

**Does money buy happiness in the XXI century: Life satisfaction and happiness association with GDP per capita**

*by Ayaz Aliyev*

## **Table of Contents**

1. Story of Happiness, Life satisfaction and Money
  - 1.1 Datasets
2. Theoretical frameworks
3. Visualisation choice
  - 3.1 Scatter plot
  - 3.2 Map
4. Implications and Improvements
  - 4.1 Ethical implications
  - 4.2 Improvements over Visualisations
  - 4.3 Conclusion
5. References

# **1. Story of Happiness, Life satisfaction and Money**

Researchers are actively working on identifying the complex relationship between GDP per capita, happiness and life satisfaction (Aral & Bakir, 2022; Proto & Rustichini, 2014).

It is essential to deeply understand this relationship because of scientific and policy perspectives (Proto & Rustichini, 2013). From a scientific perspective, the debate is important because it helps to understand how income affects life satisfaction and happiness in order to develop policies that can improve the quality of life for citizens. From a policy perspective, the debate is important because it can help to inform policy decisions (Proto & Rustichini, 2013). If higher income is associated with higher life satisfaction and happiness, then policies that focus on increasing income may be more effective in improving the quality of life for citizens.

Additionally, as it is mentioned this relationship is complex. For example, although life satisfaction and happiness are considered the same by the majority, they are not synonymous and their relationship with GDP per capita can differ greatly. According to research by Ortiz-Ospina and Roser (2013), a positive correlation between GDP per capita and life satisfaction is commonly observed, with higher GDP per capita typically corresponding to higher levels of life satisfaction (Degutis et al., 2010). However, it is important to note that this correlation is not necessarily causal and higher GDP per capita does not always result in higher levels of happiness. For example, studies by Stanca (2010) and Clark and Senik (2011) have found that sharp increases in GDP per capita in richer countries do not necessarily have a significant impact on overall happiness.

While analysing this relationship, it is best to see GDP per capita, happiness and life satisfaction maps to understand how their overall relationship is: Figure 1 demonstrates the average GDP per capita in the XXI century:

