Representing a Pairing

The Role of Colours in Data Representation

In colour theory, green and red are often used to convey positive and negative connotations, respectively, making them effective choices in data visualization. Here's why they work well in a gradient for graphs, especially with green representing the best value (1) and red representing the worst value (0):

1. **Cultural Associations:**
    - **Green** is universally associated with positive ideas like safety, success, and growth. It evokes feelings of balance, health, and well-being. Therefore, using green to represent the best value (1) intuitively signals a good, desirable outcome.
    - **Red**, on the other hand, is associated with danger, warnings, and errors. It often symbolizes negative outcomes or poor performance. Red representing the worst value (0) conveys a clear message that this is undesirable or problematic.
2. **Perceptual Clarity in a Gradient:**
    - A green-to-red gradient is perceptually intuitive because it aligns with how people naturally interpret changes in intensity or value. Green typically feels "cooler" and more pleasant, while red feels "hotter" and more alarming. This creates a smooth visual transition from positive to negative values.
    - As the colour shifts from green to red, intermediate colours like yellow or orange can help convey a range of values between 0 and 1. This makes it easier for the viewer to interpret the data's relative performance across different points.

Current Grid-Based Design

The current design is based on a grid format. The current design displays the pairing between a selected team and all available projects. When a user clicks to view a particular team (e.g., Team 10), the interface will show a grid with that team’s pairing with all 150 projects. Each pairing is represented by a "card" that displays relevant information, such as the fit value between that team and the specific project. The cards are colour-coded based on a gradient (from green to red), where green represents the best fit and red represents the worst.

Single Team Focus: The grid format focuses on one team at a time. For example, when you click on Team 10, a grid will appear showing how Team 10 fits with Projects 1 to 150. Each card represents one of these pairings, giving a compact visual overview of the fit between Team 10 and each project.
Colour Gradient for Fit: The key feature of this grid is its colour-coded system. Cards for the best-fitting projects will appear in green, indicating that Team 10 is a strong match for those

projects. Conversely, the worst matches will be shown in red, and intermediate fits will appear in yellow, orange, or similar shades in between. This allows users to quickly identify the best and worst project matches for Team 10.
Information on the Cards: Each card in the grid contains not only colour-coding but also the best-fit value or any additional information needed to assess the pairing. This could include metrics such as a numerical score for the fit, relevant icons, or other contextual data.

Why Use a Grid Format?

The grid format is effective in certain contexts, particularly for focused analysis of one team at a time. Here are several reasons why it may be a strong choice:

1. **Visual Clarity for Individual Team-Project Pairings**: Since the user can focus on just one team at a time, it minimizes cognitive overload. Rather than displaying all 150 teams at once, users can digest information about Team 10's pairings with different projects more easily, without distractions from other teams.
2. **Easy Comparison Across Projects**: The grid format makes it simple to compare how well a team matches with each of the 150 projects. Users can quickly scan the row of cards and see where the strongest (green) and weakest (red) matches are. This allows for quick decision-making regarding which projects would be the best fit for a particular team.
3. **Compact Presentation with Detail on Demand**: The format is compact and allows for a large volume of information to be displayed in a relatively small space. Users don't need to click through multiple pages of data—they can see all of Team 10's pairings at once. Additionally, interactive elements (e.g., clicking or hovering) allow users to drill down into the specifics of any pairing without cluttering the display.
4. **Colour-Coded for Fast Interpretation**: The colour gradient is an intuitive way to convey information, enabling users to quickly pick out key patterns, such as the strongest or weakest matches. For example, the grid may show that Team 10 is a perfect fit for Project 5 (in green) but a poor match for Project 75 (in red), which speeds up analysis.
5. **Customizable and Scalable**: While the grid focuses on one team at a time, the format is scalable. Users can select different teams and apply the same approach for other team-project pairings. Additionally, filtering or sorting can be applied to further simplify navigation.

Challenges of the Grid Format

Although the grid format has many strengths, it also has some potential drawbacks when dealing with large datasets like 150 teams and 150 projects. Here's why it might not always be the best option:

Still Requires User Interaction

Since you can only view one team at a time, users will need to click through and examine each team individually. This could become cumbersome if users need to analyze multiple teams and projects simultaneously. The constant switching between different team views might slow down the overall decision-making process, especially if you need to assess many teams quickly.

