National Intelligence Quotient (IQ) Scores

Peyton Hall

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Load Necessary Libraries

```
library(readr)
library(ggplot2)
library(rworldmap)
```

```
## Loading required package: sp

## ### Welcome to rworldmap ###

## For a short introduction type :   vignette('rworldmap')
```

```
library(RColorBrewer)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

Read the CSV file

```
avgIQpercountry <- read_csv("~/Desktop/NationalIQScores/avgIQpercountry.csv")
```

```
## Rows: 193 Columns: 10
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (3): Country, Continent, Population - 2023
## dbl (7): Rank, Average IQ, Literacy Rate, Nobel Prices, HDI (2021), Mean yea...
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
avgIQpercountry
```

```
## # A tibble: 193 x 10
##     Rank Country       `Average IQ` Continent `Literacy Rate` `Nobel Prices`
##    <dbl> <chr>                <dbl> <chr>               <dbl>          <dbl>
##  1     1 Japan                 106. Asia                 0.99             29
##  2     2 Taiwan                106. Asia                 0.96              4
##  3     3 Singapore             106. Asia                 0.97              0
##  4     4 Hong Kong             105. Asia                 0.94              1
##  5     5 China                 104. Asia                 0.96              8
##  6     6 South Korea           102. Asia                 0.98              0
##  7     7 Belarus               102. Europe               1                 2
##  8     8 Finland               101. Europe               1                 5
##  9     9 Liechtenstein         101. Europe               1                 0
## 10    10 Germany               101. Europe               0.99            111
## # i 183 more rows
## # i 4 more variables: `HDI (2021)` <dbl>,
## #   `Mean years of schooling - 2021` <dbl>, `GNI - 2021` <dbl>,
## #   `Population - 2023` <chr>
```

Let = Average National IQ, AF = Africa, AS = Asia, CA = Central America, EU = Europe, EA = Eurasia, NA = North America, OC = Oceania, SA = South America

Let = 0.05 (significance level)

$H_0 : \mu_{\text{AF}} = \mu_{\text{AS}} = \mu_{\text{CA}} = \mu_{\text{EU}} = \mu_{\text{EA}} = \mu_{\text{NA}} = \mu_{\text{OC}} = \mu_{\text{SA}}$ vs H_a : At least two means differ

Hypothesis Testing

```
# Perform a One-Way Analysis of Variance (ANOVA)
iq_aov <- aov(`Average IQ`~Continent, data = avgIQpercountry)
summary(iq_aov)
```

```
##              Df Sum Sq Mean Sq F value Pr(>F)
## Continent     7  19196  2742.3   33.93 <2e-16 ***
## Residuals   185  14952    80.8
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
TukeyHSD(iq_aov) # pairwise comparison test
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = `Average IQ` ~ Continent, data = avgIQpercountry)
##
## $Continent
##                                    diff         lwr       upr     p adj
## Asia-Africa                   17.238029  11.7210620 22.754996 0.0000000
## Central America-Africa         6.546697  -0.3555053 13.448900 0.0768176
## Europe-Africa                 26.338532  20.5818725 32.095191 0.0000000
## Europe/Asia-Africa            20.630321   4.2643521 36.996289 0.0037697
## North America-Africa          25.973654  11.6720412 40.275266 0.0000025
```

```
## Oceania-Africa                 19.567654  10.0502864 29.085021 0.0000001
## South America-Africa           15.216987   6.3898402 24.044134 0.0000096
## Central America-Asia          -10.691332 -17.6811726 -3.701490 0.0001417
## Europe-Asia                     9.100503   3.2390523 14.961954 0.0001043
## Europe/Asia-Asia                3.392292 -13.0108300 19.795413 0.9983531
## North America-Asia              8.735625  -5.6084888 23.079739 0.5751507
## Oceania-Asia                    2.329625  -7.2514898 11.910740 0.9954280
## South America-Asia             -2.021042 -10.9168834  6.874800 0.9970077
## Europe-Central America         19.791835  12.6112996 26.972370 0.0000000
## Europe/Asia-Central America    14.083623  -2.8357704 31.003017 0.1807113
## North America-Central America  19.426957   4.4952092 34.358704 0.0023860
## Oceania-Central America        13.020957   2.5805907 23.461322 0.0043718
## South America-Central America   8.670290  -1.1449778 18.485557 0.1266383
## Europe/Asia-Europe             -5.708211 -22.1934959 10.777073 0.9637814
## North America-Europe           -0.364878 -14.8028767 14.073121 1.0000000
## Oceania-Europe                 -6.770878 -16.4919873  2.950231 0.3962607
## South America-Europe          -11.121545 -20.1679918 -2.075098 0.0053104
## North America-Europe/Asia       5.343333 -15.7080704 26.394737 0.9940425
## Oceania-Europe/Asia            -1.062667 -19.2066949 17.081362 0.9999997
## South America-Europe/Asia      -5.413333 -23.2050168 12.378350 0.9824633
## Oceania-North America          -6.406000 -22.7123472  9.900347 0.9297745
## South America-North America   -10.756667 -26.6700321  5.156699 0.4366802
## South America-Oceania          -4.350667 -16.1523343  7.451001 0.9493748
```

f = 33.93; p-value = <2e-16 (i.e. 0.0000000000000002)

Reject H0; there is no evidence to support the claim that the average IQ among each continent is equal. Viz., there is a 0.00000000000002% probability this difference occurred by chance. The difference occurred through observations of IQ scores.

In the pairwise comparison test, it is found the following continents are significantly different in average IQ scores: Asia-Africa, Europe-Africa, Europe/Asia-Africa, North America-Africa, Oceania-Africa, South America-Africa, Central America-Asia, Europe-Asia, Europe-Central America, North America-Central America, Oceania-Central America, South America-Europe.

The following continents are not significantly different in average IQ scores: Central America-Africa, Europe/Asia-Asia, North America-Asia, Oceania-Asia, South America-Asia, Europe/Asia-Central America, South America-Central America, Europe/Asia-Europe, North America-Europe, Oceania-Europe, North America-Europe/Asia, Oceania-Europe/Asia, South America-Europe/Asia, Oceania-North America, South America-North America, South America-Oceania.

Pairwise comparison determinations are based upon the "p adj" column. If p adj < 0.05, there is a significant difference. If p adj > 0.05, there is no significant difference. That is not to say there are no smaller differences.

Define Global Variables for Graphing

```r
# Save the value of the column header "Average IQ" to the variable Average_IQ
Average_IQ <- avgIQpercountry$`Average IQ`

# Pass Average_IQ into the iq_colors function
iq_colors <- function(Average_IQ) {
  if (is.na(Average_IQ)) {
    return("gray")
    }
  else if (Average_IQ < 50) {
    return("#8B0000")
```

```
    }
  else if (50 <= Average_IQ & Average_IQ < 60) {
    return("#FF4500")
    }
  else if (60 <= Average_IQ & Average_IQ < 70) {
    return("#FFA500")
    }
  else if (70 <= Average_IQ & Average_IQ < 80) {
    return("#F5DEB3")
    }
  else if (80 <= Average_IQ & Average_IQ < 90) {
    return("#ADD8E6")
    }
  else if (90 <= Average_IQ & Average_IQ < 100) {
    return("#7B68EE")
  }
  else {
    return("#0000CD")
    }
} # end iq_colors

iq_labels <- function(Average_IQ) {
  if (is.na(Average_IQ)) {
    return("N/A")
    }
  else if (Average_IQ < 50) {
    return("<50")
    }
  else if (50 <= Average_IQ & Average_IQ < 60) {
    return("50-59")
    }
  else if (60 <= Average_IQ & Average_IQ < 70) {
    return("60-69")
    }
  else if (70 <= Average_IQ & Average_IQ < 80) {
    return("70-79")
    }
  else if (80 <= Average_IQ & Average_IQ < 90) {
    return("80-89")
    }
  else if (90 <= Average_IQ & Average_IQ < 100) {
    return("90-99")
  }
  else {
    return("100+")
    }
} # end iq_labels

iq_breaks <- c(-Inf, 50, 60, 70, 80, 90, 100, Inf) # Define the breaks
```

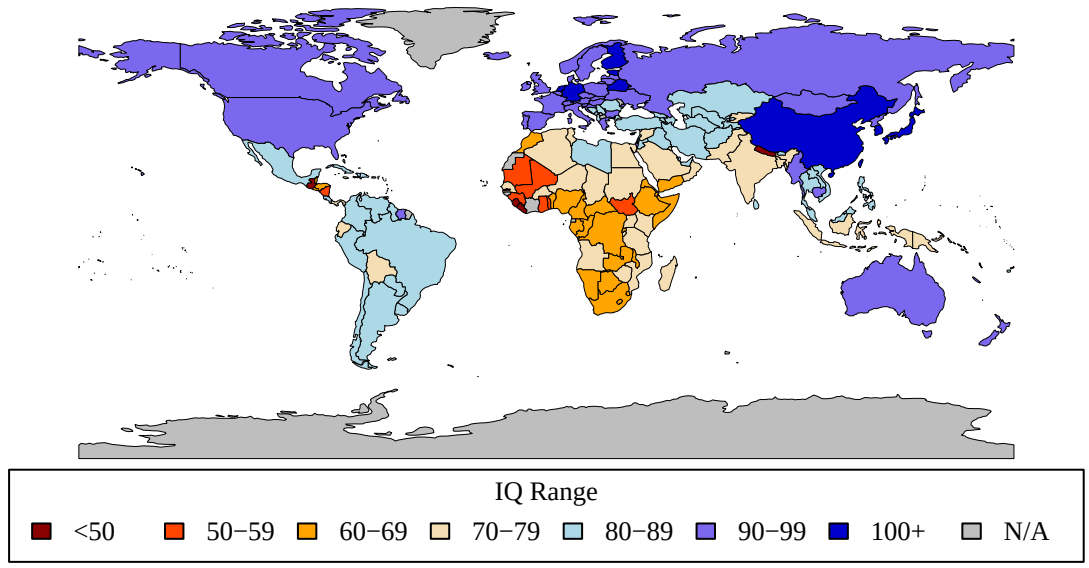
Global Map of Average IQ per Country