### Average GDP for the XXI century

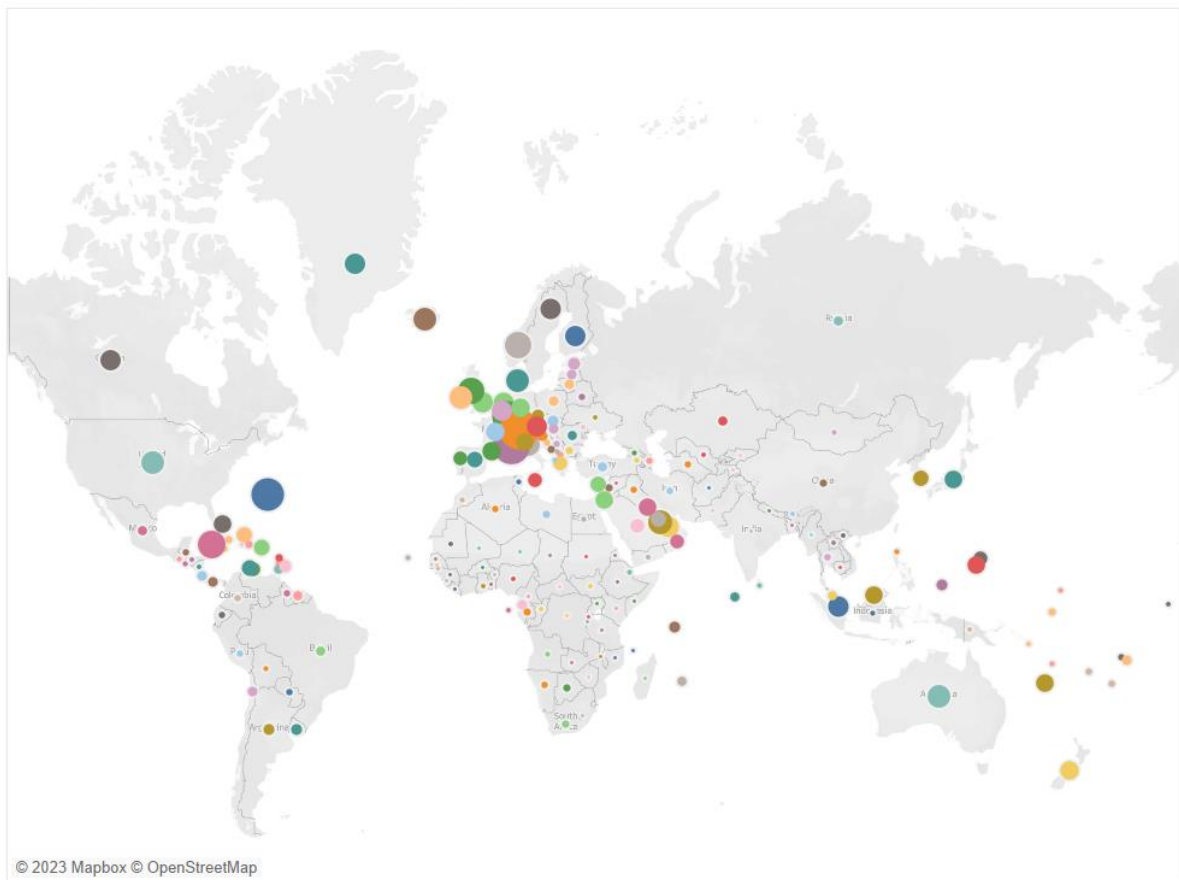


Figure 1. GDP per capita in the 21st century

According to Figure 1, Europe and North America, regions have higher GDP per capita in comparison with other regions so, they should have higher happiness and life satisfaction. However, it's important to note that GDP per capita is just one indicator of a country's or region's economic situation and should be considered in conjunction with other economic and social indicators to get a more comprehensive understanding of the overall situation (Rodriguez-Pose & Maslauskaitė, 2011). Additionally, according to Aral and Bakir's (2022) spatial analysis, even the countries in the neighbourhood influence happiness and life satisfaction rate. Figures 2 and 3 demonstrate the average Happiness and Life satisfaction rate in the XXI century, respectively and it is easily can be seen that generally, happy countries are surrounded by happy countries as well as the countries which have higher life satisfaction:

