mariner Report Theme

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1 Colour

Every colour below comes from the theme rather than from this document. `_brand.yml` is the only file in the package where a hex is typed, and both the page and the figures on it resolve back to it.

1.1 Brand chrome

Chrome dresses the document: headings, rules, links, body ink. Neither official colour can carry a data series. The green reads as near-black in a plot, and the gold is too light against the page to carry text. The theme ships a darkened gold for ink and another for rules, each walked along the gold's own hue until it clears its contrast threshold.

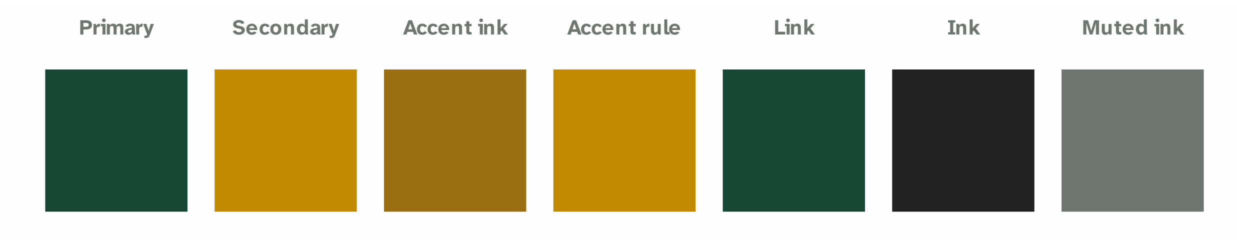

Figure 1: Brand chrome, by the role each colour plays.

1.2 The four palette families

Each family answers a different question about the data.

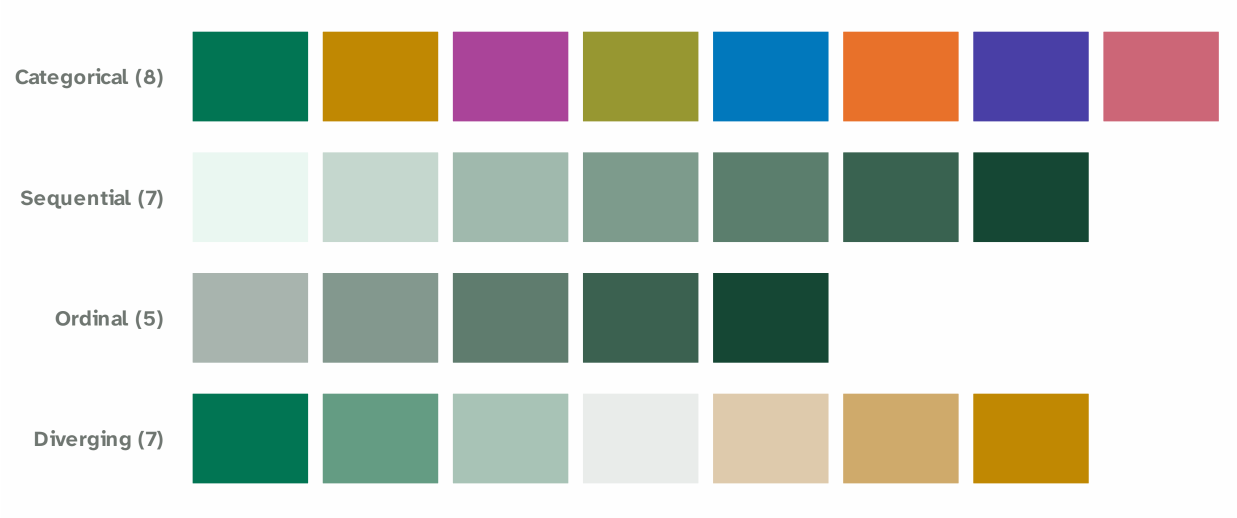

Figure 2: The four palette families, as swatches.

Categorical separates things that have no order. Sequential carries magnitude on one hue. Ordinal is sequential over a few ranked levels. Diverging needs its neutral step to mean *no difference*, which is why the section below sets symmetric limits rather than letting the data decide.