```r
# Set graphical parameters to use Times New Roman for the title
par(family = "serif")

# Join the country data to the map
sPDF <- joinCountryData2Map(avgIQpercountry, joinCode = "NAME",
                            nameJoinColumn = "Country")
```

```
## 189 codes from your data successfully matched countries in the map
## 4 codes from your data failed to match with a country code in the map
## 54 codes from the map weren't represented in your data
```

```r
# Apply the color function to create a color palette for the map
sPDF$color <- sapply(sPDF$`Average IQ`, iq_colors)

# Define the legend text based on the IQ values
legend_labels <- unique(sapply(sort(unique(sPDF$`Average IQ`)), iq_labels))
legend_colors <- unique(sapply(sort(unique(sPDF$`Average IQ`)), iq_colors))

# Plot the map
mapParams <- mapCountryData(sPDF,
                            nameColumnToPlot = "Average IQ",
                            mapTitle = "Global Map of Average IQ per Country",
                            colourPalette = legend_colors,
                            catMethod = iq_breaks,
                            oceanCol = "#FFFFFF",
                            missingCountryCol = "gray",
                            addLegend = FALSE,
                            borderCol = "#000000",
                            xlim = c(-180, 180), ylim = c(-90, 90))

# Add "N/A" to the legend manually
legend_labels <- c(legend_labels, "N/A")
legend_colors <- c(legend_colors, "gray")

# Add the legend manually at the bottom
legend("bottom",
       legend = legend_labels,
       fill = legend_colors,
       title = "IQ Range",
       horiz = TRUE,
       cex = 0.8,
       inset = c(0, -0.16),
       xpd = TRUE) # Allow legend to be drawn outside plot area

# Add caption
mtext("Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.",
      side = 1, line = 2.5, adj = 0.5, cex = 1, family = "serif")
```

Global Map of Average IQ per Country



Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.

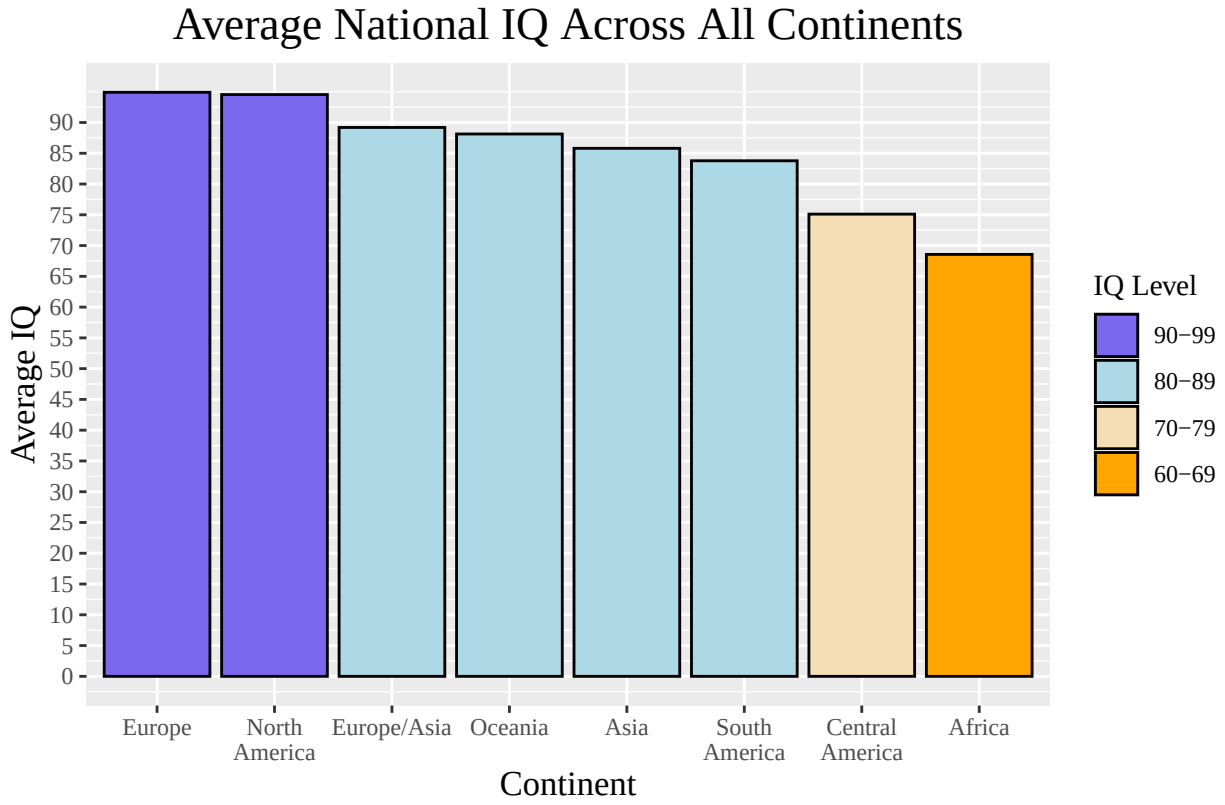
The global map provides a broad overview of what IQ scores look like per country.

Compare Average National IQ Across All Continents

```
# Calculate average IQ for each continent
avg_continent_iq <- avgIQpercountry %>%
  group_by(Continent) %>%
  summarize(Average_IQ = mean(`Average IQ`, na.rm = TRUE)) %>%
  mutate(Color = sapply(Average_IQ, iq_colors), # Call global function iq_colors
         Label = sapply(Average_IQ, iq_labels)) %>%
  arrange(desc(Average_IQ)) # Sort continents in descending order of Average IQ
avg_continent_iq # print the calculated results
```

```
## # A tibble: 8 x 4
##   Continent       Average_IQ Color   Label
##   <chr>                <dbl> <chr>   <chr>
## 1 Europe                94.9 #7B68EE 90-99
## 2 North America         94.5 #7B68EE 90-99
## 3 Europe/Asia           89.2 #ADD8E6 80-89
## 4 Oceania               88.1 #ADD8E6 80-89
## 5 Asia                  85.8 #ADD8E6 80-89
## 6 South America         83.8 #ADD8E6 80-89
## 7 Central America       75.1 #F5DEB3 70-79
## 8 Africa                68.6 #FFA500 60-69
```

```r
# Adjusting the labels for better display on the graph
avg_continent_iq$Continent <- gsub("North America", "North\nAmerica",
                                   avg_continent_iq$Continent)
avg_continent_iq$Continent <- gsub("South America", "South\nAmerica",
                                   avg_continent_iq$Continent)
avg_continent_iq$Continent <- gsub("Central America", "Central\nAmerica",
                                   avg_continent_iq$Continent)