Happiness for XXI century

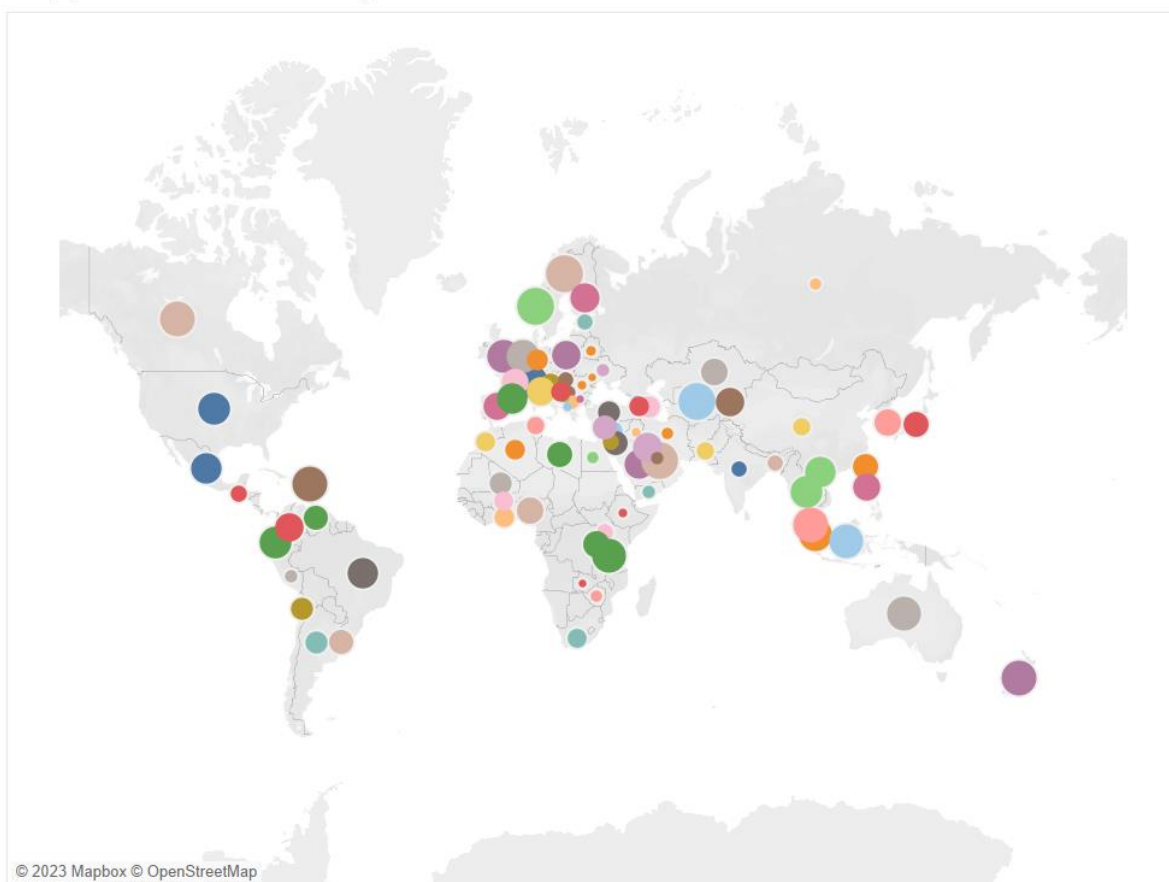


Figure 2. Happiness rate in the 21st century

### Life satisfaction rate for the XXI century

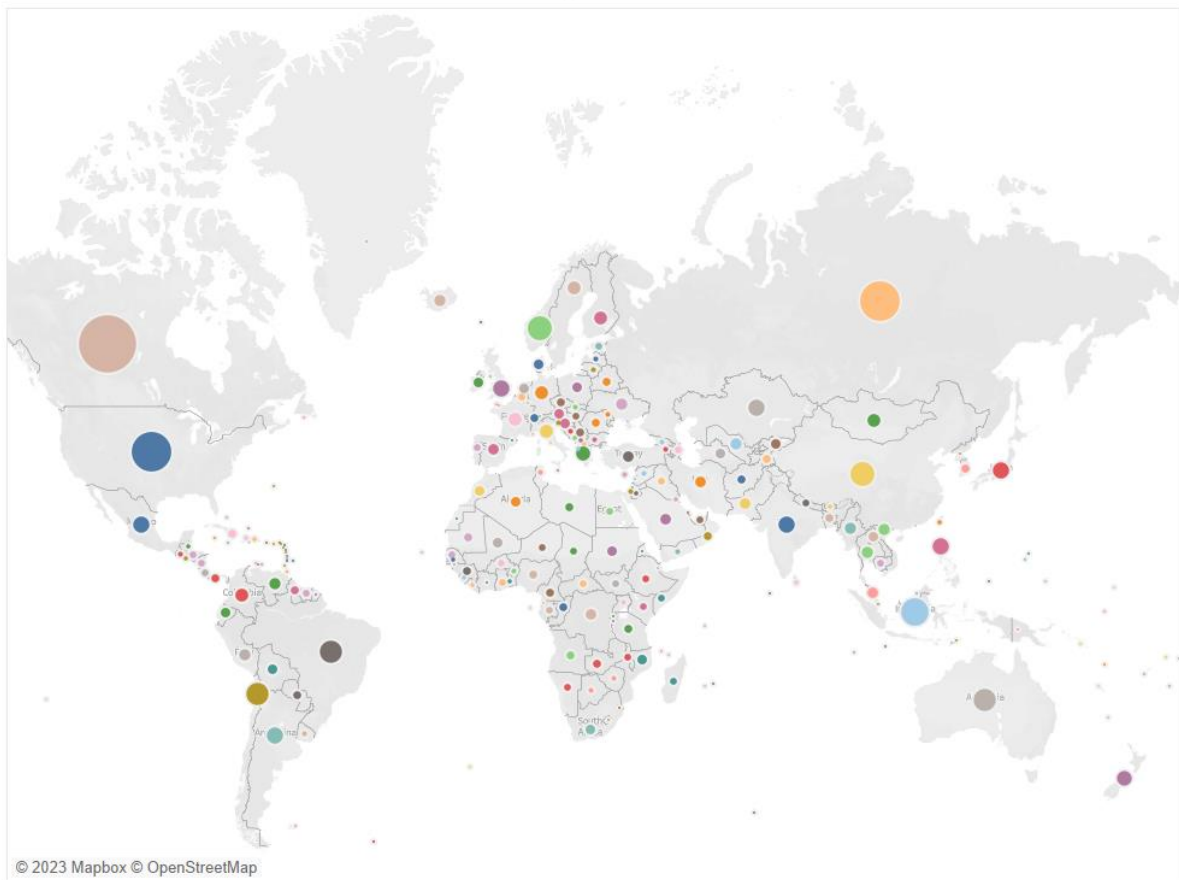


Figure 3. Life satisfaction rate in the 21st century

As it is mentioned happiness and life satisfaction are different indicators and their relationship with GDP per capita is different so, it is easily can be seen in these maps that although GDP per capita is a strong factor that determines higher life satisfaction, it cannot totally explain happiness. Regions like North America and Europe have higher GDP per capita and life satisfaction; however, the happiness map shows us that regions like Southeast Asia and some South America and Middle Eastern countries also reach the highest happiness rates.

