

National Intelligence Quotient (IQ) Scores

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

Let $\alpha = 0.05$ (significance level)

$H_0 : \mu_{AF} = \mu_{AS} = \mu_{CA} = \mu_{EU} = \mu_{EA} = \mu_{NA} = \mu_{OC} = \mu_{SA}$ 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 0.000000000000002% 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

```
# 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

```

# 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

# 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))

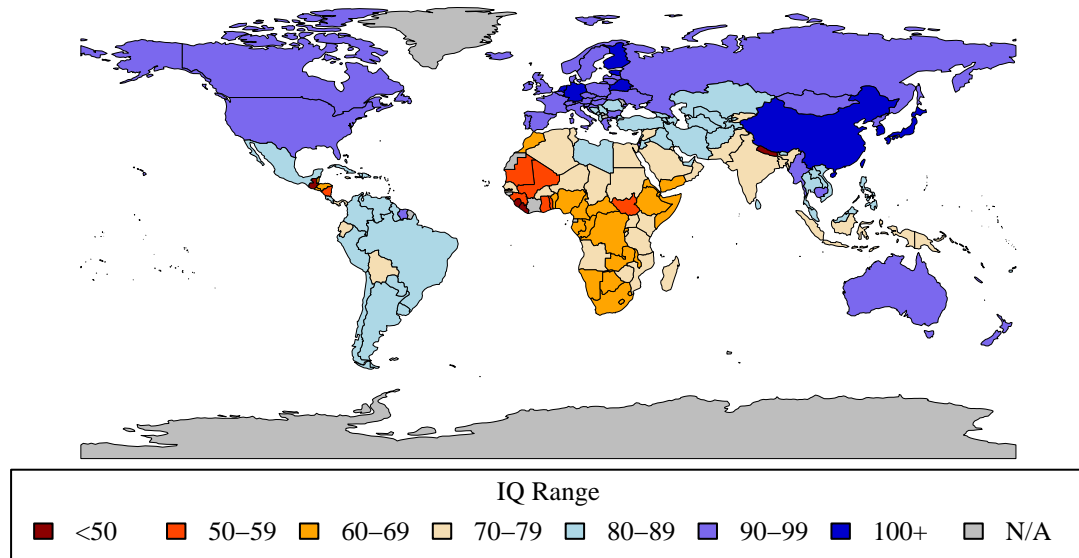
# Add "N/A" to the legend manually
legend_labels <- c(legend_labels, "N/A")
legend_colors <- c(legend_colors, "gray")