ggplot(avg_continent_iq, aes(x = reorder(Continent, -Average_IQ), y = Average_IQ,
                             fill = Label)) +
  geom_bar(stat = "identity", color = "black") +
  scale_fill_manual(values = c("60-69" = "#FFA500", "70-79" = "#F5DEB3",
                               "80-89" = "#ADD8E6", "90-99" = "#7B68EE"),
                    name = "IQ Level") + # Change the legend title here
  guides(fill = guide_legend(reverse = TRUE)) + # Reverse legend order
  scale_y_continuous(breaks = seq(0, 90, by = 5)) +
  labs(title = "Average National IQ Across All Continents",
       x = "Continent",
       y = "Average IQ",
       caption = "Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.") +
  theme(text = element_text(family = "serif"),
        axis.text.x = element_text(size = rel(1)), # x-axis labels
        axis.text.y = element_text(size = rel(1)), # y-axis labels
        axis.title.x = element_text(size = rel(1.2)), # x-axis title
        axis.title.y = element_text(size = rel(1.2)), # y-axis title
        plot.title = element_text(hjust = 0.5, size = rel(1.5)), # Center title
        plot.caption = element_text(hjust = 1, size = rel(1))) # Center caption
```

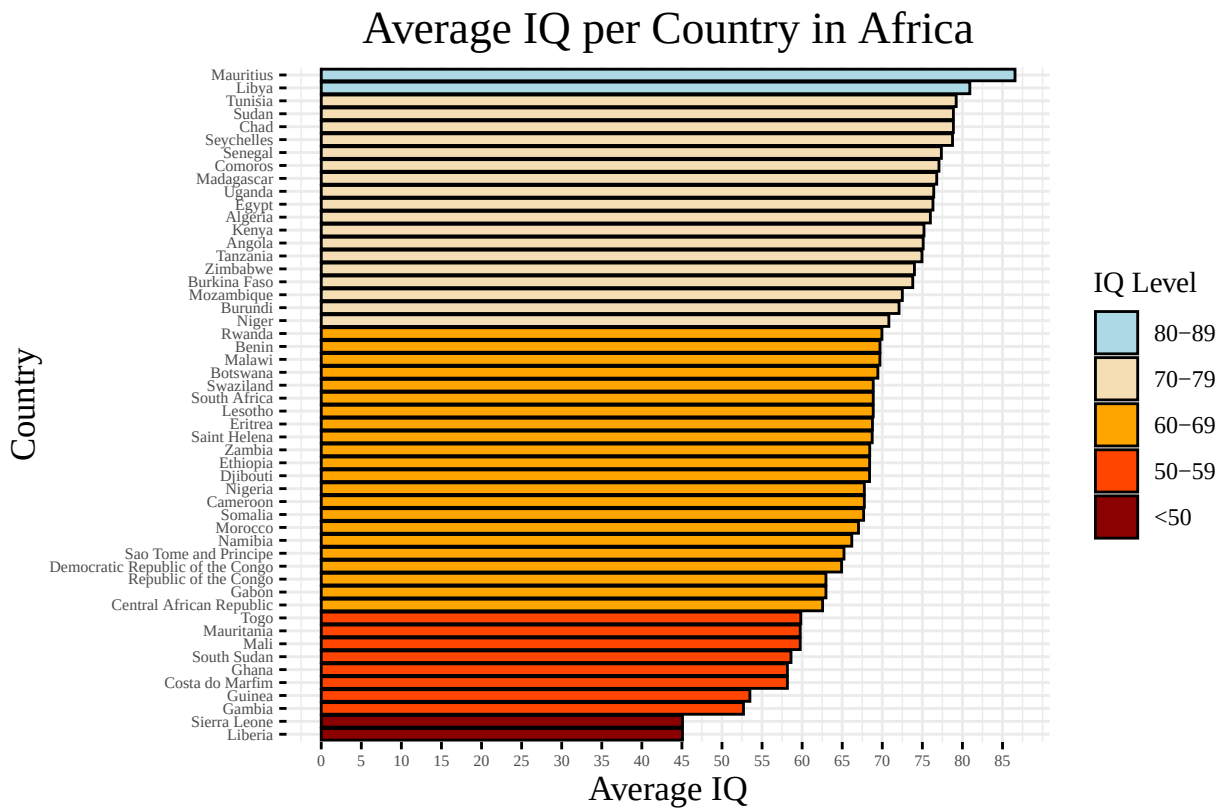


Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.

Bar Graph of Average IQ per Country In Africa

```
# Filter the dataset for African countries
africa_data <- avgIQpercountry %>%
  filter(Continent == "Africa") %>%
  mutate(IQ_level = sapply(`Average IQ`, iq_labels))

# Create the color palette based on unique IQ levels in africa_data
iq_color_values <- sapply(unique(africa_data$IQ_level), iq_colors)
names(iq_color_values) <- unique(africa_data$IQ_level)

# Create bar graph
ggplot(africa_data, aes(x = reorder(Country, `Average IQ`), y = `Average IQ`,
                        fill = IQ_level)) +
  geom_bar(stat = "identity", color = "#000000") +
  coord_flip() +
  theme_minimal() +
  scale_fill_manual(values = iq_color_values, name = "IQ Level") +
  guides(fill = guide_legend(reverse = TRUE)) + # Reverse legend order
  labs(title = "Average IQ per Country in Africa", x = "Country",
       y = "Average IQ",
       caption = "Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.") +
  scale_y_continuous(breaks = seq(0, max(africa_data$`Average IQ`, na.rm = TRUE),
                                  by = 5)) +
  theme(text = element_text(family = "serif"),
        axis.text.x = element_text(size = rel(0.7)), # x-axis labels
```

```
        axis.text.y = element_text(size = rel(0.7)), # y-axis labels
        axis.title.x = element_text(size = rel(1.2)), # x-axis title
        axis.title.y = element_text(size = rel(1.2)), # y-axis title
        plot.title = element_text(hjust = 0.5, size = rel(1.5)), # Center title
        plot.caption = element_text(hjust = 1, size = rel(1)), # Center caption
        axis.ticks.x = element_line(color = "black"), # Add black ticks on x-axis
        axis.ticks.y = element_line(color = "black"), # Add black ticks on y-axis
        legend.position = "right")
```

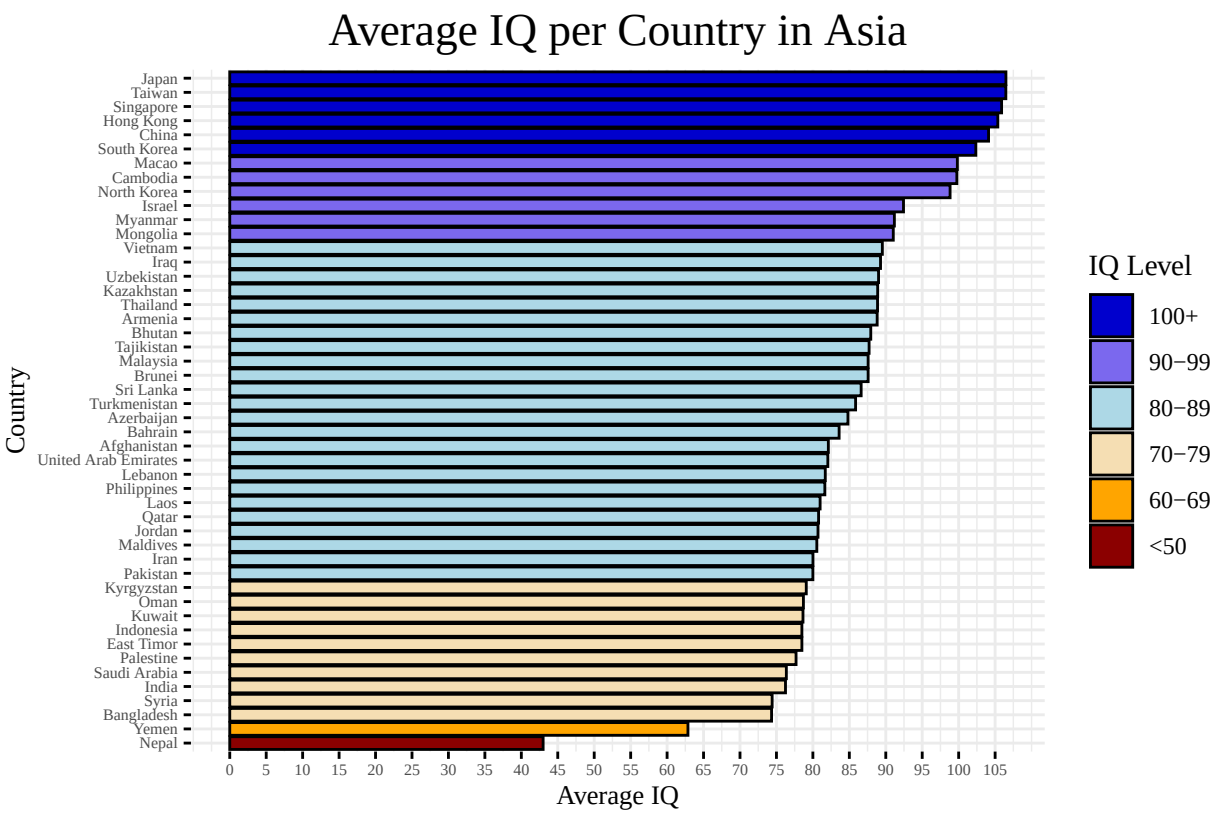


Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.

Bar Graph of Average IQ per Country In Asia

```
# Define the order of levels for IQ_level factor
iq_levels_ordered <- c("<50", "60-69", "70-79", "80-89", "90-99", "100+")

# Filter the dataset for Asian countries
asia_data <- avgIQpercountry %>%
  filter(Continent == "Asia") %>%
  mutate(IQ_level = factor(sapply(`Average IQ`, iq_labels),
                           levels = iq_levels_ordered))

# Define the color palette
iq_color_values <- c("<50" = "#8B0000", "60-69" = "#FFA500", "70-79" = "#F5DEB3",
                     "80-89" = "#ADD8E6", "90-99" = "#7B68EE", "100+" = "#0000CD")

