

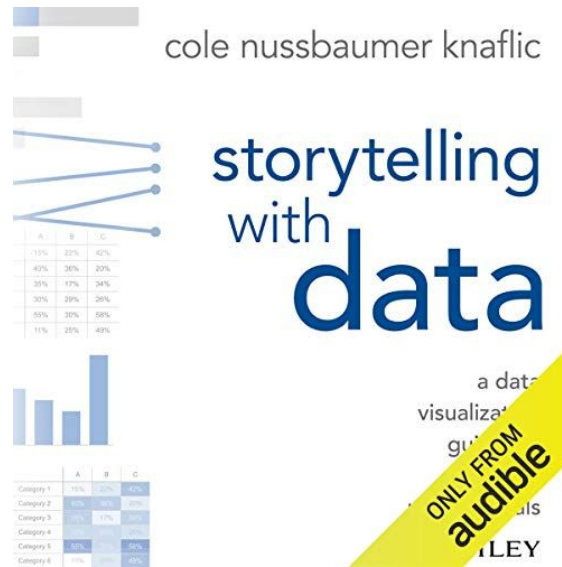


# Visualisation de données

Julien Romero

# Sources

- Cours et illustrations basés sur *Storytelling with Data: A Data Visualization Guide for Business Professionals* de Cole Nussbaumer Knaflic



# Qu'est-ce que la visualisation de données ?

- La visualisation de données est une discipline des sciences des données qui a but but de traduire graphiquement une information contenue dans les données de manière facilement intelligible.
- Pourquoi ?
  - Comprendre les données
  - Reconnaître des motifs
  - Partager l'information avec un large publique
  - Aider à prendre des décisions

# Dans ce cours...

- Deux types de visualisations
  - **Exploratoire** : On veut trouver ce qui est intéressant dans les données
  - **Explicative** : On veut communiquer de l'information

On va se concentrer sur la partie **explicative**, c'est-à-dire réussir à communiquer clairement un résultat.

# Connaître le contexte

Une communication doit toujours pensée dans son contexte

- Pour qui ? Ingénieurs ? Investisseurs ?
- Quoi ? Que voulez-vous transmettre à votre audience ?
  - Format ? Présentation orale ? Document écrit ? Contrôle vs détails
- Comment ? À l'aide de quelles données ?

# Choisir une bonne représentation visuelle

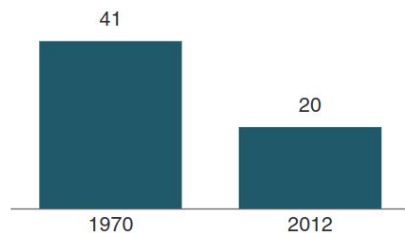
# Texte

- Efficace et souvent oublié
- Utile quand on veut communiquer un seul nombre
- Ce n'est pas parce qu'on a beaucoup de données qu'il faut tout montrer

# Texte

## Children with a "Traditional" Stay-at-Home Mother

*% of children with a married stay-at-home mother with a working husband*



Note: Based on children younger than 18. Their mothers are categorized based on employment status in 1970 and 2012.

Source: Pew Research Center analysis of March Current Population Surveys Integrated Public Use Microdata Series (IPUMS-CPS), 1971 and 2013

Adapted from PEW RESEARCH CENTER



# 20%

of children had a **traditional stay-at-home mom** in 2012, compared to 41% in 1970



# Tableau

- Bien dans un document écrit, mauvais à l'oral
- Demande d'être lu, chacun prend ce qui l'intéresse
- Exhaustif
- Attention de garder le design le plus simple possible, qui s'éclipse dans l'arrière plan

Heavy borders

Group	Metric A	Metric B	Metric C
Group 1	\$X.X	Y%	Z,ZZZ
Group 2	\$X.X	Y%	Z,ZZZ
Group 3	\$X.X	Y%	Z,ZZZ
Group 4	\$X.X	Y%	Z,ZZZ
Group 5	\$X.X	Y%	Z,ZZZ