# 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
```

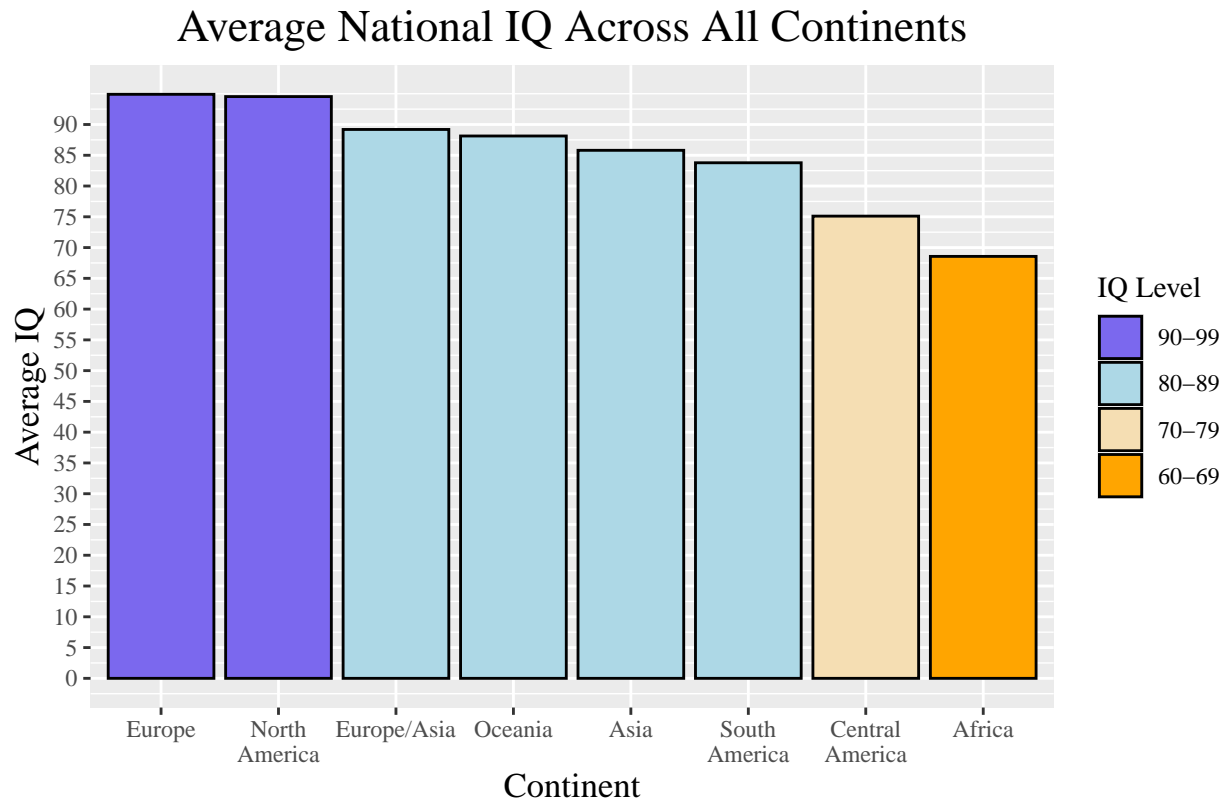
```
## # A tibble: 8 x 4
##   Continent      Average_IQ Color   Label
##   <chr>          <dbl> <chr>   <chr>
## 1 Europe          94.9 #7B68EE 90-99
## 2 North America  94.5 #7B68EE 90-99
## 3 Europe/Asia    89.2 #ADD8E6 80-89
## 4 Oceania        88.1 #ADD8E6 80-89
## 5 Asia           85.8 #ADD8E6 80-89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

```

# 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

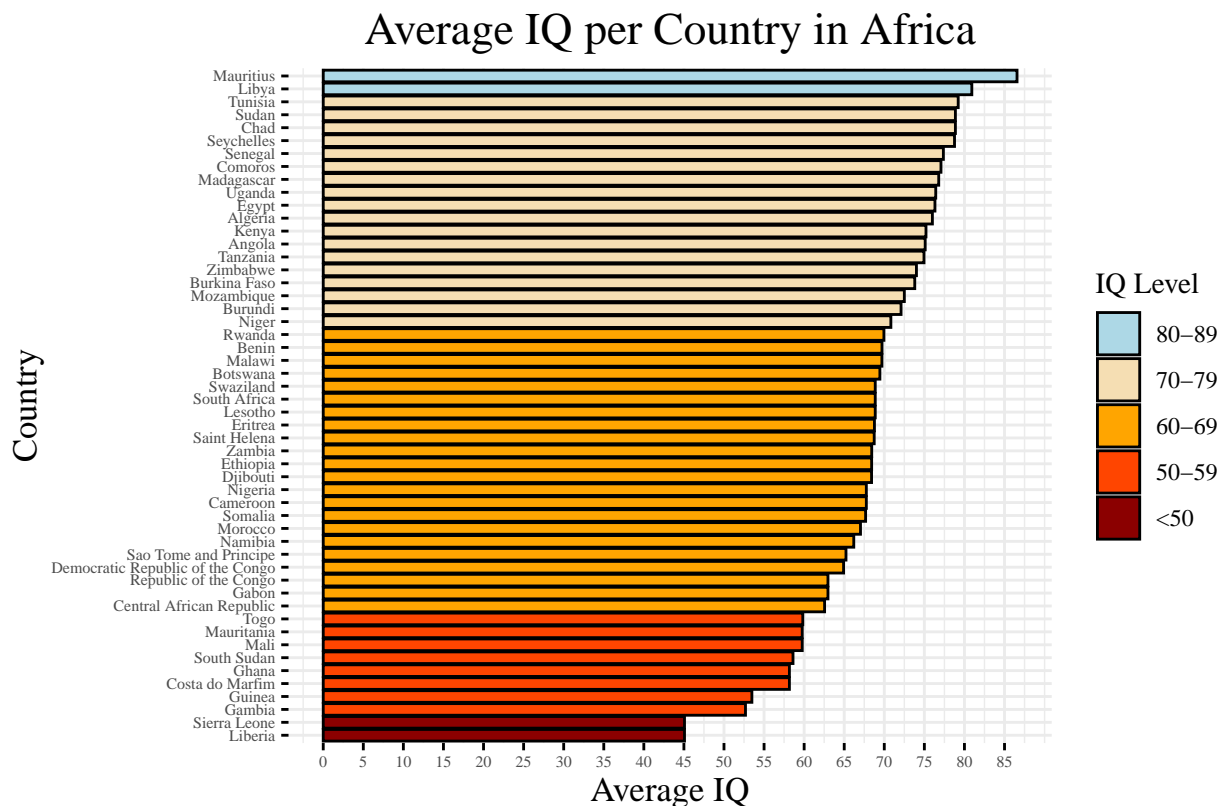
```
# Filter the dataset for African countries
africa_data <- avgIQpercountry %>%
  filter(Continent == "Africa") %>%
  mutate(IQ_level = sapply(`Average IQ`, iq_labels))

