

HCC Bar Chart: A Custom Chart for RAWGraphs

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Abstract

This report explores the use of bar charts for effective data visualisation. Several bar chart types are presented, including regular, wrapped, clustered, stacked, and merged bar charts, each serving different visualisation purposes. The report also discusses key design recommendations for creating clear and effective bar charts, based on the best practices described in Desbarats' 2023 book *Practical Charts*.

The report then introduces RAWGraphs, an open source visualisation framework that supports the creation of a wide range of standard charts without the need to write code. RAWGraphs also provides a mechanism for integrating custom chart types to extend its functionality.

The body of the report describes the HCC Bar Chart custom chart extension for RAWGraphs, which provides an alternative to RAWGraphs' standard bar charts and follows the best practice recommendations of Desbarats for its default settings. It also provides many additional customisation options, and optional support for hand-drawn styling.

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Chapter 1

Introduction

Data visualisation plays an important role in the analysis and communication of information by transforming numerical data into graphical representations that are easier to understand. Among the many visualisation techniques available, bar charts are one of the most widely used and effective methods for presenting and comparing data across categories [Sönning 2026]. Bar charts are particularly effective for comparing values across categories and sub-categories, making them one of the most widely used chart types in data visualisation. Typical applications include comparing the number of students by gender in a class, population figures across regions, or revenue generated by different departments. One of the main advantages of bar charts is their simplicity and readability. Since people can easily compare the lengths of bars, differences between categories become immediately apparent. In addition, bar charts are highly flexible and can be adapted to represent many types of quantitative data.

The objective of this project is to explore different types of bar charts, and to explore best practices for their design and application, following the recommendations of Desbarats [2023]. The practical part of the project involves the building of a custom bar chart extension for RAWGraphs [Mauri et al. 2017; RAWGraphs 2026], an open source data visualisation framework. The extension is called the HCC Bar Chart [Nsofor 2026a]; it extends the capabilities of traditional bar charts through additional customisation features, support for established visualisation best practices, and optional hand-drawn styling.

Chapter 2

Types of Bar Charts

Although all bar charts represent quantitative values using the lengths of bars, there are many different variants of bar charts used in data visualisation, including regular, wrapped, clustered, stacked, and merged bar charts. These bar chart variants provide a range of approaches for presenting categorical data, demonstrating the versatility of bar charts in data visualisation. According to Desbarats [2023], different bar chart forms can be used to address specific communication and comparison objectives.

2.1 Regular Bar Chart

A regular bar chart represents quantitative values across a set of categories using individual bars, whose lengths correspond to the magnitude of the displayed values. Regular bar charts are typically used for single-series data, where one set of related values is plotted across multiple categories [Desbarats 2023]. This visual encoding enables clear comparisons between categories and is particularly effective when the primary objective is to compare individual values. An example of a regular bar chart is shown in Figure 2.1.

2.2 Wrapped Bar Chart

A wrapped bar chart is intended for datasets containing a large number of categories. Like a regular bar chart, it is generally used to display single-series data, where a single set of related values is compared across multiple categories [Desbarats 2023]. The key difference is that, rather than displaying all bars within a single row or column, the categories are arranged across multiple wrapped sections.

By dividing the chart into smaller sections, the layout makes more efficient use of the available space and can improve the readability of category labels when numerous categories are present. According to Desbarats [2023], wrapped bar charts provide an effective alternative when a standard bar chart becomes crowded or difficult to interpret. An example of a wrapped bar chart is shown in Figure 2.2.

2.3 Clustered (Grouped) Bar Chart

A clustered or grouped bar chart is used to display and compare multiple data series across the same set of categories. Rather than representing each category with a single bar, multiple bars are placed side by side within each category, with each bar corresponding to a different variable or group.

This layout enables comparisons both across categories and between the individual variables within each category. As a result, clustered bar charts are particularly useful when examining several related measures simultaneously, such as performance indicators or survey results. An example of a clustered bar chart is shown in Figure 2.3.