At last, to see a clear relationship between these notions and to see the big picture, 4<sup>th</sup> and 5<sup>th</sup> figures demonstrate the relation between GDP per capita and happiness, and GDP per capita and life satisfaction respectively:

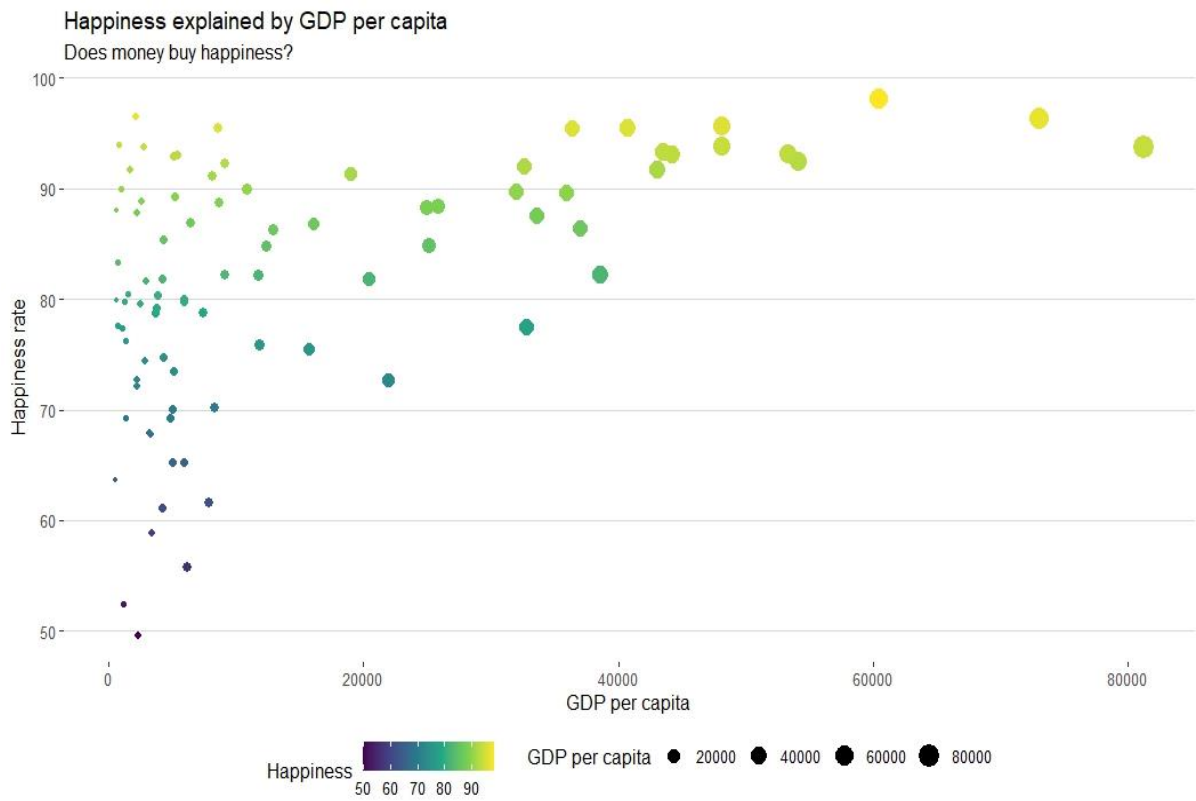


Figure 4. Happiness and GDP per capita

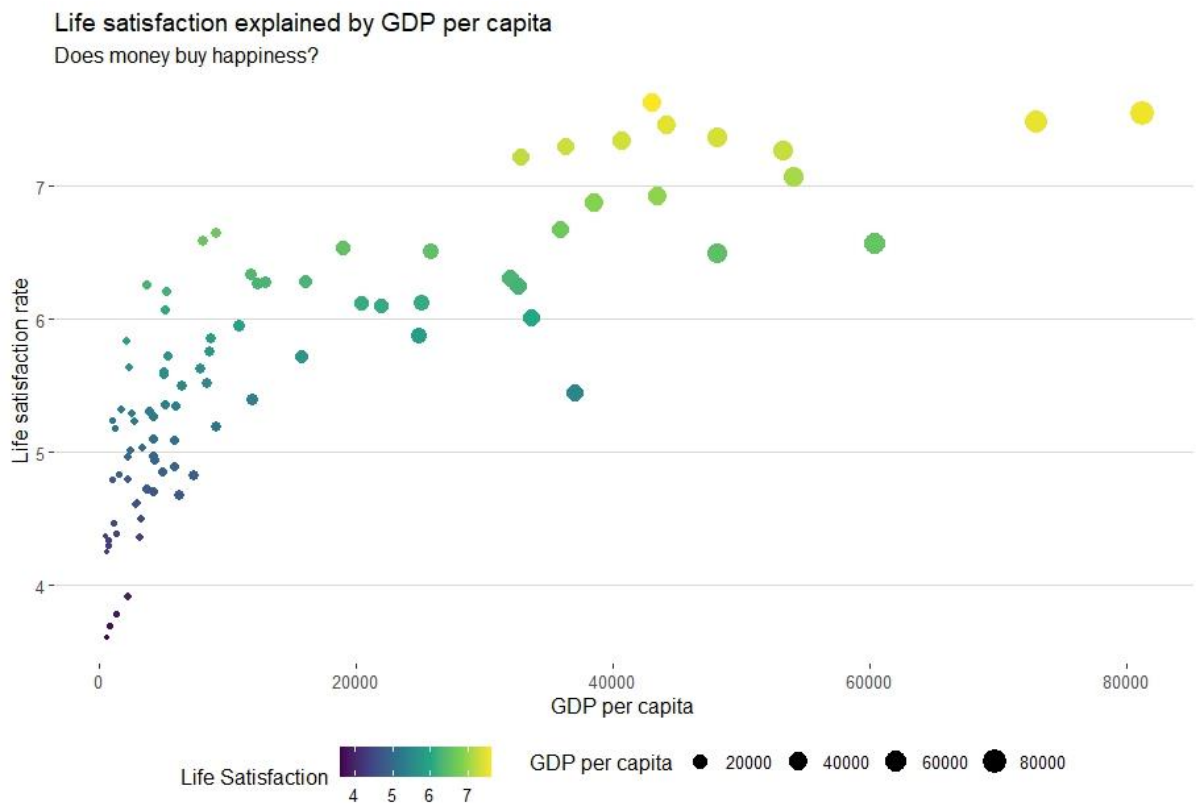


Figure 5. Life satisfaction and GDP per capita

Figures 4 and 5 demonstrate the correlation between GDP per capita and happiness and life satisfaction. While life satisfaction has a strong correlation with GDP per capita, happiness does not show the same strong correlation. These results are exactly the same as we observed on the maps and researched in the literature.

In conclusion, our research found that there is a positive correlation between income and life satisfaction, but not necessarily with happiness. This suggests that money does play a role in overall life satisfaction, but it may not be the sole determining factor in one's happiness. These findings have important implications for individuals and policymakers in the 21st century, as they highlight the need to consider factors beyond just income when striving for overall well-being.

## **1.2 Data sets**

In this report, 3 different data sets on the Our World in Data web page have been used: “GDP per capita in US-Dollar” data set (Our World in Data, 2022), “Share of people who say they are happy” (Our World in Data, 2016) and “Happiness Cantril Ladder” (Our World in Data, 2022). “GDP per capita in US-Dollar” time coverage is 1960-2020, “Share of people who say they are happy” is 1984-2014 and “Happiness Cantril Ladder” is 2003-2020. Because of our analysis focus, only XXI-century data is utilized.