# 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))

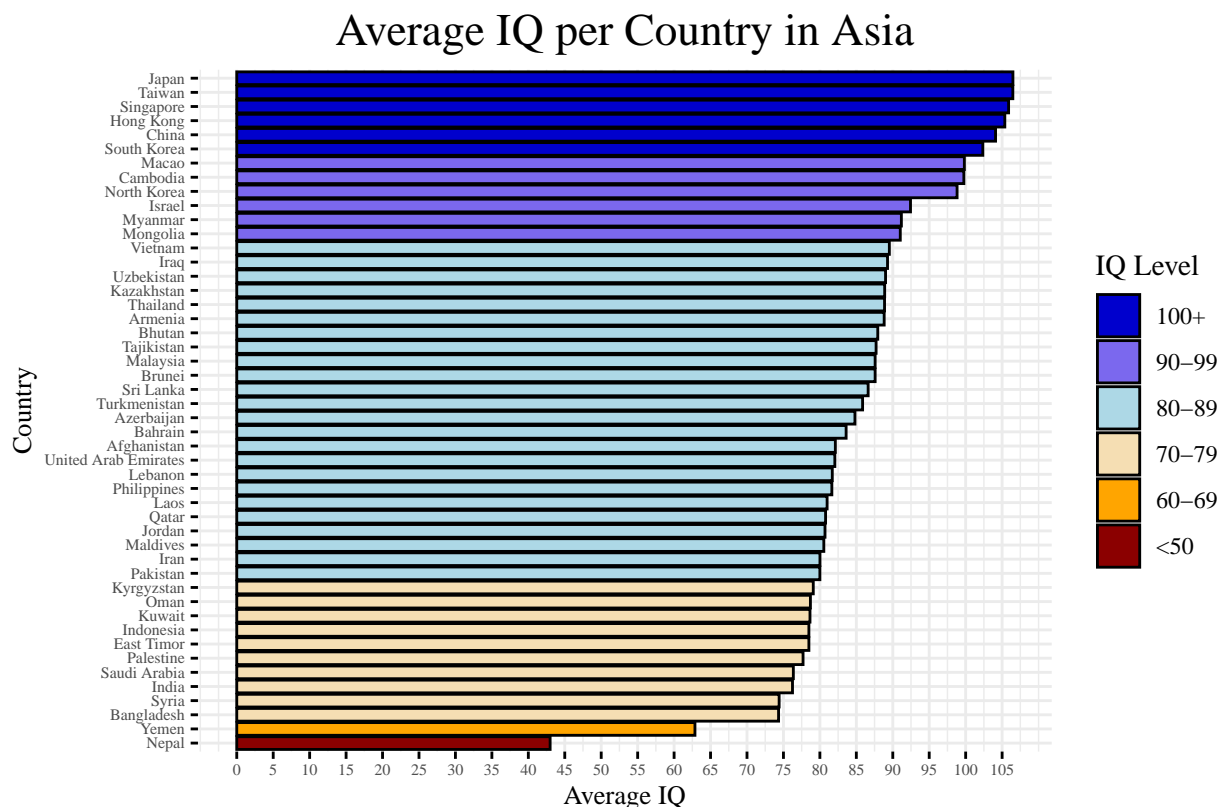
# Define the color palette
iq_color_values <- c("<50" = "#8B0000", "60-69" = "#FFA500", "70-79" = "#F5DEB3",
                    "80-89" = "#ADD8E6", "90-99" = "#7B68EE", "100+" = "#0000CD")

# 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") %>%

```

```

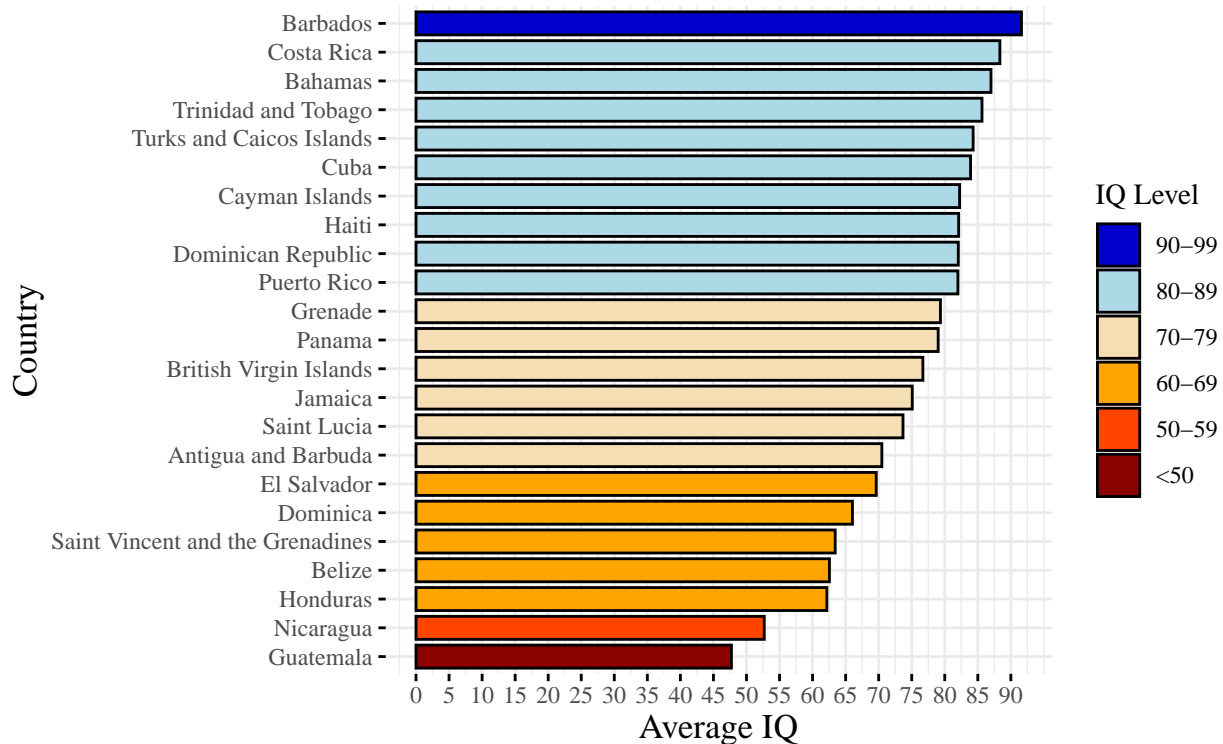
mutate(IQ_level = sapply(`Average IQ`, iq_labels))