Light borders

Group	Metric A	Metric B	Metric C
Group 1	\$X.X	Y%	Z,ZZZ
Group 2	\$X.X	Y%	Z,ZZZ
Group 3	\$X.X	Y%	Z,ZZZ
Group 4	\$X.X	Y%	Z,ZZZ
Group 5	\$X.X	Y%	Z,ZZZ

Minimal borders

Group	Metric A	Metric B	Metric C
Group 1	\$X.X	Y%	Z,ZZZ
Group 2	\$X.X	Y%	Z,ZZZ
Group 3	\$X.X	Y%	Z,ZZZ
Group 4	\$X.X	Y%	Z,ZZZ
Group 5	\$X.X	Y%	Z,ZZZ

# Carte thermique / Heatmap

- Variante du tableau dans laquelle la couleur = l'amplitude
- Aide à rapidement voir les extrêmes
- Garder les couleurs simples = saturations d'une seule couleur

Table

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%
Category 5	55%	30%	58%
Category 6	11%	25%	49%

Heatmap

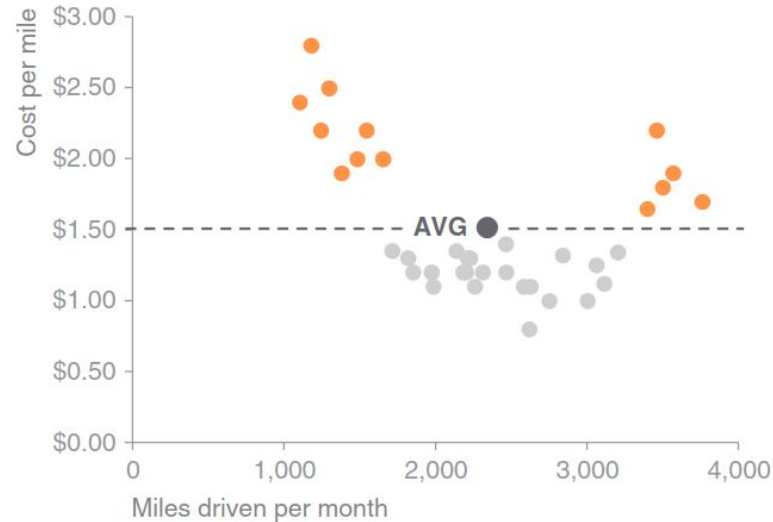
LOW-HIGH

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%
Category 5	55%	30%	58%
Category 6	11%	25%	49%

# Nuage de points

- Permet de montrer une relation entre deux concepts
- Beaucoup utilisé en science