Overwhelming with Large Project Data
Although focusing on one team at a time helps reduce cognitive load, displaying all 150 projects in a single view can still become overwhelming. Even with colour coding, scrolling through 150 cards might make it difficult to keep track of the best and worst project matches, especially if they are spread out across the row.

Matrix Heatmap: An Alternative Visualization

What is a Matrix Heatmap

A matrix heatmap is a graphical representation where values of a matrix are depicted as colours in a grid. It uses colour gradients to express data intensities, making it easier to spot patterns, trends. In a matrix heatmap for pairing trams with projects, the x-axis and y-axis can represent teams and projects, respectively. The cells of the heatmap show the strength of the compatibility between a team and a project, with the colour intensity indicating the degree of matching the two.
To represent the pairing of **Team 10** to **Project 9**, and similar data for 150 teams and 150 projects, a matrix heatmap would be structured with teams listed along one axis (e.g., the y-axis) and projects along the other axis (e.g., the x-axis). Each intersection or grid cell of the matrix represents the relationship between a specific team and project, typically with colours indicating the strength or relevance of the relationship.

- **Data Representation**: For each team-project pair, the heatmap will represent the best-fit value. For example, the use of the 2 colours Green and Red stated earlier will used. The colour green will represent a strong fit between Team 10 and Project 9, while the colour Red will indicate a weaker relationship.
- **Highlighting Patterns**: By visualizing all teams and projects in a matrix, decision-makers can quickly observe clusters of high compatibility, outliers, or areas where more attention is needed.
- **Ease of Interpretation**: By scanning the colour gradations, the matrix heatmap allows for a visual comparison between different team-project pairings. This helps in understanding how well Team 10 might perform compared to other teams when paired with Project 9 or other projects.

Why Use a Matrix Heatmap?

Visualization of Large Datasets
A matrix heatmap can handle large datasets effectively, making it a good fit for this scenario, where you have 150 teams and 150 projects (resulting in 22,500 possible pairings). A simple

tabular list or manual comparison would be overwhelming. The heatmap simplifies this complexity by providing a visual representation that can reveal patterns at a glance. For example, if the goal is to identify strong matches for each team quickly, the heatmap can show this through clusters of high-intensity colours, eliminating the need for manual inspection.

Pattern Recognition
The heatmap helps to identify trends, such as:

- Clusters: A grouping of strong relationships in the heatmap might suggest that certain teams are generally well-suited to a range of projects.
- Outliers: It might reveal outliers, where specific teams, like Team 10, stand out as being particularly suited or unsuited for specific projects like Project 9.
- Balanced Matching: If the heatmap is uniformly distributed, it may suggest that the pairing process is fair and that there is no bias toward certain teams or projects.

Ease of Use and Communication

Matrix heatmaps provide an intuitive, quick snapshot that can be easily shared with stakeholders. Decision-makers can immediately understand which team-project pairings work well without needing to parse through numerical data. In the case of Team 10, for example, a quick glance at the intersection with Project 9 would show whether the match is strong, weak, or somewhere in between.

Comparative Analysis

A heatmap allows for easy comparative analysis. It would be straightforward to compare how well Team 10 pairs with Project 9 compared to other projects. Similarly, Team 10's performance relative to other teams on Project 9 can be seen in adjacent cells, making it clear where strengths and weaknesses lie.

Limitations of the Matrix Heatmap

Limited Precision

While heatmaps provide a great visual overview, they can lack precision when fine details are needed. If the decision-making process requires specific quantitative values or detailed insights, such as exact percentages or ranking differences between team-project pairs, a heatmap may oversimplify these nuances. For example, if Team 10 scores 0.89 on Project 9 and another team scores 0.87, a heatmap may not clearly differentiate between the two.