## **2. Theoretical frameworks**

To create visualizations in this report, the ASSERT framework was extensively used. The ASSERT framework is one of the crucial tools for creating good and more based visualizations because it draws attention to 5 essential steps in creating visualizations: Ask, Search, Structure, Envision, Represent and Tell (Ferster & Shneiderman, 2013; Rees & Laramee, 2019).

1. Ask: The starting point of this report was a question: Can high-income or money purchase happiness or life satisfaction in the XXI century? The main hardness of this question is that there are a variety of different answers to this question, although some research suggests that happiness and life satisfaction are subjective and high income does not have any impact on that, other research states that happiness and life satisfaction have a linear relationship (Ugur, 2019; Muresan et al., 2019).
2. Search: While searching for the data sets some important points are needed to focus on: First, data should be accurate and up to date. Second, data should be relevant to the question being asked and can be used to create a meaningful visualization. It is identified that data on life satisfaction, happiness, and GDP per capita is needed to answer a question. To ensure data quality data set has been found on the Our World in Data web page which has various open-source and reliable data sets.
3. Structure: The first step in structuring the data set is to filter it for years (Year>1999), so it helps us to focus on only the XXI century. The second step is to find the average GDP per capita, happiness and life satisfaction for the XXI century. So, this makes it



possible to create maps which demonstrate average happiness, life satisfaction and GDP per capita and do spatial analysis. The third step is to merge average data sets and delete N/A values, so we can do some correlation graphs to see the relationship between GDP per capita and, happiness and life satisfaction.