Cost per mile by miles driven



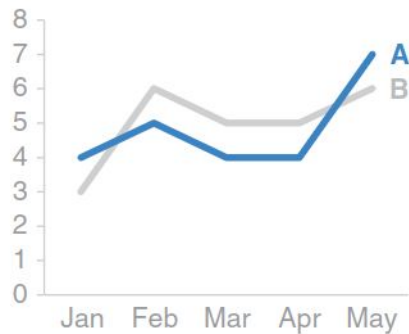
# Lignes

- Pour des données continues

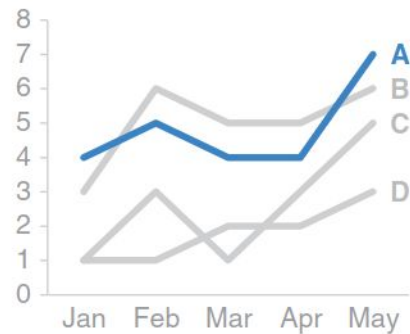
Single series



Two series

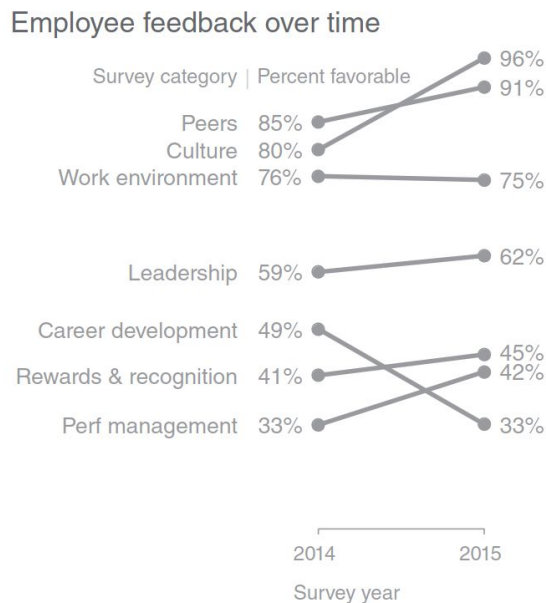


Multiple series



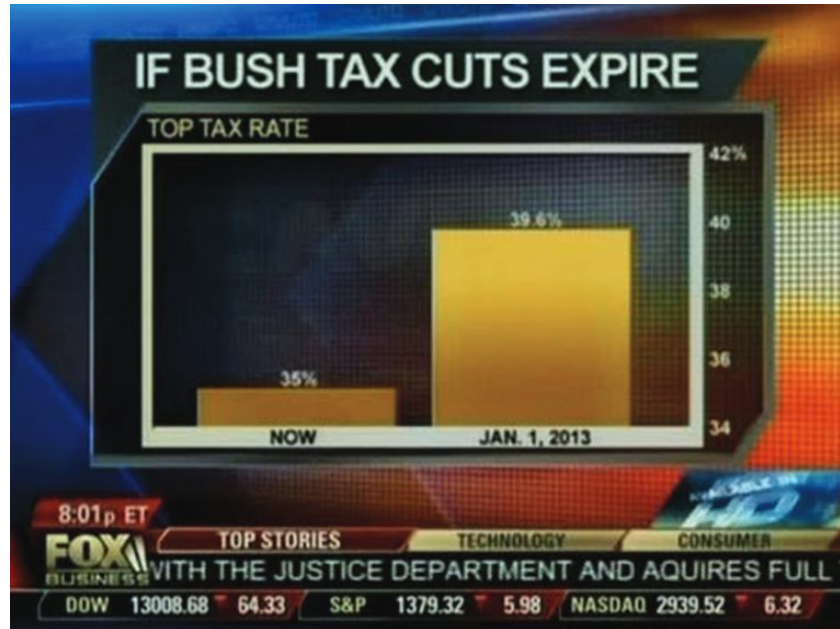
# Pente

- Variante de la ligne qui permet de visualiser une évolution entre deux catégories ou dates



# Diagramme à bande

- Très commun, mais sujet à beaucoup de mauvaises utilisations

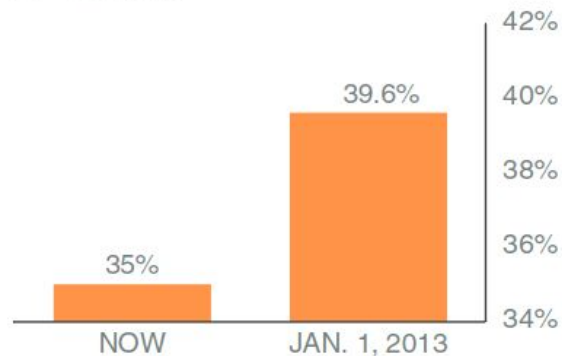


# Diagramme à bande

- Très commun, mais sujet à beaucoup de mauvaises utilisations
- On commence à zéro !