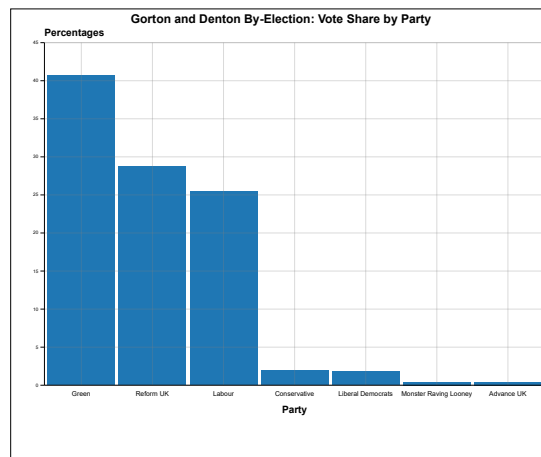


Figure 2.1: Regular Bar Chart: The vote share of political parties in the UK Gorton and Denton By-Election of 26 Feb 2026. Data from MCC [2026]. [Chart created in RAWGraphs by the author.]

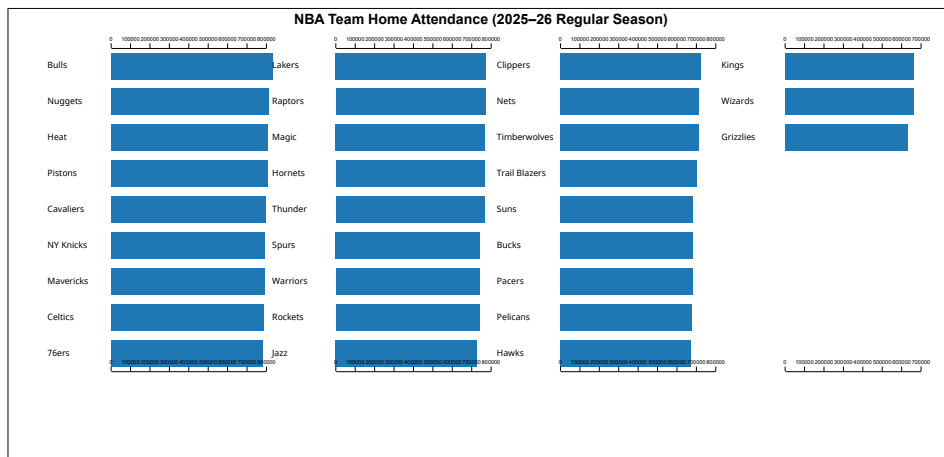


Figure 2.2: Wrapped Bar Chart: NBA team home attendance during the 2025–26 regular season. Data from ESPN [2026]. [Chart created in RAWGraphs by the author.]

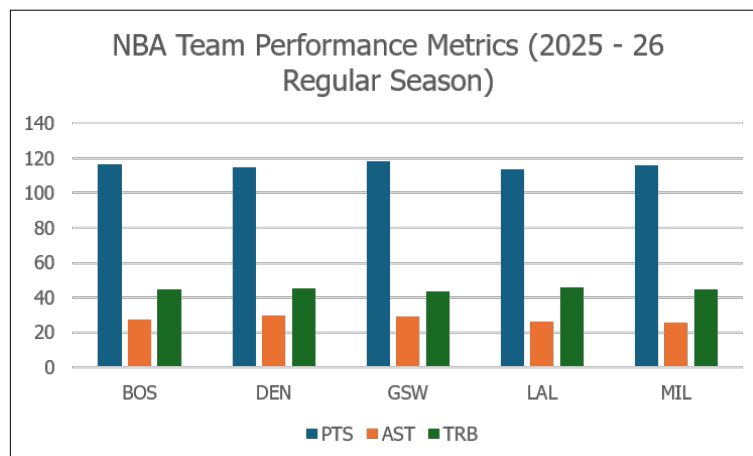


Figure 2.3: Clustered (Grouped) Bar Chart: Team performance metrics for three teams during the 2025–26 regular season. Data from Sports Reference [2026a]. [Chart created in Excel by the author.]