4. Envision: After structuring the data, it is important to find a strategy for visualising the data. It is decided that doing spatial analysis and showing the obvious patterns of happiness, life satisfaction and GDP per capita is the first step in our strategical analysis. Because after this step, the reader can easily be aware of the general trend in the world. After indicating the general trend and giving background information about the topic, answering the main question is our second and main step: Creating the GDP per capita and happiness, and GDP per capita and life satisfaction scatter plots to show associations.
5. Represent: While creating maps (Figures 1,2,3) viridis colour scheme has been used. It is used to create a range of colours from light to dark. According to Braun et al. (2022), viridis colour scheme is better to show the difference between different points and Kaspar and Crameri (2022) add that viridis scheme is one of the most easily readable colour schemes. In our maps, brighter colours demonstrate the high rate of GDP per capita, happiness and life satisfaction while darker colour shows a lower rate. Additionally, different sizes of points are used to show GDP per capita change in the charts.
6. Tell: Storytelling is a process that turns the abstract plot into a meaningful story (Lee et al., 2015). Storytelling can be used to entertain, educate, and inspire. If visualizations are used correctly, it makes the overall story highly effective (Ma et al., 2012). In the storytelling process in this report, maps are used for the introduction to the overall topic and after these scatter plots are used with the text to answer the main question and deepen the knowledge between main topics. Figueiras (2014) also mentioned that for the introduction part maps are useful. For drawing conclusions and finalising the point of the story scatter plots are used because they are more useful for detailed analysis.

### **3. Visualisation choice**

In this report, two types of visualisations have been used: map and scatter plot. Both of these visualisations have some benefits and drawbacks and in the next sections, they are discussed in more detail.

#### **3.1 Scatter plot**

Scatter plots are a great way to visualize the association between two variables. They can be used to identify trends, patterns, and outliers in the data. Scatter plots can also be used to compare different groups or to look for correlations between variables. Additionally, scatter plots can be used to identify clusters or groups in the data. Although scatter plots are

considered flexible, high dimensionality and a high amount of data cannot really be visualised on scatter plots (Sarıkaya & Gleicher, 2018; Sedrakyan et al., 2019).

In the 4 and 5 figures, scatter plots have been used to visualise the association between GDP per capita and happiness, and GDP per capita and life satisfaction. As it is mentioned above, the ultimate goal of a scatter plot to help readers to understand the relationship between two variables and it is provided. Readers easily can see the relationship between life satisfaction and GDP per capita (Figure 5) is stronger than the GDP per capita and happiness relationship (Figure 4). Moreover, the low dimensionality in our data and the small amount of data make scatter plots the best way to visualise it.

As an alternative one correlation plot can be used instead of two scatter plots. Correlation plots are mainly used in more detailed and statistical analyses, and they reduce the interactivity of text and can be boring for readers, so scatter plots are preferred.

## **3.2 Map**

Map visualizations are a great way to convey information quickly and easily. They can be used to show the geographic distribution of data, compare different regions, and identify patterns and trends. Maps can also be used to illustrate relationships between different variables, such as population density and economic activity. Additionally, maps can be used to show the impact of natural disasters or other events on a region. Finally, maps can be used to help people make decisions, such as where to locate a business.

In our analysis, the 1,2,3 figures are maps and they have mainly used for giving general information about the topic. There are two main aims for using maps as visualisation choices: First, they are preparing the readers for the final point of the topic and help them to fully understand the relationships between GDP per capita, happiness and life satisfaction. For instance, a reader after looking at the map and additionally scattered plot can fully understand which countries and which parts of the world are happier and what exactly brings happiness to them. Additionally, maps are visually appealing and can be used to engage viewers in a way that tabular data cannot. This can be especially useful when presenting data to a non-technical audience.