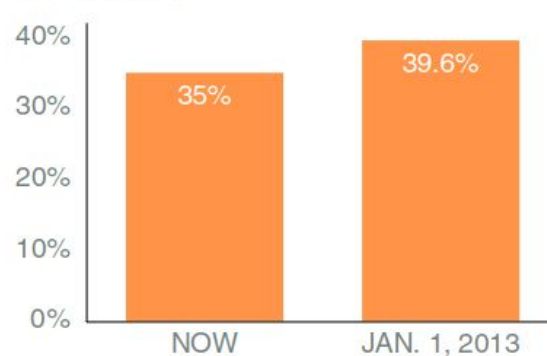
**Non-zero baseline:** as originally graphed

IF BUSH TAX CUTS EXPIRE  
TOP TAX RATE



**Zero baseline:** as it should be graphed

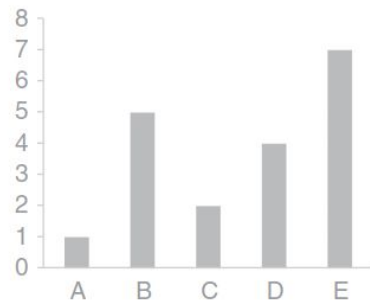
IF BUSH TAX CUTS EXPIRE  
TOP TAX RATE



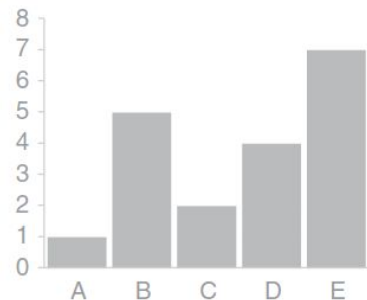
# Diagramme à bande

- Très commun, mais sujet à beaucoup de mauvaises utilisations
- On commence à zéro !
- Bien choisir la largeur

Too thin



Too thick



Just right

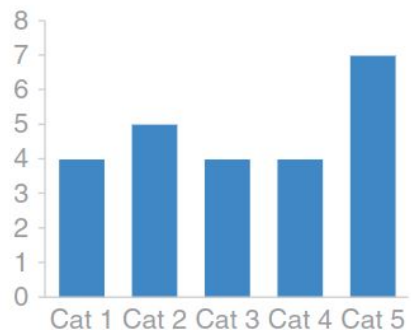




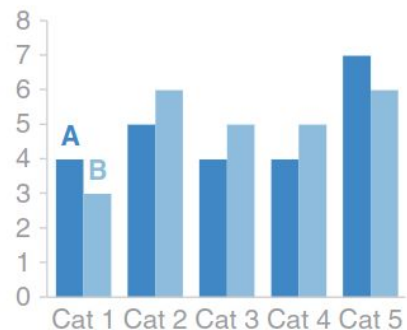
# Diagramme à bande

- On peut afficher plusieurs séries ensemble
  - Attention de ne pas en mettre trop => illisible

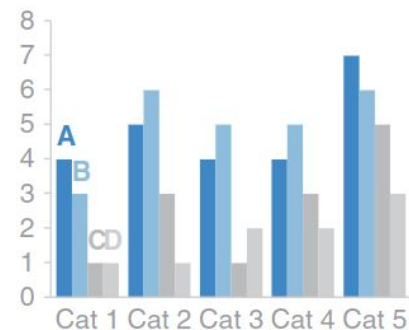
Single series



Two series



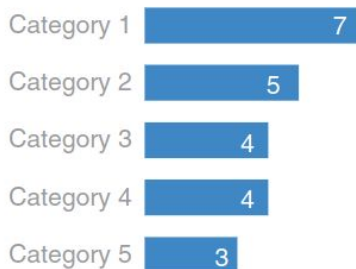
Multiple series



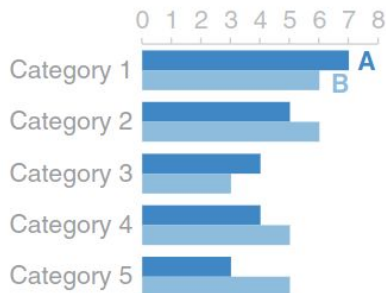
# Diagramme à bande

- Vertical ou horizontal (catégories souvent plus faciles à lire)