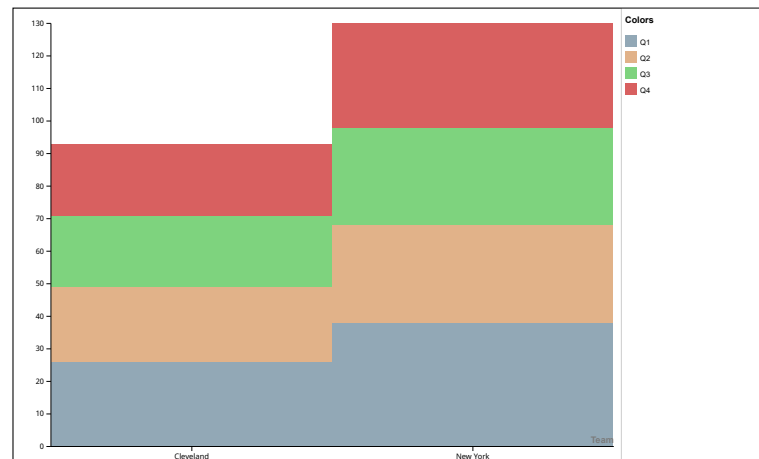


Figure 2.4: Stacked Bar Chart: The scoring distribution per quarter for the New York Knicks and Cleveland Cavaliers game on 25 May 2026. Data from Sports Reference [2026b]. [Chart created in RAWGraphs by the author.]

2.4 Stacked Bar Chart

A stacked bar chart represents both the overall value of a category and the values of its individual sub-categories within a single bar. Each bar is divided into multiple segments, with each segment corresponding to a specific part of the total.

Stacked bar charts are particularly useful for visualising the composition of categories while simultaneously displaying their overall magnitude. This allows viewers to examine both the total values and the relative contributions of individual components. However, comparisons between segments can be challenging, since only the lowest segment is aligned to a common baseline. An example of a stacked bar chart is shown in Figure 2.4.

2.5 Merged Bar Chart

A merged bar chart combines elements from multiple bar charts into a single visualisation, enabling several variables to be displayed together while preserving their individual scales. Unlike clustered bar charts, which place multiple bars side by side on a common scale, merged bar charts integrate related measures that may differ in magnitude or unit of measurement.

This approach provides a compact representation of related data and can help highlight patterns and relationships between variables. Merged bar charts are particularly useful when comparing metrics which vary substantially in scale, since displaying them on a single axis may reduce readability or conceal meaningful differences. An example of a merged bar chart is shown in Figure 2.5.