# 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")

```

Average IQ per Country in Central America



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

Bar Graph of Average IQ per Country In Europe

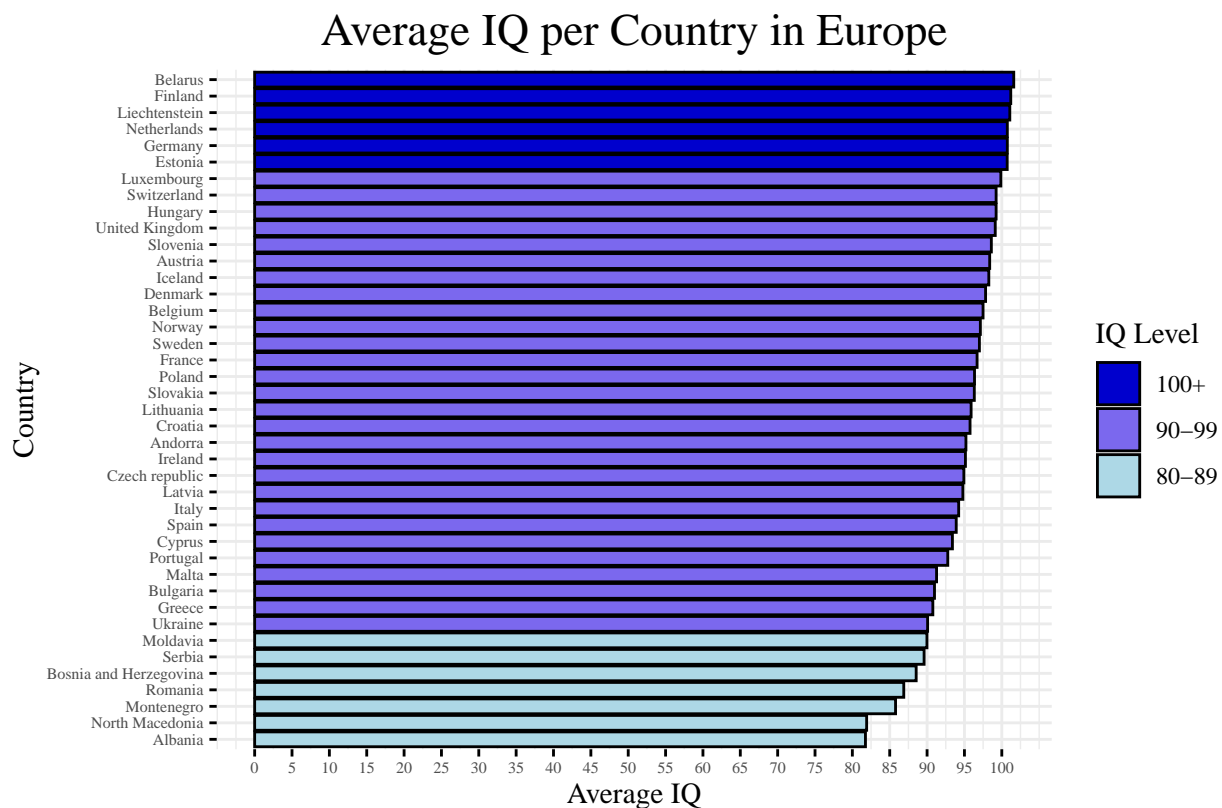
```
# Define the order of levels for IQ_level factor
iq_levels_ordered <- c("80-89", "90-99", "100+")