Five scale families reach these four palettes. Sequential is spent twice: `scale_*_mariner_c()` runs it as a gradient, `scale_*_mariner_b()` cuts it into steps. The rest map one to one — `_d()` to categorical, `_o()` to ordinal, `_div()` to diverging.

2 Typography

One type system, and each face does something the other cannot.

Atkinson Hyperlegible — headings, and every figure label

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h i j k l m n o p q r s t u v w x y z 0 1 2 3 4 5 6 7 8 9 — **I l 1 · 0 O · rn m**

Lora — body copy

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h i j k l m n o p q r s t u v w x y z 0 1 2 3 4 5 6 7 8 9 — *Italic*, **Bold**, ***Bold Italic***

JetBrains Mono — code

`A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h i j k l m n o p q r s t u v w x y z 0 1 2 3 4 5 6 7 8 9 — I l 1 · 0 O · rn m`

The pairs in bold are why Atkinson carries the structure: `I l 1`, `0 O` and `rn m` collapse at small sizes, and a figure axis is nothing but small text. Lora keeps the body. A serif tracks the eye from line to line, and it sets narrower, which is what a dense table needs.

3 Mathematics and notation

These pages exercise the markup vocabulary: defined terms, definition and theorem blocks, and cross-reference anchors.

Definition (Formal sum). Let $\mathcal{M}$ be a set of abstract basis elements and let $\mathcal{F}$ be a field. A *formal sum* is a function $\phi : \mathcal{M} \to \mathcal{F}$ with finite support, where the *support* of ϕ is

$$\operatorname{supp}(\phi) \;=\; \{\, m \in \mathcal{M} \;\mid\; \phi(m) \neq 0 \,\}.$$

The finite-support condition is what guarantees that every combination below has finitely many non-zero terms.

Definition (Formal linear combination). A *formal linear combination* $c_\phi \in \mathcal{V}$ pairs coefficients $a_i = \phi(m_i) \in \mathcal{F}$ with elements $m_i \in \mathcal{M}$:

$$c_\phi \;=\; \sum_{i=1}^{n} \phi(m_i)\, m_i \;=\; \sum_{i=1}^{n} a_i m_i.$$

The terms remain ***unreduced*** symbolic expressions.

Theorem. The set of functions $\phi : \mathcal{M} \to \mathcal{F}$ with finite support forms a vector space $\mathcal{V}$ under pointwise addition and scalar multiplication:

$$(\phi_1 + \phi_2)(m) \;=\; \phi_1(m) + \phi_2(m), \qquad (a \cdot \phi)(m) \;=\; a \cdot \phi(m).$$

3.1 A worked example

Fix $\mathcal{M} = \{v_0, v_1, v_2\}$ and $\mathcal{F} = \mathbb{R}$, and take two maps out of $\mathcal{M}$:

$$\phi(v_0) = 3, \quad \phi(v_1) = -2.5, \quad \phi(v_2) = 0, \qquad \psi(v_0) = -1, \quad \psi(v_1) = 0, \quad \psi(v_2) = 4.$$

Both have finite support, so both are formal sums:

$$\operatorname{supp}(\phi) = \{v_0, v_1\}, \qquad \operatorname{supp}(\psi) = \{v_0, v_2\}.$$

Reading the coefficients off each map gives the two *formal linear combinations*

$$c_\phi = 3v_0 - 2.5v_1, \qquad c_\psi = -v_0 + 4v_2.$$

Neither simplifies further. v_0, v_1 and v_2 are distinct **basis** elements, so $3v_0 - 2.5v_1$ is already in lowest terms in a way that $3 - 2.5$ is not.

Addition is pointwise. Adding coefficient by coefficient,

$$(\phi + \psi)(v_0) = 3 + (-1) = 2, \qquad (\phi + \psi)(v_1) = -2.5, \qquad (\phi + \psi)(v_2) = 4,$$

so $c_{\phi+\psi} = 2v_0 - 2.5v_1 + 4v_2$. Here the supports union, but in general only the containment

$$\operatorname{supp}(\phi + \psi) \;\subseteq\; \operatorname{supp}(\phi) \cup \operatorname{supp}(\psi)$$

holds, and it can be ***strict***: a coefficient that cancels drops out of the support entirely.