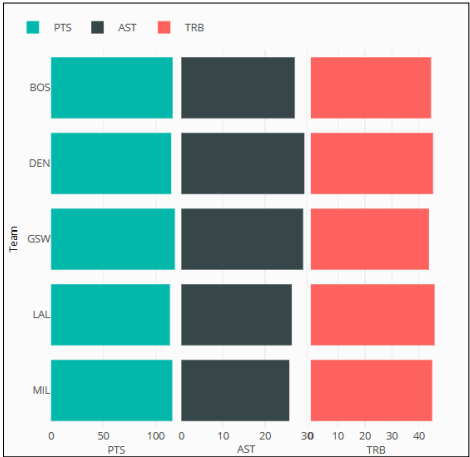


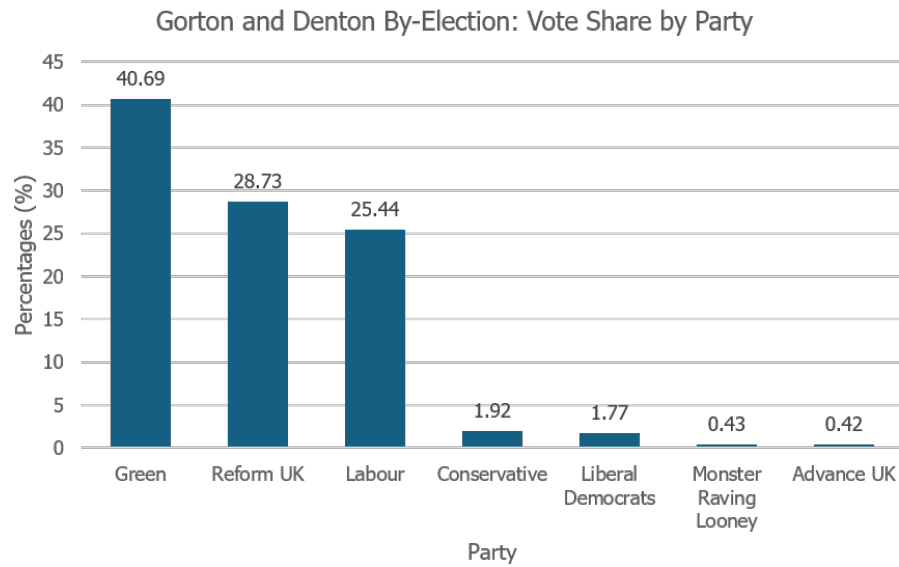
Figure 2.5: Merged Bar Chart: Team performance metrics for three teams during the 2025–26 NBA regular season. Data from Sports Reference [2026a]. [Chart created in Power BI Visual Editor by the author.]

Chapter 3

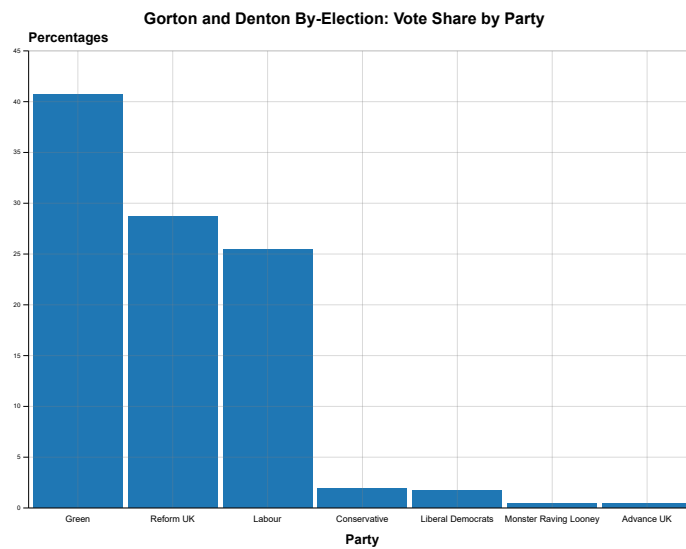
Bar Chart Best Practice

Although bar charts are among the simplest and most widely used forms of data visualisation, poor design choices can reduce readability and obscure important insights. To communicate information as clearly and accurately as possible with a bar chart requires careful consideration of chart type, scale, colour, labelling, and overall layout. Following the recommendations of Desbarats [2023], the following design practices can improve the readability and effectiveness of bar charts:

- *Include Zero in the Scale:* Bar charts encode quantitative values through the lengths of bars. For this reason, the scale should generally begin at zero. Starting the axis above zero can exaggerate differences between categories and lead to misleading interpretations of the data [Desbarats 2023].
- *Label Zero-Length Bars:* Categories with values of zero may be difficult to identify visually. Adding data labels ensures that these categories remain visible and prevents important information from being overlooked [Desbarats 2023].
- *Position Legends Effectively:* Legends should be placed in a location that allows viewers to identify categories quickly and easily. Desbarats [2023] recommends positioning legends at the top of the chart, where they are typically easier to locate and interpret.
- *Sort Bars Meaningfully:* The ordering of bars can significantly influence how easily patterns can be identified. Rather than displaying categories in an arbitrary order, bars should be sorted according to a meaningful criterion, such as ascending value, descending value, or a logical sequence relevant to the data [Desbarats 2023].
- *Use Colour Intentionally:* Colour should be used purposefully rather than decoratively. For example, contrasting colours can be used to emphasise important categories or distinguish positive and negative values, such as using green to represent gains or positive outcomes and red to represent losses or negative outcomes. However, colour choices should remain uniform and purposeful to avoid unnecessary visual complexity and to ensure that attention is directed towards the most important aspects of the data [Desbarats 2023].
- *Use Direct Labelling Where Appropriate:* Where possible, labels should be placed directly on or near the bars they describe. Direct labelling allows viewers to identify values and categories easily, thereby improving the speed and accuracy of interpretation [Desbarats 2023].
- *Limit the Number of Categories:* Bar charts become increasingly difficult to interpret as the number of categories grows. Desbarats [2023] suggests limiting regular bar charts to around eight categories where possible, in order to maintain readability. When larger datasets must be presented, grouping categories, creating multiple charts, or selecting an alternative visualisation may provide a clearer representation of the data.



(a) Typical bar chart.



(b) Revised bar chart.

Figure 3.1: Comparison of a typical and revised bar chart showing the Gorton and Denton By-Election Results, 26 February 2026. Data from MCC [2026]. [Charts created in Excel and RAWGraphs by the author.]

In a typical bar chart (see Figure 3.1a), several design aspects reduce clarity. The bars are thinner, making comparisons less immediate. Although data labels are present, they are not essential in this case, as the aim is not to focus on exact values, but on the relationships between categories. Instead, interpretation should be guided primarily by the relative lengths of the bars.

The revised bar chart (see Figure 3.1b) applies selected design principles from Desbarats [2023]. The bars are made wider to improve visual comparability, and the overall layout is simplified to reduce unnecessary clutter. Data labels are used more selectively to support interpretation where needed, while allowing the overall pattern of the data to remain the primary focus. Axis titles are also repositioned for improved readability, with the y-axis title moved from a vertical orientation on the left-hand side to a horizontal orientation at the top of the chart.

Overall, the revised design improves clarity and makes patterns and differences easier to identify. This example demonstrates how relatively small design adjustments can substantially enhance the effectiveness of a bar chart as a communication tool.

Chapter 4

RAWGraphs

RAWGraphs is an open source data visualisation framework designed to support the creation of a wide range of chart types without requiring advanced programming knowledge [Mauri et al. 2017; RAWGraphs 2026]. It allows users to import structured datasets, such as CSV files, and map data attributes to different visual encodings. The chart can then be exported to formats including SVG, PNG, and JPEG. The tool was designed to produce semi-finished charts, which can be exported in Scalable Vector Graphics (SVG) format, and then edited and polished in a vector graphics editor such as Inkscape or Illustrator. Figure 4.1 shows the RAWGraphs web site.

The chart creation process in RAWGraphs follows a structured workflow consisting of five steps:

1. *Load Data*: Data can be pasted directly into the application, uploaded from a file, loaded from a sample dataset, retrieved through a URL or SPARQL query, or opened from a previously saved project.
2. *Choose Chart*: Users select a chart type from the available visualisations or load a custom chart extension.
3. *Mapping*: Dataset attributes are assigned to the visual variables required by the selected chart.
4. *Customise*: Visual properties and chart settings can be adjusted to suit the intended presentation.
5. *Export*: The completed visualisation can be exported in SVG, PNG, JPEG, or RAWGraphs project format.

In addition to its collection of standard visualisations, RAWGraphs supports the development and integration of custom charts. This feature allows developers to extend the platform, by creating new visualisation types or modifying existing ones to address specific analytical and design requirements. Custom charts follow the RAWGraphs chart architecture and can be integrated directly into the platform alongside the built-in chart library. This flexibility enables the creation of specialised visualisations that are not available in standard charting tools, while still benefiting from RAWGraphs' data mapping and export capabilities.