# 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")
```



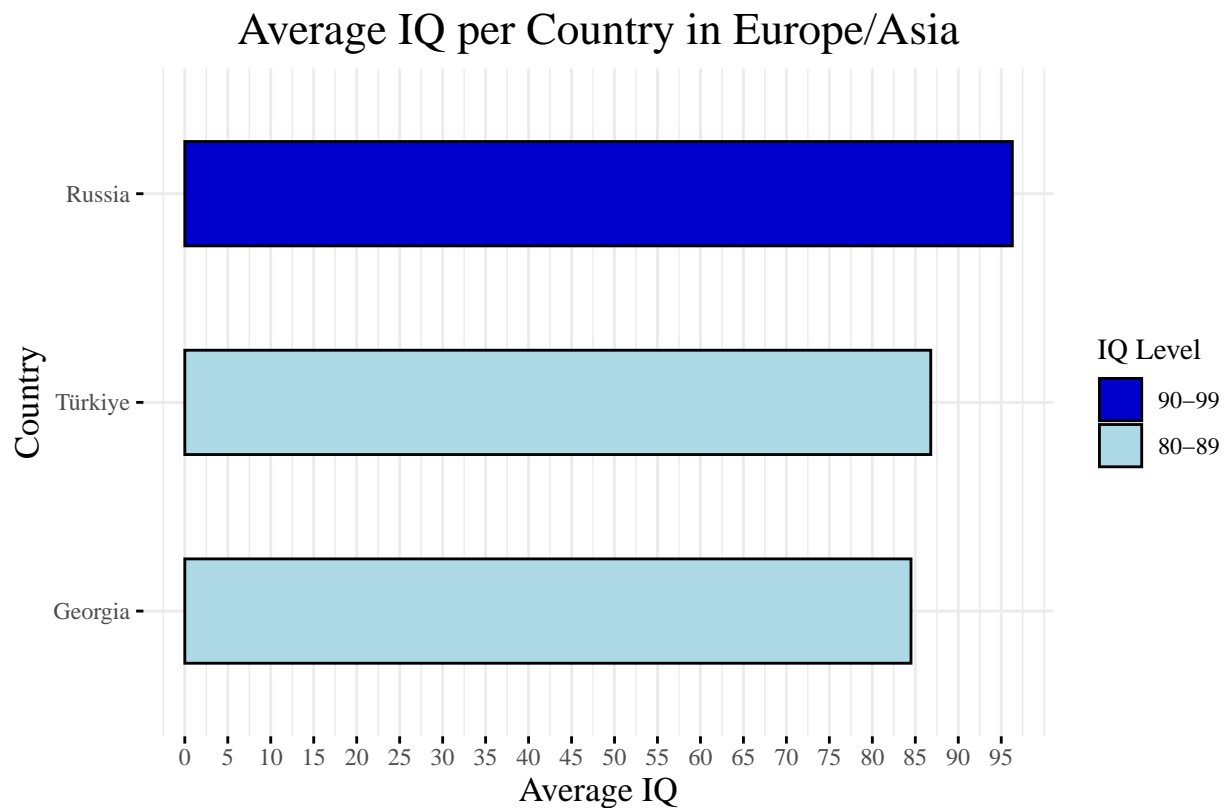
Source: Kaggle/ Google LLC (2023) Average Global IQ per Country with Other Stats.

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)
```

```
# 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

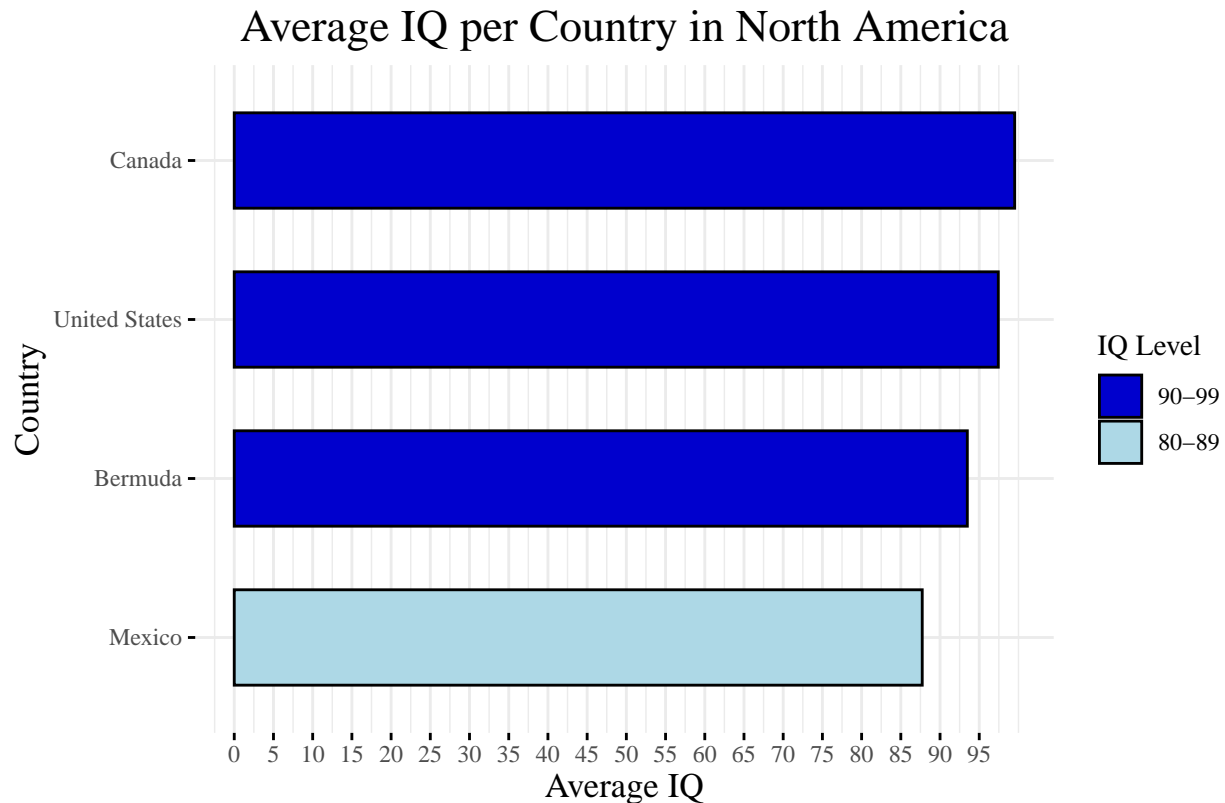
```