Single series



Two series



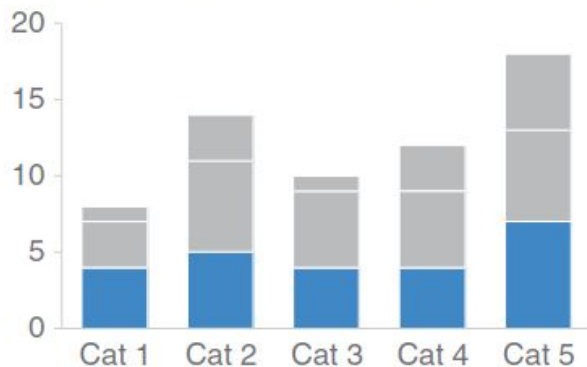
Multiple series



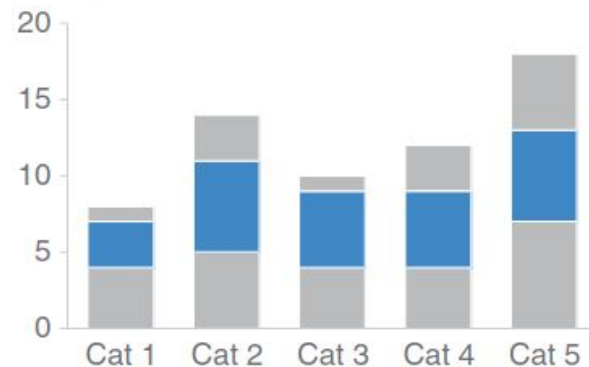
# Diagramme à bande

- On peut empiler des sous-catégories
  - Devient vite illisible, surtout au milieu

Comparing **these** is easy



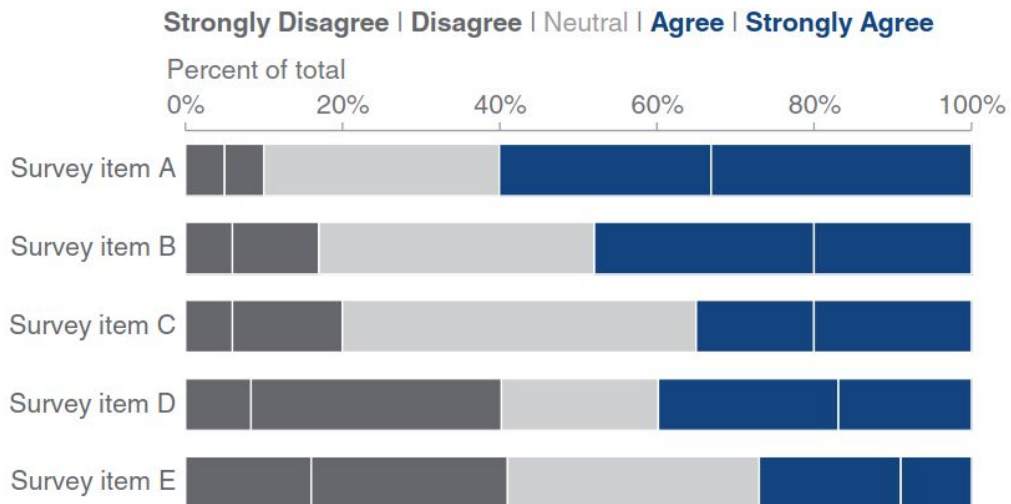
Comparing **these** is hard



# Diagramme à bande

- On peut exprimer des valeurs absolues ou en pourcentage

Survey results



# Diagramme en cascade / Waterfall

- Représentation de sous-composantes qui s'ajoutent ou s'enlèvent pour former un total

## 2014 Headcount math

Though more employees transferred out of the team than transferred in, aggressive hiring means overall headcount (HC) increased 16% over the course of the year.