# Create bar graph
ggplot(asia_data, aes(x = reorder(Country, `Average IQ`), y = `Average IQ`,
```

```
                      fill = IQ_level)) +
  geom_bar(stat = "identity", color = "#000000") +
  coord_flip() +
  theme_minimal() +
  scale_fill_manual(values = iq_color_values, name = "IQ Level") +
  guides(fill = guide_legend(reverse = TRUE)) + # Reverse legend order
  labs(title = "Average IQ per Country in Asia", x = "Country", y = "Average IQ",
       caption = "Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.") +
  scale_y_continuous(breaks = seq(0, max(asia_data$`Average IQ`, na.rm = TRUE),
                                  by = 5)) +
  theme(text = element_text(family = "serif"),
        axis.text.x = element_text(size = rel(0.7)), # x-axis labels
        axis.text.y = element_text(size = rel(0.7)), # y-axis labels
        axis.title.x = element_text(size = rel(0.9)), # x-axis title
        axis.title.y = element_text(size = rel(0.9)), # y-axis title
        plot.title = element_text(hjust = 0.5, size = rel(1.5)), # Center title
        plot.caption = element_text(hjust = 1, size = rel(1)), # Center caption
        axis.ticks.x = element_line(color = "black"), # Add black ticks on x-axis
        axis.ticks.y = element_line(color = "black"), # Add black ticks on y-axis
        legend.position = "right")
```

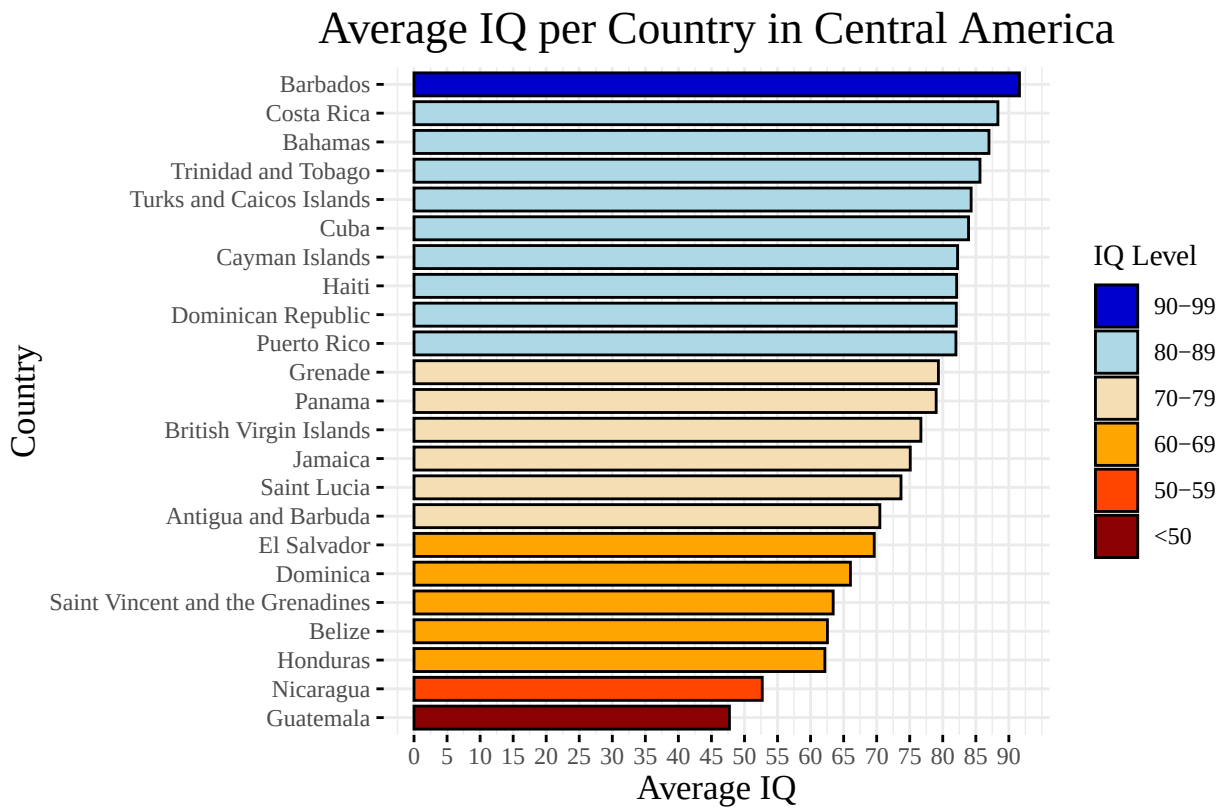


Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.

Bar Graph of Average IQ per Country In Central America

```
# Filter the dataset for Central American countries
centralamerica_data <- avgIQpercountry %>%
  filter(Continent == "Central America") %>%
```

```r
  mutate(IQ_level = sapply(`Average IQ`, iq_labels))

# Create the color palette based on unique IQ levels in centralamerica_data
iq_color_values <- sapply(unique(centralamerica_data$IQ_level), iq_colors)
names(iq_color_values) <- unique(centralamerica_data$IQ_level)

# Create bar graph
ggplot(centralamerica_data, aes(x = reorder(Country, `Average IQ`),
                                y = `Average IQ`, fill = IQ_level)) +
  geom_bar(stat = "identity", color = "#000000", width = 0.8) +
  coord_flip() +
  theme_minimal() +
  scale_fill_manual(values = iq_color_values, name = "IQ Level") +
  guides(fill = guide_legend(reverse = TRUE)) + # Reverse legend order
  labs(title = "Average IQ per Country in Central America",
       x = "Country", y = "Average IQ",
       caption = "Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.") +
  scale_y_continuous(breaks = seq(0, max(centralamerica_data$`Average IQ`,
                                         na.rm = TRUE), by = 5)) +
  theme(text = element_text(family = "serif"),
        axis.text.x = element_text(size = rel(1)), # x-axis labels
        axis.text.y = element_text(size = rel(1)), # y-axis labels
        axis.title.x = element_text(size = rel(1.2)), # x-axis title
        axis.title.y = element_text(size = rel(1.2)), # y-axis title
        plot.title = element_text(hjust = 0.5, size = rel(1.5)), # Center title
        plot.caption = element_text(hjust = 1, size = rel(1)), # Center caption
        axis.ticks.x = element_line(color = "black"), # Add black ticks on x-axis
        axis.ticks.y = element_line(color = "black"), # Add black ticks on y-axis
        legend.position = "right")
```

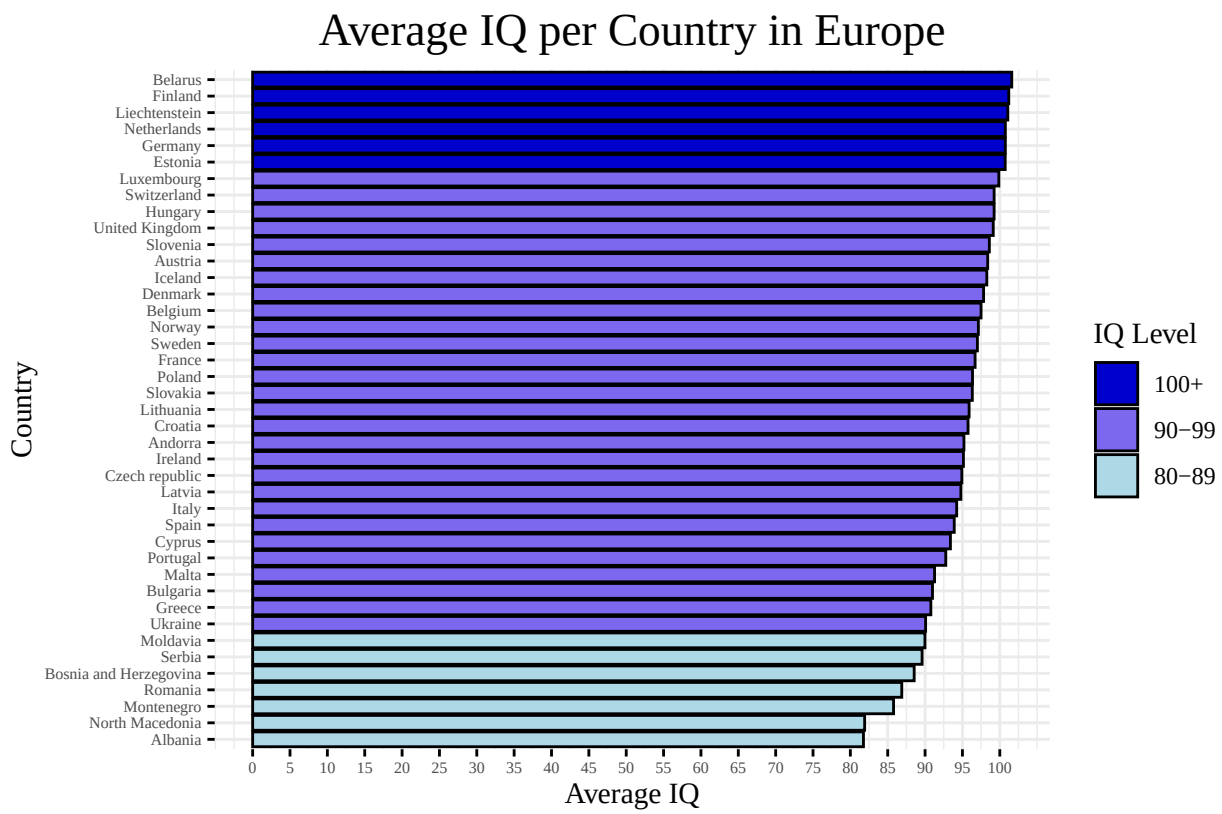


Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.

Bar Graph of Average IQ per Country In Europe

```
# Define the order of levels for IQ_level factor
iq_levels_ordered <- c("80-89", "90-99", "100+")

# Filter the dataset for European countries
europe_data <- avgIQpercountry %>%
  filter(Continent == "Europe") %>%
  mutate(IQ_level = factor(sapply(`Average IQ`, iq_labels),
                           levels = iq_levels_ordered))

# Define the color palette
iq_color_values <- c("80-89" = "#ADD8E6",
                     "90-99" = "#7B68EE",
                     "100+" = "#0000CD")