# 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

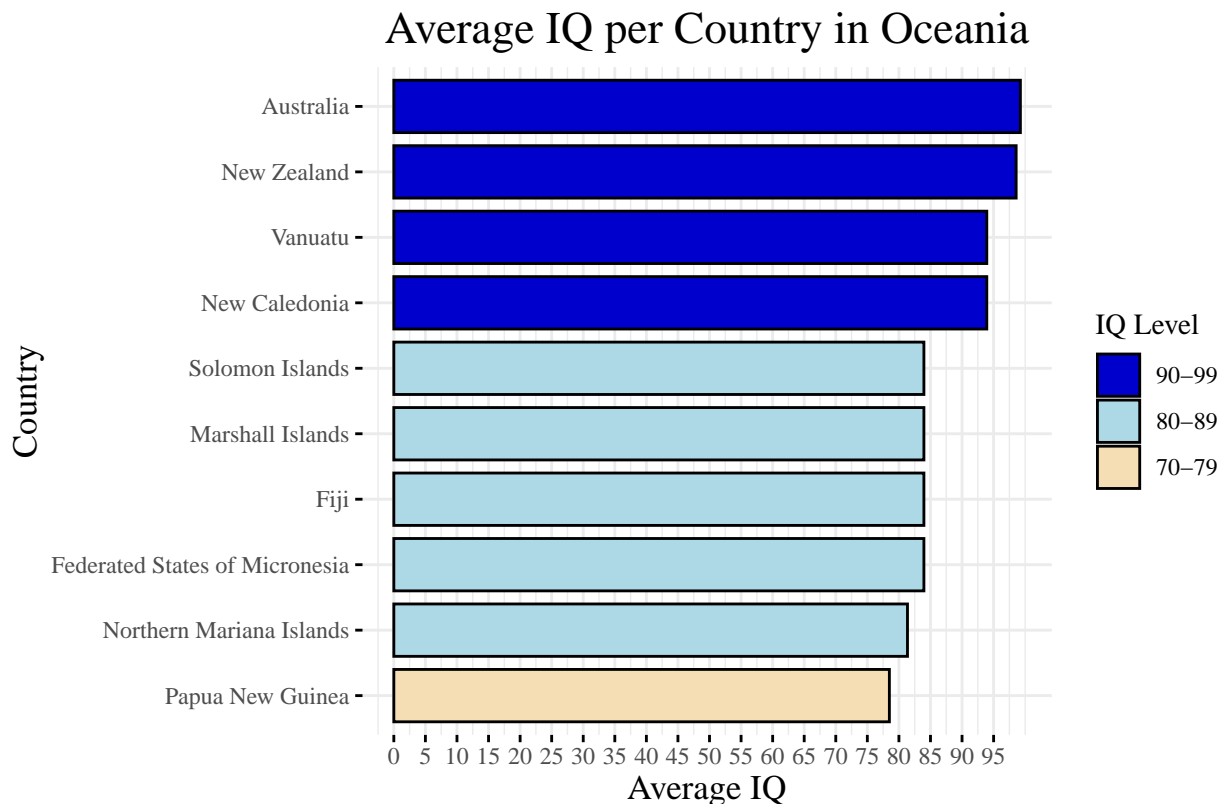
```
# Filter the dataset for Oceanian countries
oceanian_data <- avgIQpercountry %>%
  filter(Continent == "Oceania") %>%
  mutate(IQ_level = sapply(`Average IQ`, iq_labels))

# 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))

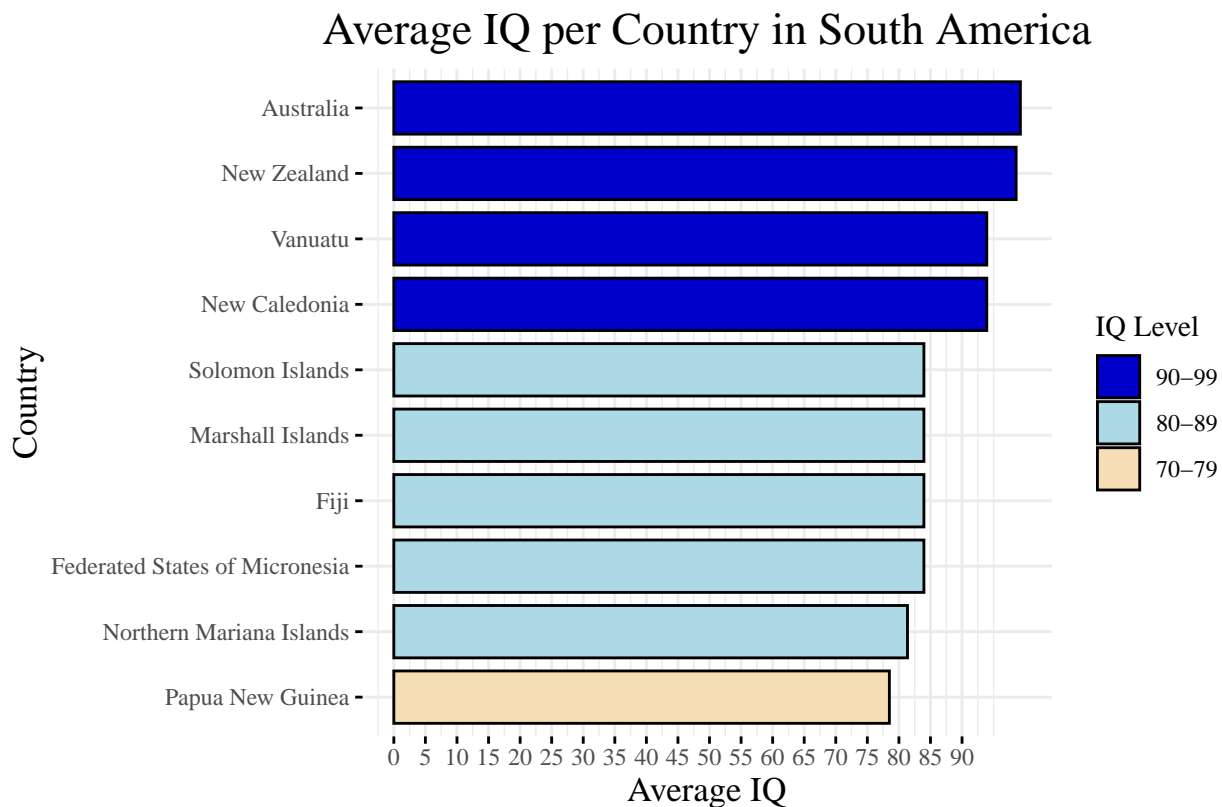