Overwhelming Complexity

While heatmaps are meant to simplify complex data, a matrix with 150 teams and 150 projects could become overwhelming, especially if there are too many close relationships to highlight. If nearly every team is highly compatible with multiple projects, the heatmap might show a uniformly intense colour distribution, making it difficult to discern meaningful patterns. In this case, a matrix heatmap could lose its value as a visualization tool because the data would appear cluttered and difficult to interpret.

Risk of Oversimplification

By reducing data to colour gradients, some important contextual information could be lost. For instance, it might be important to know not just how well Team 10 pairs with Project 9 but why they are a good or poor match. A heatmap cannot convey these kinds of details, which might require complementary text or charts to provide a fuller picture.

Network Diagram: Visualizing Relationships as Connections

What is a Network Diagram

A network diagram is a graphical representation where nodes and edges are used to illustrate relationships between entities. In the context of pairing teams with projects, the nodes represent the teams and projects, while the edges (connections between the nodes) indicate relationships or compatibility between specific teams and projects. The thickness, colour, or label of the edges can be used to denote the strength or quality of the relationship.

For example, in pairing **Team 10** with **Project 9**, Team 10 and Project 9 would each be a node in the diagram, with an edge connecting them that represents their suitability.

A network diagram can represent the relationships between 150 teams and 150 projects using nodes for teams and projects and edges to show potential pairings.

- **Node Representation**: Each team (e.g., Team 10) is represented as a node, and so is each project (e.g., Project 9). This results in 300 total nodes (150 teams + 150 projects).
- **Edges**: Edges connect the team nodes to the project nodes, symbolizing potential matches or pairings. The thickness or color of each edge can represent the strength of the relationship, such as the suitability of a team for a particular project.
- **Interactivity**: Advanced network diagrams may allow users to filter or interact with the graph, highlighting specific relationships like Team 10's compatibility with Project 9, or comparing Team 10's edge to other teams' connections to Project 9.

Benefits of a Network Diagram

Visualizing Complex Relationships

A network diagram is excellent at representing complex, many-to-many relationships like the pairing of 150 teams with 150 projects. Instead of using a grid or matrix, which can feel confined, a network diagram allows for a more fluid and organic visualization of relationships. For instance, you could instantly see which teams have strong connections to which projects, based on the density or prominence of edges connecting the nodes.

For Team 10, their relationship to Project 9 could be visually expressed by the existence of an edge between their respective nodes. If Team 10 has many strong project connections, it would have multiple thick or highly visible edges connecting it to various project nodes, making it easy to compare the team's fit across multiple projects.

Identifying Gaps and Clusters

A network diagram can also reveal gaps and clusters in the pairing process:

- **Clusters**: If certain teams or projects have strong relationships across the board, this would result in densely connected nodes, highlighting areas where matches are highly concentrated. For instance, if many teams are highly compatible with a small subset of projects, those nodes would form visible clusters in the diagram.
- **Gaps**: Conversely, teams or projects with few good matches would be less connected or more isolated in the network, making it easier to spot these gaps. For example, if Team 10 only has a strong connection to Project 9 and no other projects, this would be clearly visible in the network as a lone or sparsely connected node.

One of the key advantages of using a **network diagram** is the potential for interactivity, including the ability to filter relationships based on specific criteria. In the case of pairing teams with projects, we could implement a filter that allows users to display only pairings within a specified range of strength. For example, a filter could be added to show only those pairings with a **best-fit value between 0.6 and 0.99**

How the Filter Enhances the Diagram:

- Focused Insights: Filtering out weaker pairings would simplify the network, reducing clutter and making it easier to focus on the most relevant connections. If we were evaluating Team 10’s compatibility with Project 9, this filter would allow us to see only the pairings that are above a threshold of 0.6, ensuring that only meaningful and strong relationships are displayed.
- Improved Usability: This filtering functionality enhances the usability of the diagram by preventing it from becoming overwhelming. For instance, with 150 teams and 150 projects, if only the strongest connections (e.g., those scoring between 0.6 and 1) are shown, the network becomes much easier to interpret. This enables decision-makers to make more informed comparisons, focusing on the strongest potential matches for both teams and projects.
- Dynamic Exploration: This filtering approach also offers flexibility. Users could easily adjust the threshold to explore pairings at different levels of strength. For example, you

might initially view relationships with scores between 0.8 and 1 to focus on the very best matches, then expand the filter to include pairings between 0.6 and 1 to consider more options. This makes the network diagram adaptable to different decision-making contexts, allowing for deeper exploration of the data.