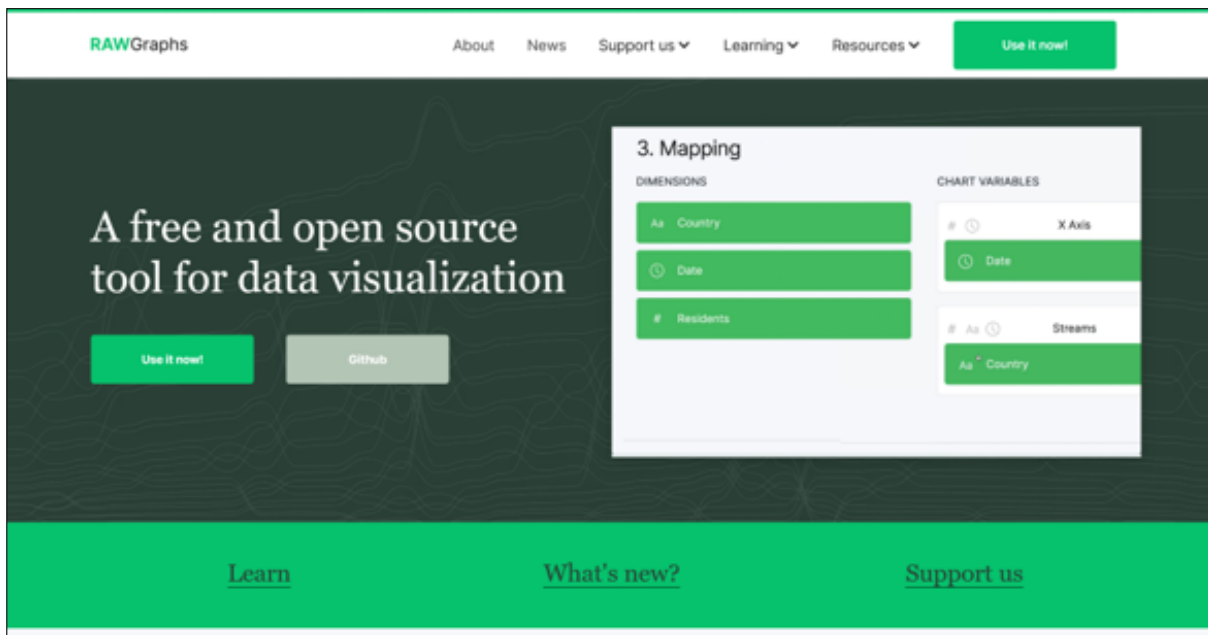


Figure 4.1: Screenshot of RAWGraphs homepage. [Screenshot taken from RAWGraphs by the author.]