# Create the color palette based on unique IQ levels in southamerican_data
iq_color_values <- sapply(unique(southamerican_data$IQ_level), iq_colors)
names(iq_color_values) <- unique(southamerican_data$IQ_level)

# 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)

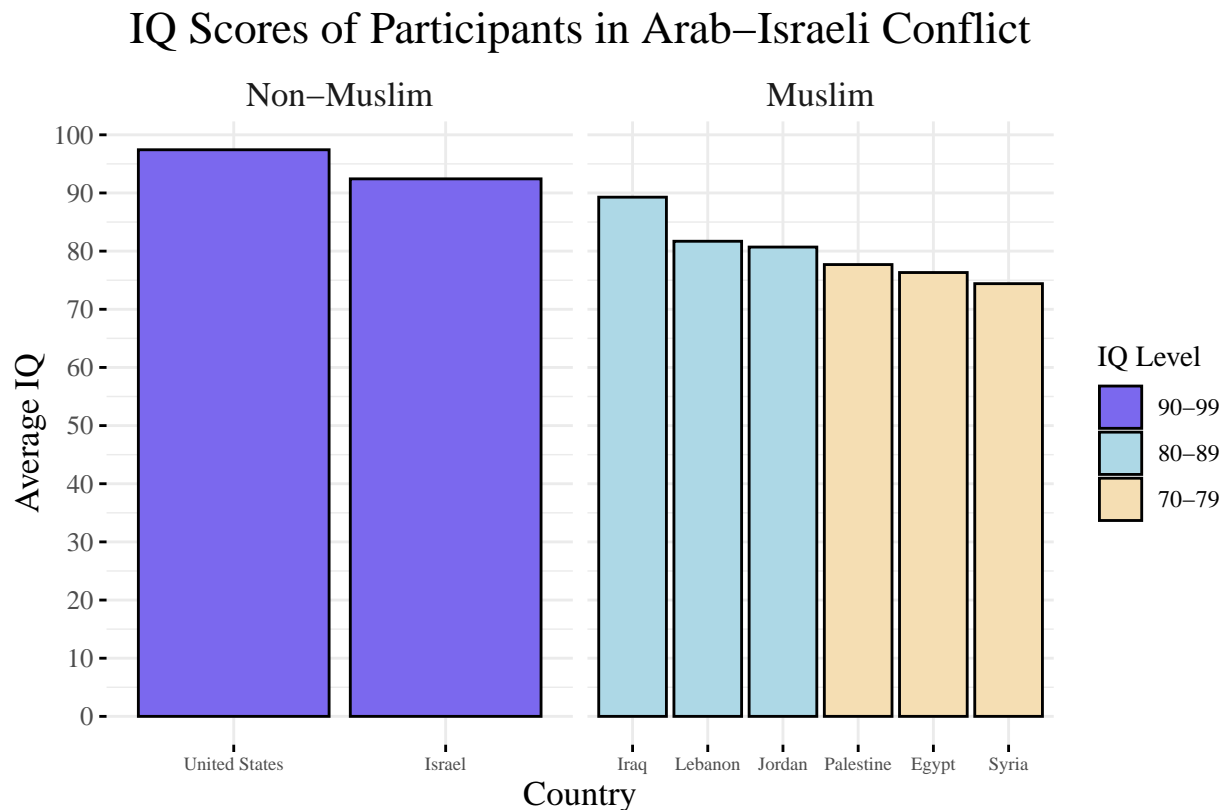
# Graph their IQs with custom colors and relative text sizing
ggplot(selected_countries_data, aes(x = Country, y = `Average IQ`,