# Create bar graph
ggplot(europe_data, aes(x = reorder(Country, `Average IQ`),
                        y = `Average IQ`, fill = IQ_level)) +
  geom_bar(stat = "identity", color = "#000000") +
  coord_flip() +
  theme_minimal() +
  scale_fill_manual(values = iq_color_values, name = "IQ Level") +
  guides(fill = guide_legend(reverse = TRUE)) + # Reverse legend order
  labs(title = "Average IQ per Country in Europe",
       x = "Country", y = "Average IQ",
```

```
      caption = "Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.") +
  scale_y_continuous(breaks = seq(0, max(europe_data$`Average IQ`, na.rm = TRUE),
                                  by = 5)) +
  theme(text = element_text(family = "serif"),
        axis.text.x = element_text(size = rel(0.7)), # x-axis labels
        axis.text.y = element_text(size = rel(0.7)), # y-axis labels
        axis.title.x = element_text(size = rel(1)), # x-axis title
        axis.title.y = element_text(size = rel(1)), # y-axis title
        plot.title = element_text(hjust = 0.5, size = rel(1.5)), # Center title
        plot.caption = element_text(hjust = 1, size = rel(1)), # Center caption
        axis.ticks.x = element_line(color = "black"), # Add black ticks on x-axis
        axis.ticks.y = element_line(color = "black"), # Add black ticks on y-axis
        legend.position = "right")
```

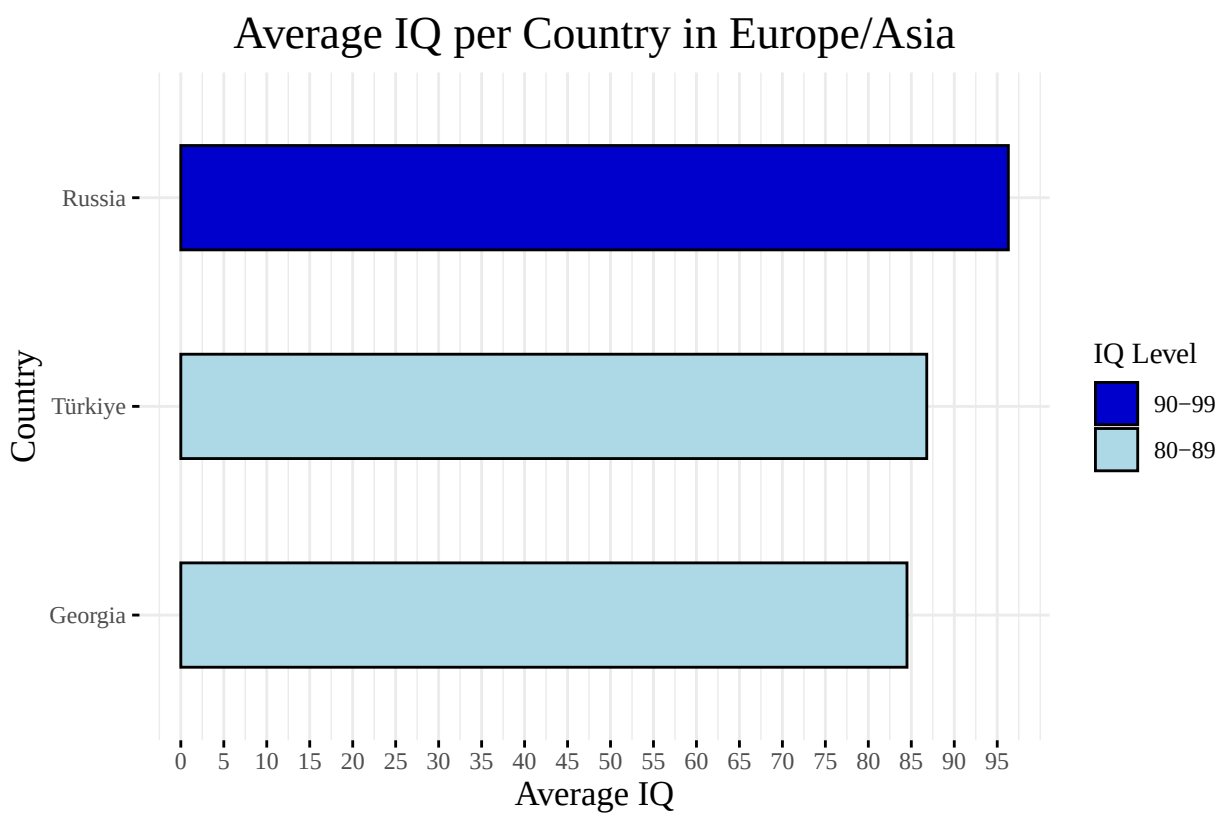


Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.

Bar Graph of Average IQ per Country In Europe/Asia

```
# Filter the dataset for Eurasian countries
eurasian_data <- avgIQpercountry %>%
  filter(Continent == "Europe/Asia") %>%
  mutate(Country = ifelse(Country == "Turkey", "Türkiye", Country),
         IQ_level = sapply(`Average IQ`, iq_labels))

# Create the color palette based on unique IQ levels in eurasian_data
iq_color_values <- sapply(unique(eurasian_data$IQ_level), iq_colors)
names(iq_color_values) <- unique(eurasian_data$IQ_level)
```

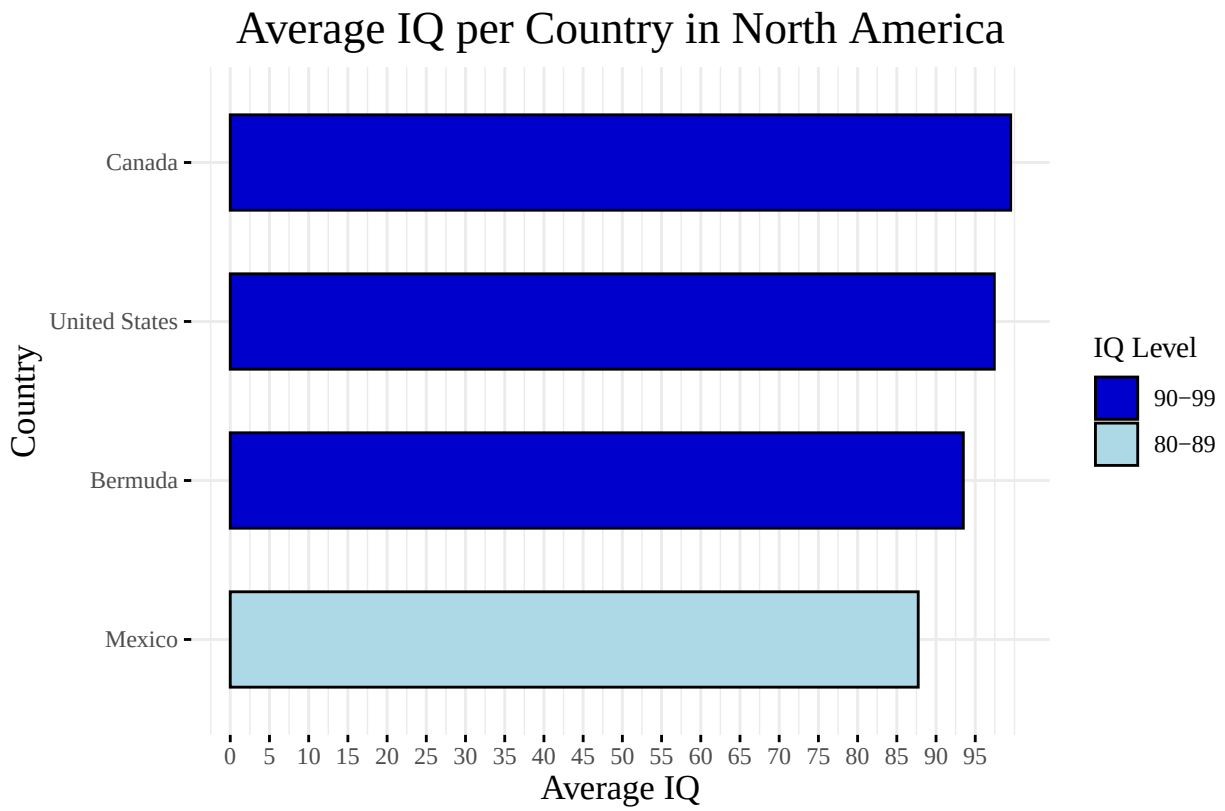
```r
# Create bar graph
ggplot(eurasian_data, aes(x = reorder(Country, `Average IQ`),
                          y = `Average IQ`, fill = IQ_level)) +
  geom_bar(stat = "identity", color = "#000000", width = 0.5) +
  coord_flip() +
  theme_minimal() +
  scale_fill_manual(values = iq_color_values, name = "IQ Level") +
  guides(fill = guide_legend(reverse = TRUE)) + # Reverse legend order
  labs(title = "Average IQ per Country in Europe/Asia",
       x = "Country", y = "Average IQ",
       caption = "Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.") +
  scale_y_continuous(breaks = seq(0, max(eurasian_data$`Average IQ`, na.rm = TRUE),
                                  by = 5)) +
  theme(text = element_text(family = "serif"),
        axis.text.x = element_text(size = rel(1)), # x-axis labels
        axis.text.y = element_text(size = rel(1)), # y-axis labels
        axis.title.x = element_text(size = rel(1.2)), # x-axis title
        axis.title.y = element_text(size = rel(1.2)), # y-axis title
        plot.title = element_text(hjust = 0.5, size = rel(1.5)), # Center title
        plot.caption = element_text(hjust = 1, size = rel(1)), # Center caption
        axis.ticks.x = element_line(color = "black"), # Add black ticks on x-axis
        axis.ticks.y = element_line(color = "black"), # Add black ticks on y-axis
        legend.position = "right")
```



Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.

Bar Graph of Average IQ per Country In North America