Cancellation supplies the inverses. Taking $a = -1$ and adding,

$$(\phi + (-1) \cdot \phi)(m) \;=\; \phi(m) - \phi(m) \;=\; 0 \qquad \text{for every } m \in \mathcal{M},$$

so the combination is the empty sum 0. Every element of $\mathcal{V}$ therefore has an additive inverse — the last axiom the theorem needs, and the reason the finite-support condition had to be there from the start.

4 Data

One dataset for the whole section, fuel economy for 234 vehicle models, so a difference between two figures is the palette rather than a change of subject.

4.1 Categorical — economy by vehicle class

The observations themselves rather than a boxplot, which would summarise them and hide how many models sit behind each class.

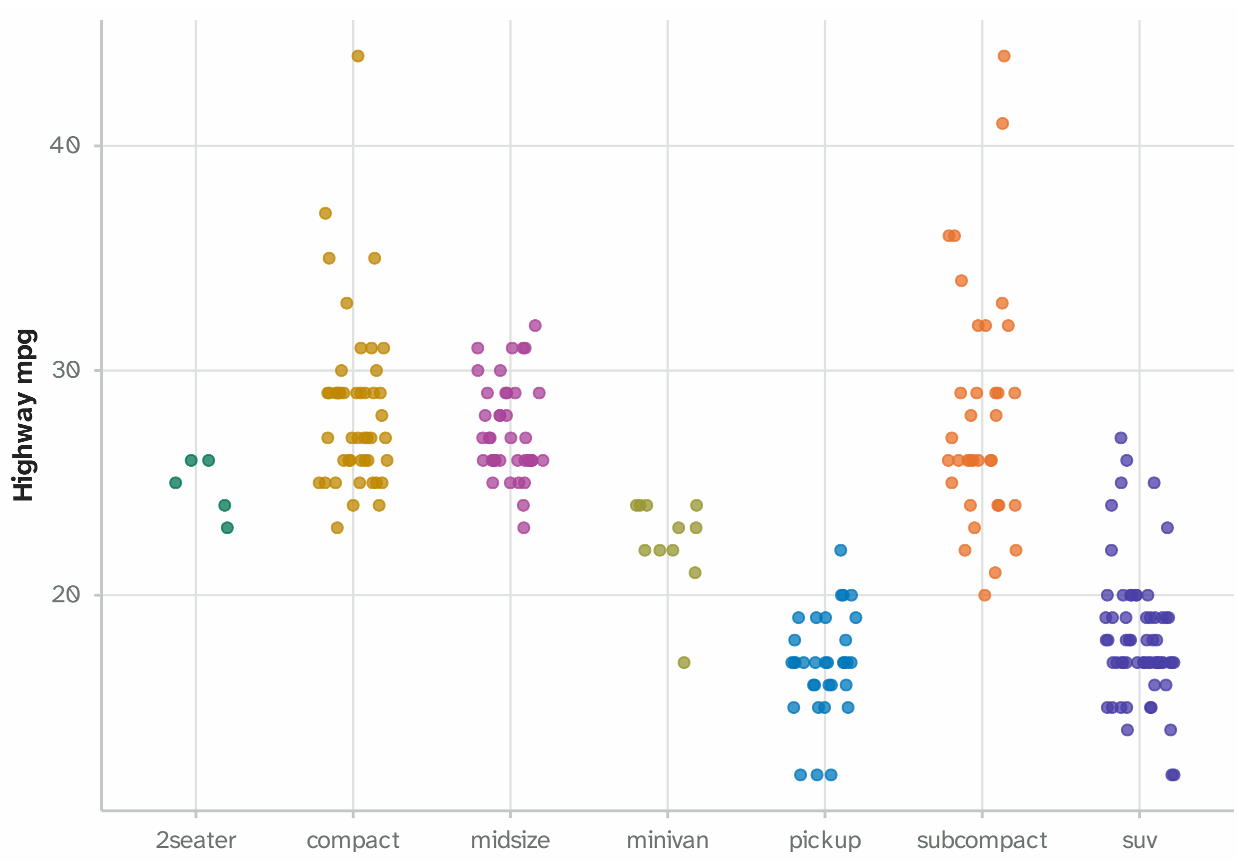

Figure 3: Highway economy by class, one point per model.