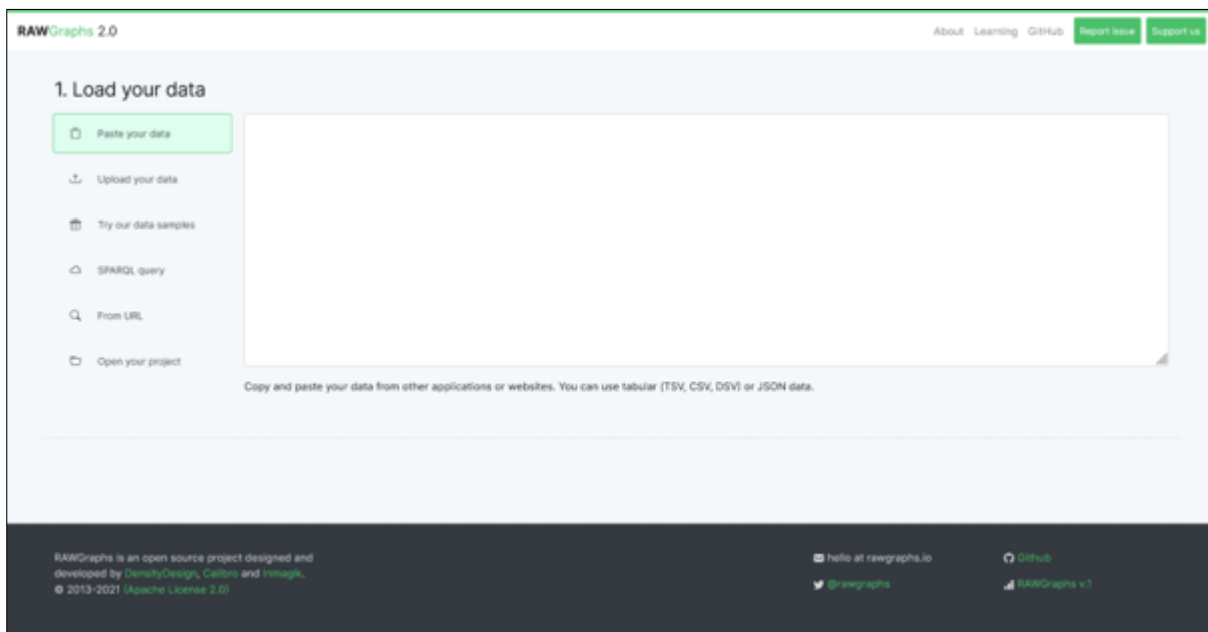


Figure 4.2: The section within RAWGraphs for loading a dataset. [Screenshot taken from RAWGraphs chart section by the author.]

Chapter 5

HCC Bar Chart

The HCC Bar Chart is a custom chart extension developed for RAWGraphs. It extends the functionality of the standard bar chart by introducing additional configuration options and embedding established design recommendations. The best practices recommended by Desbarats [2023] are implemented as the default settings, reducing the risk of poor chart design choices. In addition to improving default visual quality, the extension provides enhanced control over chart appearance and structure, enabling more precise adaptation to specific data and presentation needs. The extension also supports hand-drawn visual styling, allowing users to create charts with a sketch-like appearance while preserving the underlying data representation. Figure 5.1 shows the HCC Bar Chart extension within RAWGraphs. A showcase video is available on YouTube [Nsofor 2026b].

In Section 4 of the RAWGraphs workflow, the chart extension can be customised. There are eight groups of customisation settings: Artboard, Legend, Chart, Grouped, Colors, Axes, Grid, and Artistic. Four of these groups are described in more detail:

- **Chart:** Users can edit the chart title, select the desired bar chart variant, including regular, wrapped, clustered, and stacked layouts, depending on the nature of the data and the intended comparison. The section also provides options for sorting categories, controlling bar spacing, and adjusting the overall presentation of the chart. The Chart customisation settings are shown in Figure 5.2.
- **Axes:** Users can customise axis titles, label placement, orientation, and formatting to improve readability. Additional options allow control over scale behaviour, including the use of zero baselines and the display of tick marks. The Axes customisation settings are shown in Figure 5.3.
- **Grid:** Users can adjust the visibility, spacing, and styling of grid lines, which support value estimation and improve visual alignment across categories. The Grid customisation settings are shown in Figure 5.4.
- **Artistic:** Artistic settings control the visual style of the chart. A hand-drawn look toggle allows users to switch between a conventional chart appearance and a hand-drawn looking visual style. When enabled, additional settings can be used to adjust the roughness level and fill style. The Artistic customisation settings are shown in Figure 5.5.