```r
# Filter the dataset for North American countries
northamerican_data <- avgIQpercountry %>%
  filter(Continent == "North America") %>%
  mutate(IQ_level = sapply(`Average IQ`, iq_labels))

# Create the color palette based on unique IQ levels in northamerican_data
iq_color_values <- sapply(unique(northamerican_data$IQ_level), iq_colors)
names(iq_color_values) <- unique(northamerican_data$IQ_level)

# Create bar graph
ggplot(northamerican_data, aes(x = reorder(Country, `Average IQ`),
                               y = `Average IQ`, fill = IQ_level)) +
  geom_bar(stat = "identity", color = "#000000", width = 0.6) +
  coord_flip() +
  theme_minimal() +
  scale_fill_manual(values = iq_color_values, name = "IQ Level") +
  guides(fill = guide_legend(reverse = TRUE)) + # Reverse legend order
  labs(title = "Average IQ per Country in North America",
       x = "Country", y = "Average IQ",
       caption = "Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.") +
  scale_y_continuous(breaks = seq(0, max(northamerican_data$`Average IQ`,
                                         na.rm = TRUE), by = 5)) +
  theme(text = element_text(family = "serif"),
        axis.text.x = element_text(size = rel(1)), # x-axis labels
        axis.text.y = element_text(size = rel(1)), # y-axis labels
        axis.title.x = element_text(size = rel(1.2)), # x-axis title
        axis.title.y = element_text(size = rel(1.2)), # y-axis title
        plot.title = element_text(hjust = 0.5, size = rel(1.5)), # Center title
        plot.caption = element_text(hjust = 1, size = rel(1)), # Center caption
        axis.ticks.x = element_line(color = "black"), # Add black ticks on x-axis
        axis.ticks.y = element_line(color = "black"), # Add black ticks on y-axis
        legend.position = "right")
```

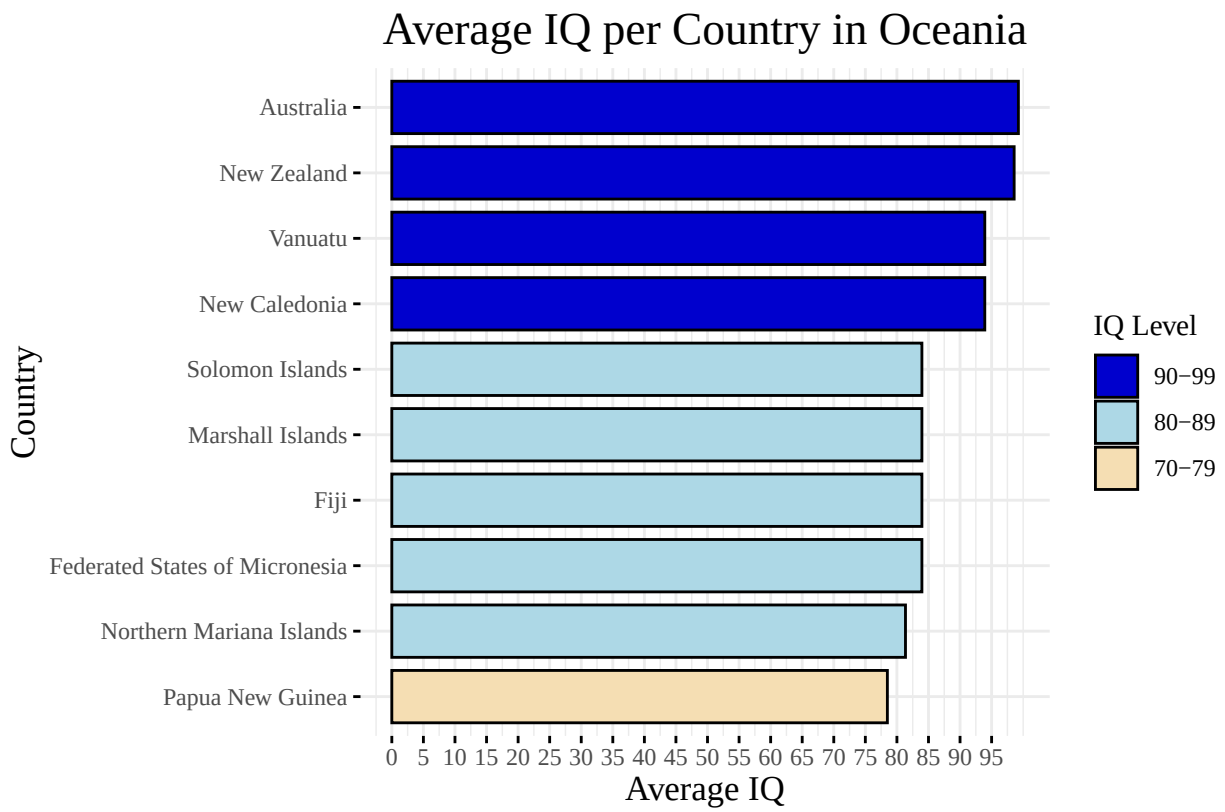


Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.

Bar Graph of Average IQ per Country In Oceania

```
# Filter the dataset for Oceanian countries
oceanian_data <- avgIQpercountry %>%
  filter(Continent == "Oceania") %>%
  mutate(IQ_level = sapply(`Average IQ`, iq_labels))

# Create the color palette based on unique IQ levels in oceanian_data
iq_color_values <- sapply(unique(oceanian_data$IQ_level), iq_colors)
names(iq_color_values) <- unique(oceanian_data$IQ_level)

# Create bar graph
ggplot(oceanian_data, aes(x = reorder(Country, `Average IQ`),
                          y = `Average IQ`, fill = IQ_level)) +
  geom_bar(stat = "identity", color = "black", width = 0.8) +
  coord_flip() +
  theme_minimal() +
  scale_fill_manual(values = iq_color_values, name = "IQ Level") +
  guides(fill = guide_legend(reverse = TRUE)) + # Reverse legend order
  labs(title = "Average IQ per Country in Oceania",
       x = "Country", y = "Average IQ",
       caption = "Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.") +
  scale_y_continuous(breaks = seq(0, max(oceanian_data$`Average IQ`, na.rm = TRUE),
                                  by = 5)) +
  theme(text = element_text(family = "serif"),
        axis.text.x = element_text(size = rel(1)), # x-axis labels
```

```
        axis.text.y = element_text(size = rel(1)), # y-axis labels
        axis.title.x = element_text(size = rel(1.2)), # x-axis title
        axis.title.y = element_text(size = rel(1.2)), # y-axis title
        plot.title = element_text(hjust = 0.5, size = rel(1.5)), # Center title
        plot.caption = element_text(hjust = 1, size = rel(1)), # Center caption
        axis.ticks.x = element_line(color = "black"), # Add black ticks on x-axis
        axis.ticks.y = element_line(color = "black"), # Add black ticks on y-axis
        legend.position = "right")
```

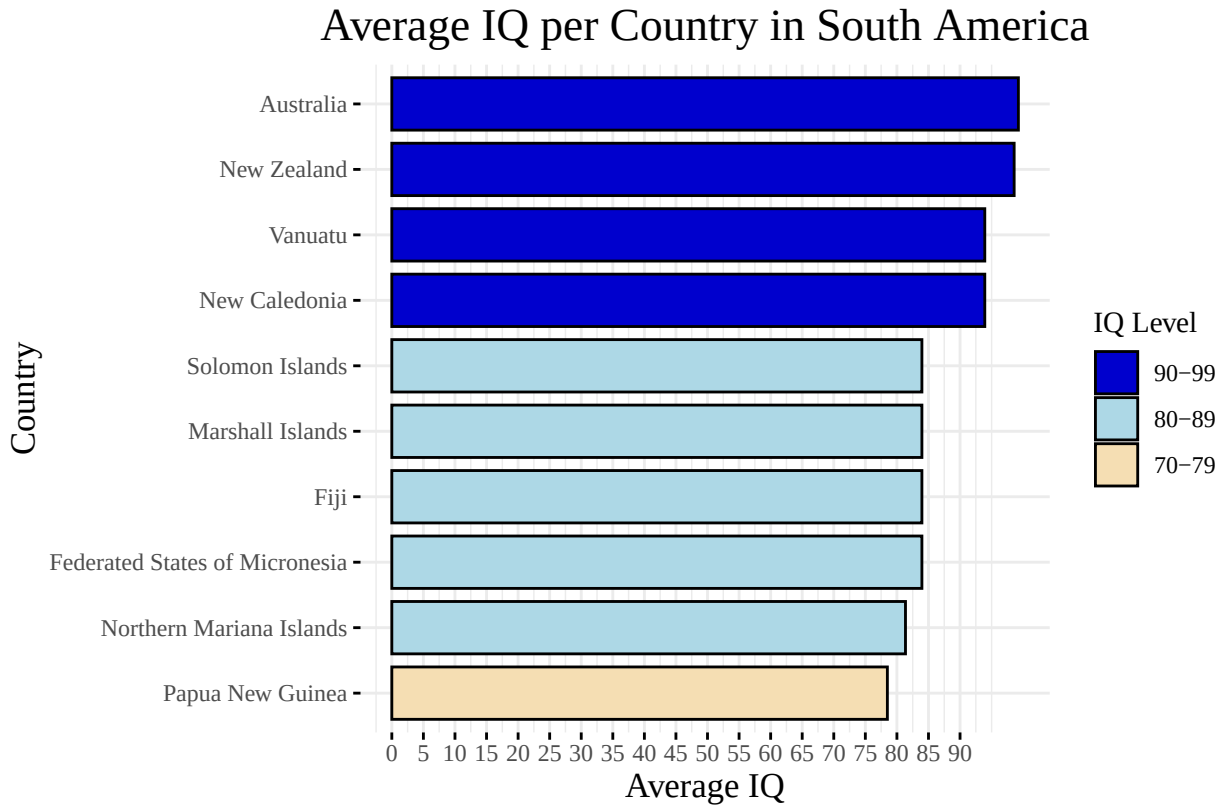


Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.

Bar Graph of Average IQ per Country In South America