4.2 Sequential — city economy across the range

Magnitude on one hue, carried by the marks themselves.

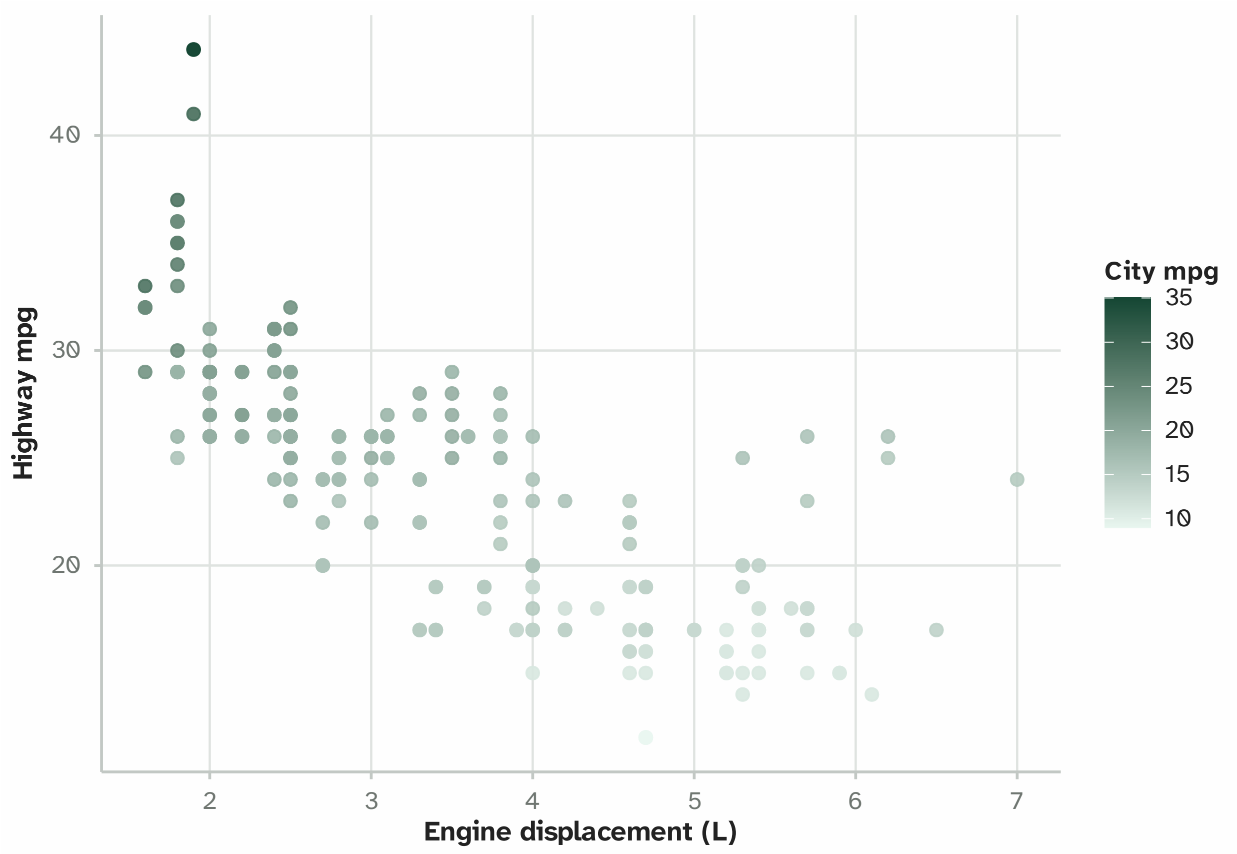

Figure 4: Displacement against highway economy, shaded by city economy.

4.3 Diverging — each class against the overall mean

A signed quantity, where the neutral step means “no difference”. The limits are symmetric on purpose. Without that, the neutral step lands wherever the data straddles and the scale misplaces zero.