```

```

    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

```
# 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_israeli2 <- aov(`Average IQ`~Group, data = NATO_nonNATO)
summary(abab_israeli2)
```

```
##           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
```

```
TukeyHSD(abab_israeli2) # 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
```

$f = 1.786$; $p\text{-value} = 0.203$

Fail to reject H_0 ; 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

```
# 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"),
```

```

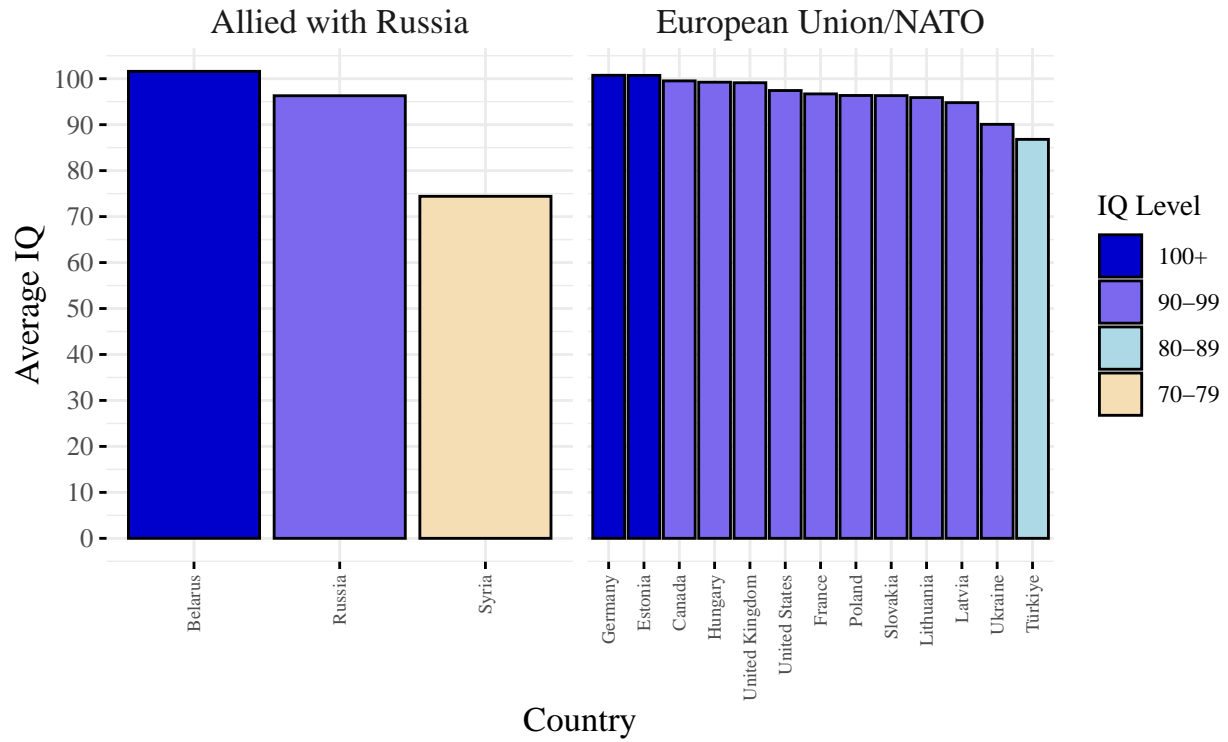
        levels = c("Allied with Russia", "European Union/NATO"))

# 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

```

IQ Scores of Countries in the Russo–Ukrainian War



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