```
# Filter the dataset for South American countries
southamerican_data <- avgIQpercountry %>%
  filter(Continent == "South America") %>%
  mutate(IQ_level = sapply(`Average IQ`, iq_labels))

# Create the color palette based on unique IQ levels in southamerican_data
iq_color_values <- sapply(unique(southamerican_data$IQ_level), iq_colors)
names(iq_color_values) <- unique(southamerican_data$IQ_level)

# Create bar graph
ggplot(oceanian_data, aes(x = reorder(Country, `Average IQ`), y = `Average IQ`,
                          fill = IQ_level)) +
  geom_bar(stat = "identity", color = "#000000", width = 0.8) +
  coord_flip() +
  theme_minimal() +
```

```
  scale_fill_manual(values = iq_color_values, name = "IQ Level") +
  guides(fill = guide_legend(reverse = TRUE)) + # Reverse legend order
  labs(title = "Average IQ per Country in South America",
       x = "Country", y = "Average IQ",
       caption = "Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.") +
  scale_y_continuous(breaks = seq(0, max(southamerican_data$`Average IQ`, na.rm = TRUE), by = 5)) +
  theme(text = element_text(family = "serif"),
        axis.text.x = element_text(size = rel(1)), # x-axis labels
        axis.text.y = element_text(size = rel(1)), # y-axis labels
        axis.title.x = element_text(size = rel(1.2)), # x-axis title
        axis.title.y = element_text(size = rel(1.2)), # y-axis title
        plot.title = element_text(hjust = 0.5, size = rel(1.5)), # Center title
        plot.caption = element_text(hjust = 1, size = rel(1)), # Center caption
        axis.ticks.x = element_line(color = "black"), # Add black ticks on x-axis
        axis.ticks.y = element_line(color = "black"), # Add black ticks on y-axis
        legend.position = "right")
```



Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.

$H_0 : \mu_{\text{Muslim IQ}} = \mu_{\text{Non-Muslim IQ}}$ vs $H_a : \mu_{\text{Muslim IQ}} \neq \mu_{\text{Non-Muslim IQ}}$

Hypothesis Testing 2

```
muslim_nonmuslim <- avgIQpercountry %>%
  filter(Country %in% c("United States", "Israel", "Palestine", "Syria",
                        "Jordan", "Egypt", "Lebanon", "Iraq"))
muslim_nonmuslim$Group <- ifelse(muslim_nonmuslim$Country %in%
                                   c("United States", "Israel"), "Non-Muslim",
```

```
                                                                    "Muslim")
# Perform a One-Way Analysis of Variance (ANOVA)
abab_israeli <- aov(`Average IQ`~Group, data = muslim_nonmuslim)
summary(abab_israeli)
```

```
##             Df Sum Sq Mean Sq F value Pr(>F)
## Group        1  333.6   333.6   13.16  0.011 *
## Residuals    6  152.1    25.4
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
TukeyHSD(abab_israeli) # pairwise comparison test
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = `Average IQ` ~ Group, data = muslim_nonmuslim)
##
## $Group
##                         diff      lwr      upr    p adj
## Non-Muslim-Muslim 14.91333 4.853403 24.97326 0.010999
```

f = 13.16; p-value = 0.011

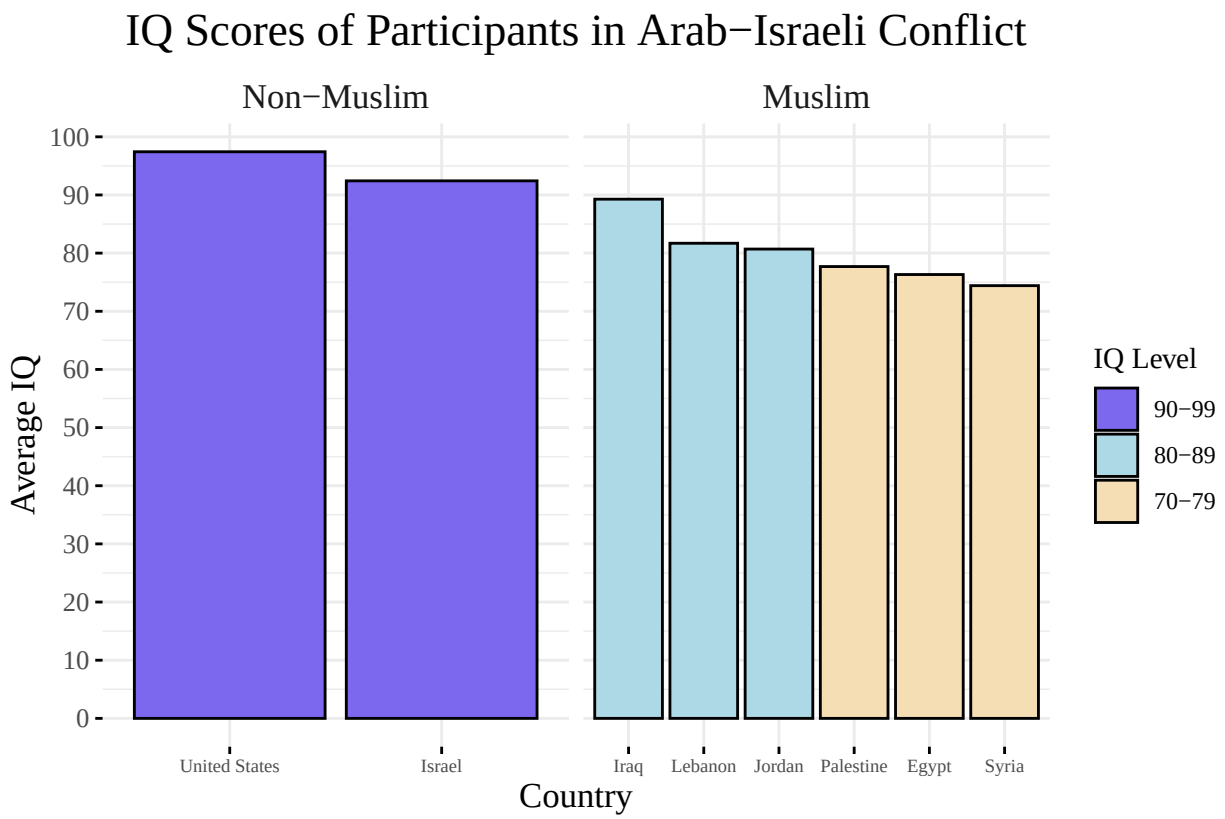
Reject H0; there is no evidence to support the claim that the mean IQs between these Muslim and Non-Muslim countries are equal at the 0.05 significance level.

In the pairwise comparison test, it is found the Muslim and Non-Muslim countries are significantly different in average IQ scores. This is denoted by the low probability value (i.e. 0.010999) in the "p adj" column. Viz., the probability this pair is equivalent is 1.0999%.

Compare IQ in Countries Involved in Arab-Israeli Conflict

```
# Define the grouping of countries and prepare the data
selected_countries_data <- avgIQpercountry %>%
  filter(Country %in% c("United States", "Israel",
                        "Palestine", "Syria",
                        "Jordan", "Egypt",
                        "Lebanon", "Iraq")) %>%
  select(Country, `Average IQ`) %>%
  arrange(desc(`Average IQ`)) %>% # Sorting by descending IQ
  mutate(Color = sapply(`Average IQ`, iq_colors), # Apply the iq_colors function
         IQ_Range = sapply(`Average IQ`, iq_labels), # Apply the iq_labels function
         Category = factor(ifelse(Country %in% c("United States", "Israel"),
                                  "Non-Muslim", "Muslim"),
                           levels = c("Non-Muslim", "Muslim")))

# Ensure the order of factors in Country matches the descending IQ order
selected_countries_data$Country <- factor(selected_countries_data$Country,
                                          levels = selected_countries_data$Country)

# Graph their IQs with custom colors and relative text sizing
ggplot(selected_countries_data, aes(x = Country, y = `Average IQ`,
```