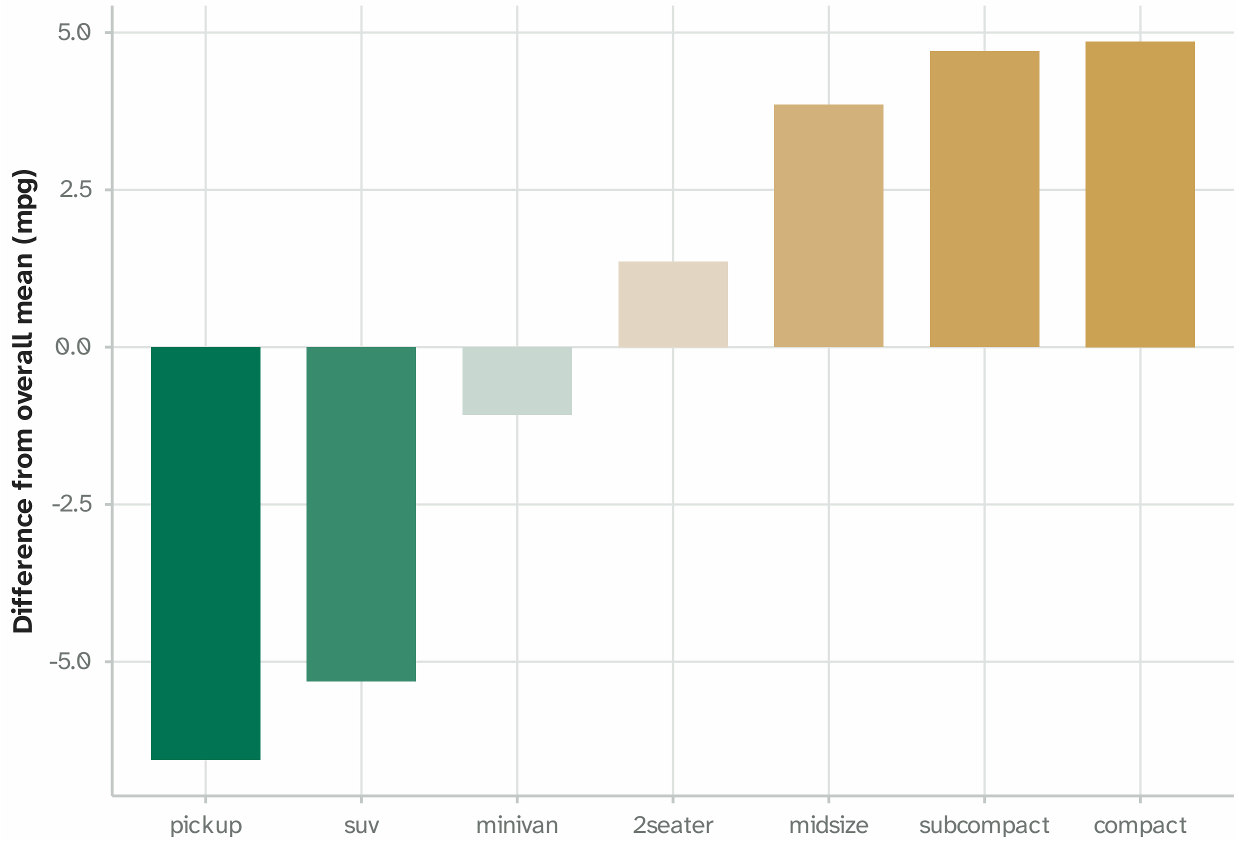

Figure 5: Mean highway economy per class, as a difference from the overall mean.

4.4 The classes, summarised

Table 1: Mean economy by class, ordered as the figure above.

Class	City	Highway	Δ vs mean
pickup	13.0	16.9	-6.6
suv	13.5	18.1	-5.3
minivan	15.8	22.4	-1.1
2seater	15.4	24.8	1.4
midsize	18.8	27.3	3.9
subcompact	20.4	28.1	4.7
compact	20.1	28.3	4.9

5 Callouts

All five, because a callout style that breaks shows up nowhere else.

> **Note**
>
> Note callouts take the primary brand colour on their border and header.

Tip

Tip callouts are for the thing the reader would otherwise have to work out.

Warning

Warning callouts keep semantic amber rather than a brand colour.

Important

Important callouts are the strongest emphasis available before shouting.

Caution

Caution callouts complete the set.