## **4. Implications and Improvements**

### **4.4 Ethical implications**

Creating visualisations of GDP per capita, happiness and life satisfaction can have several ethical implications, including:

1. It may perpetuate the idea that GDP and material wealth are the primary determinants of happiness and life satisfaction which can be problematic if it leads to a neglect of other important factors that contribute to well-being, such as social connections, mental and physical health, and access to education and opportunities. Research of

each decade strongly suggests that happiness is a strongly subjective emotion and it is not possible to explain it with income, GDP per capita or briefly money (Easterlin, 1995; Easterlin, 2005; Wang & Murnighan, 2013). So, it is important to mention that GDP per capita is not the main determinant of happiness when these visualisations are used.

2. It may also perpetuate the idea that certain countries or regions are inherently happier or less happy than others, which can lead to harmful stereotypes and discrimination.
3. Additionally, it can be misleading to compare happiness and life satisfaction levels across different cultures, as different cultures may have different understandings and expressions of happiness and life quality.
4. The data used to create the scatter plot and maps can also be unreliable or biased, leading to inaccurate conclusions.

It is important to consider these ethical implications when creating and interpreting a scatter plot of GDP per capita and happiness and to use caution when making generalizations or drawing conclusions from the data.

## **4.2 Improvements over the visualisations**

To enhance the effectiveness of the visualizations in conveying the story being told in the report, several improvements can be made:

1. One such improvement is to add trend lines and correlation measures, such as R-squared or correlation percentages, to scatter plots. This can help to clarify the direction of changes and the degree of correlation between variables, reducing the potential for misinterpretation and misuse of the data. Additionally, according to Robertson et al. (2008), it is good to use trend lines in the scatter plot if the variation of data is small.
2. Another way to improve this report is to add a scatter plot which shows the relationship between happiness and life satisfaction. As it is mentioned in the first section life satisfaction and happiness are different perceptions, and it is also can be essential to show an association between them for demonstrating the whole picture.
3. One more way to improve this report may be to add a correlation plot. A correlation plot is generally used to show overall correlation and it can easily demonstrate an association between GDP per capita, happiness and life satisfaction in one plot. As it is mentioned correlation plot has not been used because it decreases the interactivity of the story but it also can be preferred by different researchers.

## **4.3 Conclusion**

In conclusion, this report highlighted the relationship between GDP per capita, happiness, and life satisfaction using various visualizations and the ASSERT framework. The maps provided a clear picture of the distribution of GDP per capita, happiness, and life satisfaction across the world. The scatter plots also helped to visualize the correlation between GDP per capita and happiness or life satisfaction. The use of the ASSERT framework allowed for a more thorough analysis of the data and provided a deeper understanding of the relationship

between these variables. The visualizations provided a clear understanding of the relationship between these variables and helped to support the argument that money does not necessarily buy happiness in the 21st century. Additionally, the report has also discussed the ethical implications and improvements that should be taken into account while creating visualizations. Overall, the use of the visualizations and the ASSERT framework in this report provide valuable insights into the relationship between GDP per capita, happiness, and life satisfaction.

## 5. References

1. Aral, N., & Bakir, H. (2022). A spatial analysis of Happiness. *Panoeconomicus*, (00), 22–22. <https://doi.org/10.2298/pan191220022a>
2. Proto, E., & Rustichini, A. (2014). GDP and life satisfaction: New evidence. <https://cepr.org/voxeu/columns/gdp-and-life-satisfaction-new-evidence>.
3. Rodriguez-Pose, A., & Maslauskaitė, K. (2011). Can policy make us happier? individual characteristics, socio-economic factors and life satisfaction in Central and Eastern Europe. *Cambridge Journal of Regions, Economy and Society*, 5(1), 77–96. <https://doi.org/10.1093/cjres/rsr038>
4. Esteban Ortiz-Ospina and Max Roser (2013) - "Happiness and Life Satisfaction". Our World In Data. <https://ourworldindata.org/happiness-and-life-satisfaction>
5. Proto, E., & Rustichini, A. (2013). A reassessment of the relationship between GDP and life satisfaction. *PLoS ONE*, 8(11). <https://doi.org/10.1371/journal.pone.0079358>
6. Stanca, L. (2010). The Geography of Economics and happiness: Spatial patterns in the effects of economic conditions on well-being. *Social Indicators Research*, 99(1), 115–133. <https://doi.org/10.1007/s11205-009-9571-1>
7. Clark, A.E. & C. Senik (2011), Will GDP Growth Increase Happiness in Developing Countries? IZA Discussion Paper No. 5595.
8. Degutis, M., Urbonavičius, S., & Gaizūtis, A. (2010). Relation between life satisfaction and GDP in the European Union. *Ekonomika*, 89(1), 9–21. <https://doi.org/10.15388/ekon.2010.0.997>
9. Ferster, B., & Shneiderman, B. (2013). *Interactive visualization: Insight through inquiry*. MIT Press.
10. Rees, D., & Laramée, R. S. (2019). A survey of Information Visualization Books. *Computer Graphics Forum*, 38(1), 610–646. <https://doi.org/10.1111/cgf.13595>
11. Ugur, Z. B. (2019). Does money buy happiness in Turkey? *Applied Research in Quality of Life*, 16(3), 1073–1096. <https://doi.org/10.1007/s11482-019-09805-1>
12. Muresan, G. M., Ciomas, C., & Achim, M. V. (2019). Can money buy happiness? evidence for European countries. *Applied Research in Quality of Life*, 15(4), 953–970. <https://doi.org/10.1007/s11482-019-09714-3>
13. Our World in Data. (2022). GDP per capita in US dollar (World Bank). Retrieved from <https://ourworldindata.org/grapher/gdp-per-capita-in-us-dollar-world-bank?tab=map&country=~IRQ>
14. Our World in Data. (2016). Share of people who say they are happy (World Value Survey). Retrieved from <https://ourworldindata.org/grapher/share-of-people-who-say-they-are-happy?tab=map>

