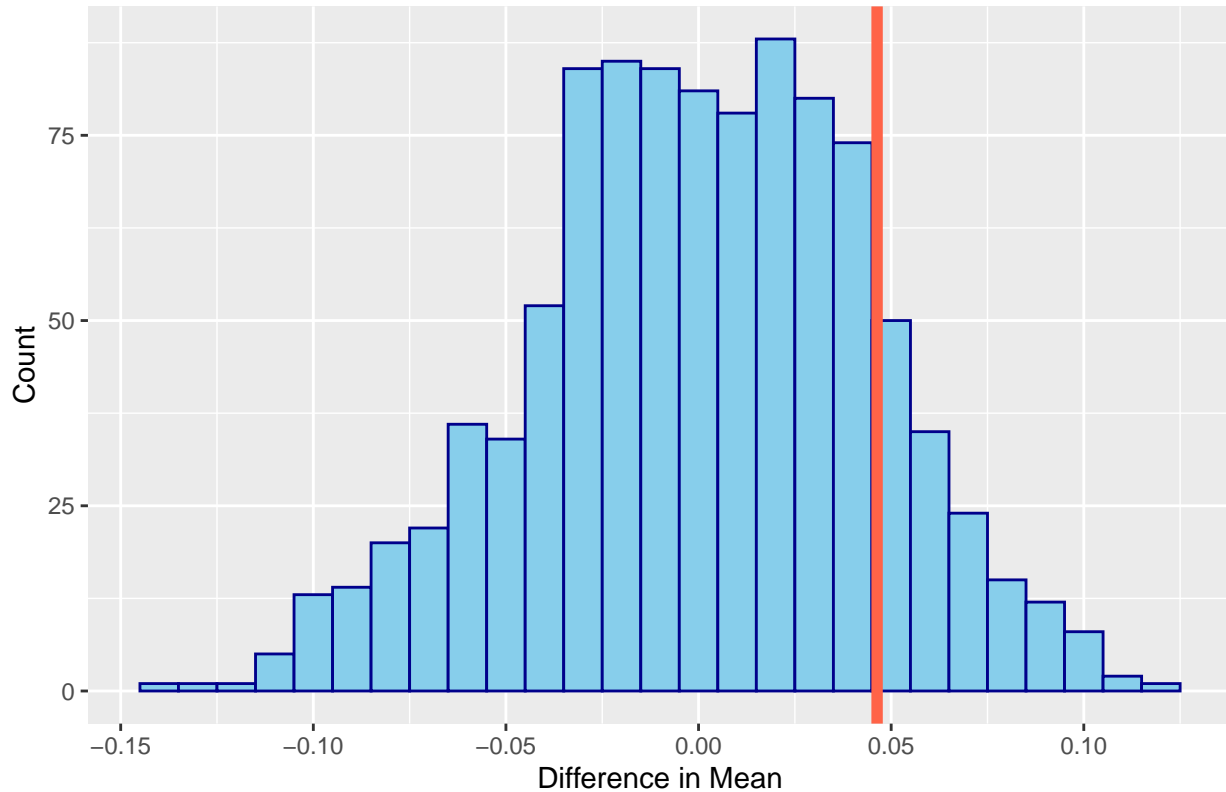
```
## p_val
## 1 0.007
```



### Perceptions of Corruption

```
## p_val  
## 1 0.142
```

## Simulated Null Distribution of Difference in mean Perceptions of Corruption



## RESULTS

### Chi-square test

With a simulated p-value of 0.1124 which is less than our  $\alpha = 0.05$ , we have sufficient evidence to reject the null hypothesis in favor of the alternative hypothesis and conclude that there is an association between region of the world and happiness score.

### Simulation-based hypothesis tests

**GDP per capita:** Since the calculated p-value of 0.145 is not significant at the  $\alpha = 0.05$  level, we fail to reject the null hypothesis. Therefore, there is not statistically significant evidence to suggest that the mean GDP per capita score in Western Europe is greater than that of North America.

**Social support:** The calculated p-value of 0.083 is not significant at the  $\alpha = 0.05$  level, so we fail to reject the null hypothesis. Therefore, there is not statistically significant evidence to suggest that the mean social support score in Western Europe is greater than that of North America.

**Freedom to make life choices** Since the calculated p-value of 0.556 is not significant at the  $\alpha = 0.05$  level, we fail to reject the null hypothesis. Therefore, there is not statistically significant evidence to suggest that the mean freedom to make life choices score in Western Europe is greater than that of North America.

**Generosity** The calculated p-value of 0.468 is not significant at the  $\alpha = 0.05$  level, so we fail to reject the null hypothesis. Therefore, there is not statistically significant evidence to suggest that the mean generosity score in Western Europe is greater than that of North America.

**Life expectancy** The calculated p-value of 0.007 is significant at the  $\alpha = 0.05$  level, so we can reject the null hypothesis. Therefore, there is statistically significant evidence to suggest that the mean life expectancy score in Western Europe is greater than that of North America.

**Perceptions of corruption** Since the calculated p-value of 0.142 is not significant at the  $\alpha = 0.05$  level, we fail to reject the null hypothesis. Therefore, there is not statistically significant evidence to suggest that the mean perceptions of corruption score in Western Europe is greater than that of North America.

## DISCUSSION