```
                                    fill = IQ_Range)) +
  geom_bar(stat = "identity", color = "#000000") +
  scale_fill_manual(values = setNames(as.character(selected_countries_data$Color),
                                      selected_countries_data$IQ_Range),
                    name = "IQ Level") +
  guides(fill = guide_legend(reverse = TRUE)) + # Reverse legend order
  labs(title = "IQ Scores of Participants in Arab-Israeli Conflict",
       x = "Country", y = "Average IQ",
       caption = "Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.") +
  theme_minimal() +
  theme(text = element_text(family = "serif"),
        axis.text.x = element_text(hjust = 0.5, size = rel(0.8)), # x-axis label
        axis.text.y = element_text(size = rel(1.1)), # y-axis label
        axis.title.x = element_text(size = rel(1.2)), # x-axis title
        axis.title.y = element_text(size = rel(1.2)), # y-axis title
        plot.title = element_text(hjust = 0.5, size = rel(1.5)), # Center title
        plot.caption = element_text(hjust = 0.5, size = rel(0.8)),# Center caption
        strip.text = element_text(size = rel(1.2)), # facet titles
        axis.ticks.x = element_line(color = "black"), # Add black ticks on x-axis
        axis.ticks.y = element_line(color = "black")) + # Add black ticks on y-axis
  scale_y_continuous(breaks = seq(0, 100, by = 10)) + # y-axis ticks
  facet_wrap(~ Category, scales = "free_x") # Split graph into two categories
```



Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.

$H_0 : \mu_{\text{Allied With Russia IQ}} = \mu_{\text{NATO IQ}}$ vs $H_a : \mu_{\text{Allied With Russia IQ}} \neq \mu_{\text{NATO IQ}}$

Hypothesis Testing 3

```r
# Create the dataset and assign groups
NATO_nonNATO <- avgIQpercountry %>%
  filter(Country %in% c("Russia", "Syria", "Belarus", "Ukraine", "United States",
                        "United Kingdom", "Germany", "France", "Poland",
                        "Canada", "Turkey", "Estonia", "Latvia", "Lithuania",
                        "Moldova", "Hungary", "Slovakia")) %>%
  mutate(Group = ifelse(Country %in% c("Russia", "Belarus", "Syria"),
                        "Allied With Russia",
                        "NATO"))

# Perform a One-Way Analysis of Variance (ANOVA)
abab_israeli3 <- aov(`Average IQ`~Group, data = NATO_nonNATO)
summary(abab_israeli3)
```

```
##             Df Sum Sq Mean Sq F value Pr(>F)
## Group        1   78.4   78.37   1.786  0.203
## Residuals   14  614.3   43.88
```

```r
TukeyHSD(abab_israeli3) # pairwise comparison test
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = `Average IQ` ~ Group, data = NATO_nonNATO)
##
## $Group
##                               diff      lwr      upr     p adj
## NATO-Allied With Russia 5.670256 -3.42984 14.77035 0.2027295
```

f = 1.786; p-value = 0.203

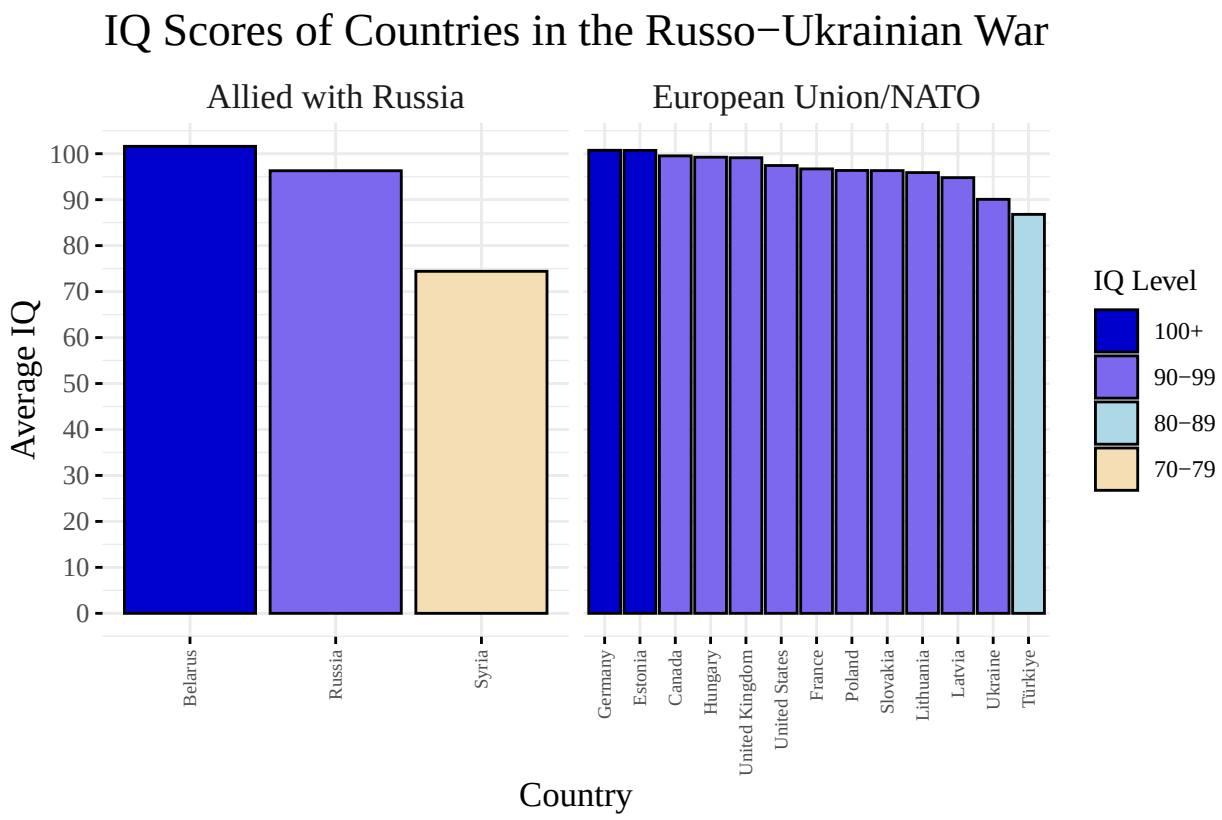
Fail to reject H0; there is no evidence to support the claim that the mean IQs between these NATO and Non-NATO countries are different at the 0.05 significance level.

In the pairwise comparison test, it is found that NATO and Non-NATO countries are not significantly different in average IQ scores. This is denoted by the high probability value (i.e. 0.2027295) in the "p adj" column. Viz., the probability this pair is equivalent is 20.27%.

Compare IQ in Countries Involved in Russo-Ukrainian War

```r
# Define the grouping of countries and prepare the data
selected_countries_data <- avgIQpercountry %>%
  filter(Country %in% c("Russia", "Syria", "Belarus", "Ukraine", "United States",
                        "United Kingdom", "Germany", "France", "Poland",
                        "Canada", "Turkey", "Estonia", "Latvia", "Lithuania",
                        "Moldova", "Hungary", "Slovakia")) %>%
  mutate(Country = gsub("Turkey", "Türkiye", Country)) %>% # Replace Turkey with Türkiye
  select(Country, `Average IQ`) %>%
  arrange(desc(`Average IQ`)) %>% # Sorting by descending IQ
  mutate(Color = sapply(`Average IQ`, iq_colors), # Apply the iq_colors function
         IQ_Range = sapply(`Average IQ`, iq_labels), # Apply the iq_labels function
         Category = factor(ifelse(Country %in% c("Russia", "Belarus", "Syria"),
                                  "Allied with Russia", "European Union/NATO"),
```

```
                          levels = c("Allied with Russia", "European Union/NATO")))

# Ensure the order of factors in Country matches the descending IQ order
selected_countries_data$Country <- factor(selected_countries_data$Country,
                                          levels = selected_countries_data$Country)

# Graph their IQs with custom colors and relative text sizing
ggplot(selected_countries_data, aes(x = Country, y = `Average IQ`,
                                    fill = IQ_Range)) +
  geom_bar(stat = "identity", color = "#000000") +
  scale_fill_manual(values = setNames(as.character(selected_countries_data$Color),
                                      selected_countries_data$IQ_Range),
                    name = "IQ Level",
                    breaks = c("100+", "90-99", "80-89", "70-79")) + # Order legend
  guides(fill = guide_legend(reverse = FALSE)) + # Maintain specified order
  labs(title = "IQ Scores of Countries in the Russo-Ukrainian War",
       x = "Country", y = "Average IQ",
       caption = "Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.") +
  theme_minimal() +
  theme(text = element_text(family = "serif"),
        axis.text.x = element_text(angle = 90, hjust = 1,
                                   vjust = .5, size = rel(0.8)), # x-axis label
        axis.text.y = element_text(size = rel(1.1)), # y-axis label
        axis.title.x = element_text(size = rel(1.2)), # x-axis title
        axis.title.y = element_text(size = rel(1.2)), # y-axis title
        plot.title = element_text(hjust = 0.5, size = rel(1.5)), # Center title
        plot.caption = element_text(hjust = 0.5, size = rel(0.8)), # Center caption
        strip.text = element_text(size = rel(1.2)), # facet titles
        axis.ticks.x = element_line(color = "black"), # Add black ticks on x-axis
        axis.ticks.y = element_line(color = "black")) + # Add black ticks on y-axis
  scale_y_continuous(breaks = seq(0, 100, by = 10)) + # y-axis ticks
  facet_wrap(~ Category, scales = "free_x") # Split graph into two categories
```



Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.