Why not use a Network Diagram?

Overwhelming Complexity for Large Networks

While network diagrams are useful for visualizing complex relationships, they can quickly become overwhelming if the network is too large or dense. In the case of 150 teams and 150 projects, with up to 22,500 possible relationships (150 × 150), a network diagram could become cluttered with overlapping edges, making it difficult to interpret. If too many teams and projects are well-matched, the diagram could devolve into a tangled web of connections, obscuring useful insights.

Limited Precision

While a network diagram provides a high-level view of relationships, it may not offer enough precision for decision-making. Similar to heatmaps, it can oversimplify relationships by reducing them to visual cues such as edge thickness or color. If you need to understand precise compatibility scores between Team 10 and Project 9, a network diagram might not provide the level of granularity required for detailed comparisons.

In addition, when analyzing subtle differences in relationships, such as two teams being nearly equally suited for Project 9, these distinctions could be visually minimized in the network, making it harder to see the finer details that may influence the final pairing decision.

Grouped Bar Chart

A grouped bar chart (also called a clustered bar chart) is a type of chart used to display discrete, categorical data. It allows for easy comparison of multiple sets of values across different categories. Each group (in this case, teams) is represented on the x-axis, and each group's bars (projects) are displayed side by side for comparison. The y-axis typically represents the magnitude or value being measured, which, in this case, is the best-fit value.

How is a Grouped Bar Chat used?

X-axis (Teams): In your scenario, the x-axis would represent the 150 different teams. These teams would be spaced equally along the axis, with each team occupying one spot.
Y-axis (Best-fit Value): The y-axis would display the best-fit value, which could be a numerical value showing how well each team is suited to or has performed with each project.
Grouping (Projects): The projects would form the basis for the grouping. For each team on the x-axis, there would be a set of bars side by side, each bar representing one of the 150 projects.

Colour-coding: Each project could be represented by a different color to distinguish the bars within each group, making it easier to see how teams performed or matched across different projects.

Why use a Grouped Bar chart?

A grouped bar chart can be a good choice if your goal is to visually compare multiple data points across different teams and projects. Here's why:

1. **Comparison Across Multiple Variables**: The grouped bar chart allows for the comparison of multiple projects for each team. You can quickly identify which project has the highest or lowest best-fit value for each team.
2. **Categorical Grouping**: Since both the teams and projects are discrete categories, the grouped bar chart works well for displaying these relationships. It avoids the need for continuous data and highlights differences between categories clearly.
3. **Visual Clarity with Colour-Coding**: With appropriate colour-coding, it is possible to see the performance or fit of each team to different projects clearly. You could easily spot trends or outliers, such as if certain teams tend to perform better or worse across many projects.

As stated earlier in the network Diagram to avoid overcrowding a potential filtering system could be implemented in the graph. Such that it will only display the top 5 teams for each project.

Why not use a Grouped Bar Chart?

Despite its potential advantages, there are significant limitations to using a grouped bar chart for this specific scenario. Here are some reasons it might not be the best choice:

1. **Overcrowding of Data**: With 150 teams and 150 projects, you are looking at 22,500 data points (150 teams × 150 projects). Displaying this in a grouped bar chart would result in extreme overcrowding, with 150 groups, each containing 150 bars. This level of complexity would make it difficult to distinguish one bar from another, defeating the purpose of visual clarity.
2. **Complexity of Reading the Chart**: Even with color-coding, it would be nearly impossible to read a chart with this many variables without overwhelming the viewer. Users may struggle to glean useful information from the chart, especially if bars are small and indistinguishable.
3. **Loss of Detail in Trends**: One of the major reasons to use a grouped bar chart is to compare groups of data quickly. However, in this case, the sheer number of teams and projects would likely obscure any meaningful trends. Viewers would have to sift through so much information that it would be difficult to make any quick insights, and visual clutter would diminish the purpose of comparison.

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