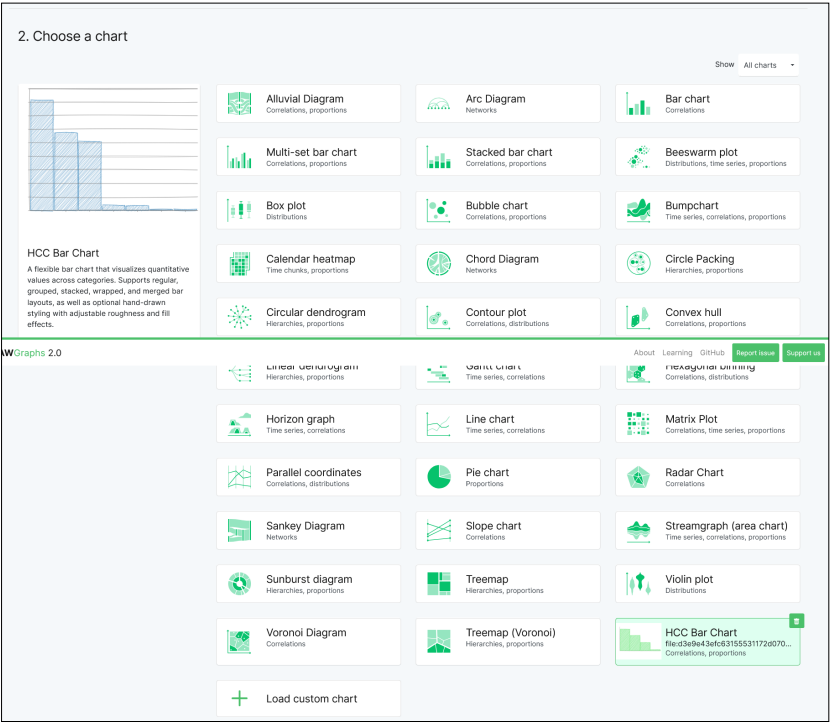


Figure 5.1: The HCC Bar Chart extension within RAWGraphs. [Screenshot of RAWGraphs HCC Bar Chart taken by the author.]

CHART

Add title

Yes

Chart title

Title position

Middle

Bar chart type

Regular

Max Bars per Column

8

Padding between sets

4

Padding between bars

1

Bars orientation

Vertically

Sort X axis by

Total value (desce

Figure 5.2: HCC Bar Chart: Chart customisation settings. [Screenshot of RAWGraphs HCC Bar Chart taken by the author.]

AXES

Show X axis

Yes

Show Y axis

Yes

X Axis title text

Y Axis title text

set X Axis title font size

15

Set Y Axis title font size

15

set X Axis label font size

7

Set Y Axis label font size

7

X axis title orientation

Below chart

Change Y axis title orientatic

Top chart

Figure 5.3: HCC Bar Chart: Axes customisation settings. [Screenshot of RAWGraphs HCC Bar Chart taken by the author.]

GRID

Edit Grid

No

Show vertical grid lines

No

Show horizontal grid lines

No

Grid style

solid

Grid opacity

0.3

Figure 5.4: HCC Bar Chart: Grid customisation settings. [Screenshot of RAWGraphs HCC Bar Chart taken by the author.]

ARTISTIC

Hand-drawn style

No

Edit Roughness

1

Change fill style

hachure

Figure 5.5: HCC Bar Chart: Artistic customisation settings. [Screenshot of RAWGraphs HCC Bar Chart taken by the author.]

Chapter 6

Concluding Remarks

This project explored the use of bar charts in data visualisation, covering regular, wrapped, clustered, stacked, and merged bar chart variants. It also reviewed key design recommendations for creating clear, readable, and effective bar charts. The project also highlighted the flexibility of RAWGraphs for custom chart development and demonstrated how the platform can be extended to support specialised visualisations.

The body of the project involved the development of the HCC Bar Chart, a custom chart extension for RAWGraphs. The HCC Bar Chart extension includes the following main features:

- Extended functionality beyond standard bar charts.
- Support for multiple bar chart variants, including regular, wrapped, clustered, and stacked bar charts.
- Default implementation of selected design best practices.
- Increased flexibility in visual configuration.
- Support for improved readability and structured layout design.
- Support for hand-drawn looking visual styles.

One limitation of the project was the implementation of the merged bar chart. Due to constraints within the RAWGraphs framework, this chart type could not be fully integrated into the extension. Despite this limitation, the HCC Bar Chart provides a flexible and practical tool for creating effective bar chart visualisations within RAWGraphs.

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