15. Our World in Data. (2022). Happiness Cantril Ladder (World Happiness Report 2022). Retrieved from <https://ourworldindata.org/grapher/happiness-cantril-ladder?time=latest&country=>
16. Braun, D., Ebell, K., Schemann, V., Pelchmann, L., Crewell, S., Borgo, R., & von Landesberger, T. (2022). Color coding of large value ranges applied to meteorological data. *2022 IEEE Visualization and Visual Analytics (VIS)*. <https://doi.org/10.1109/vis54862.2022.00034>
17. Kaspar, F., & Cramer, F. (2022). Coloring Chemistry—how mindful color choices improve chemical communication. *Angewandte Chemie International Edition*, 61(16). <https://doi.org/10.1002/anie.202114910>
18. Figueiras, A. (2014). How to tell stories using visualization. *2014 18th International Conference on Information Visualisation*. <https://doi.org/10.1109/iv.2014.78>
19. Lee, B., Riche, N. H., Isenberg, P., & Carpendale, S. (2015). More than telling a story: Transforming data into visually shared stories. *IEEE Computer Graphics and Applications*, 35(5), 84–90. <https://doi.org/10.1109/mcg.2015.99>
20. Ma, K.-L., Liao, I., Frazier, J., Hauser, H., & Kostis, H.-N. (2012). Scientific storytelling using visualization. *IEEE Computer Graphics and Applications*, 32(1), 12–19. <https://doi.org/10.1109/mcg.2012.24>
21. Elavsky, F., Bennett, C., & Moritz, D. (2022). How accessible is my visualization? evaluating visualization accessibility with chartability. *Computer Graphics Forum*, 41(3), 57–70. <https://doi.org/10.1111/cgf.14522>
22. Sarikaya, A., & Gleicher, M. (2018). Scatterplots: Tasks, data, and designs. *IEEE Transactions on Visualization and Computer Graphics*, 24(1), 402–412. <https://doi.org/10.1109/tvcg.2017.2744184>
23. Sedraky, G., Mannens, E., & Verbert, K. (2019). Guiding the choice of learning dashboard visualizations: Linking dashboard design and data visualization concepts. *Journal of Computer Languages*, 50, 19–38. <https://doi.org/10.1016/j.jvlc.2018.11.002>
24. Easterlin, R. A. (1995). Will raising the incomes of all increase the happiness of all? *Journal of Economic Behavior & Organization*, 27(1), 35–47. [https://doi.org/10.1016/0167-2681\(95\)00003-b](https://doi.org/10.1016/0167-2681(95)00003-b)
25. Easterlin, R. A. (2005). Feeding the illusion of growth and happiness: A reply to Hagerty and Veenhoven. *Social Indicators Research*, 74(3), 429–443. <https://doi.org/10.1007/s11205-004-6170-z>
26. Wang, L., & Murnighan, J. K. (2013). Money, emotions, and ethics across individuals and countries. *Journal of Business Ethics*, 125(1), 163–176. <https://doi.org/10.1007/s10551-013-1914-9>
27. Robertson, G., Fernandez, R., Fisher, D., Lee, B., & Stasko, J. (2008). Effectiveness of animation in Trend Visualization. *IEEE Transactions on Visualization and Computer Graphics*, 14(6), 1325–1332. <https://doi.org/10.1109/tvcg.2008.125>