# Surface

- On représente une quantité comme une surface
  - À utiliser avec parcimonie, moins il y a de dimensions, mieux c'est
  - Exception : On représenter de grandes variations => plus compact

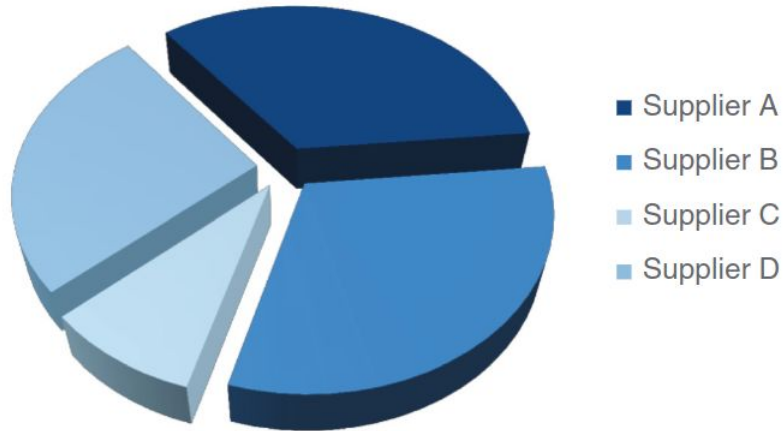
## Interview breakdown



# À éviter : les camberts

- Nous sommes très mauvais pour comparer des surfaces

Supplier Market Share

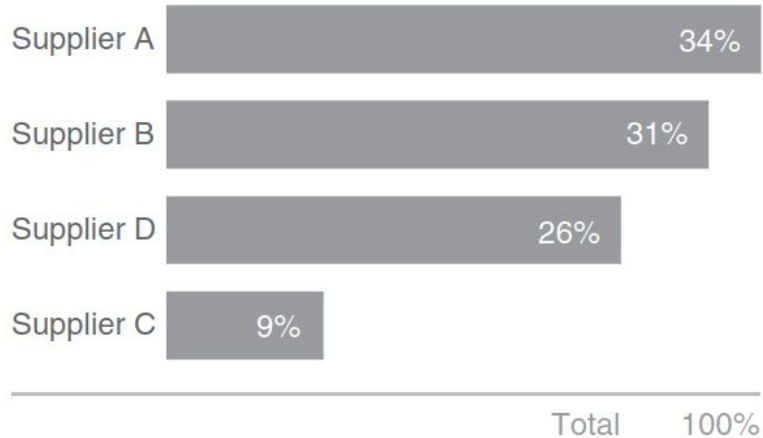


Qui a la plus grosse part ?

# À éviter : les camberts

- Nous sommes très mauvais pour comparer des surfaces

## Supplier Market Share



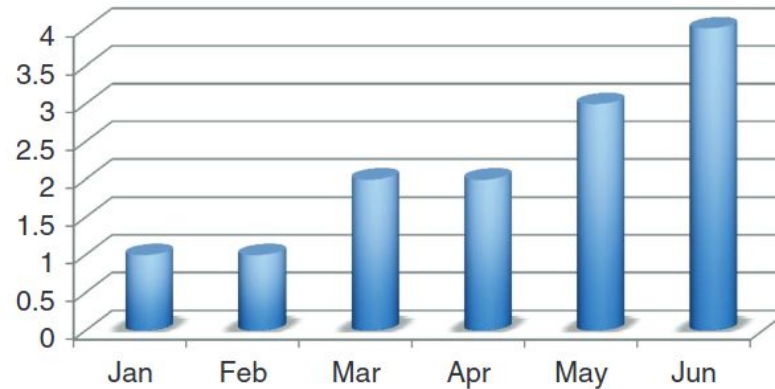
Qui a la plus grosse part ?



# À éviter : les diagrammes en 3D

- Souvent des dimensions inutiles
- Volumes encore plus compliqués à comparer que les surfaces

Number of issues



# À éviter : Plus axes y

- Difficile à lire rapidement

Secondary y-axis



# Réduire le désordre

# La solution la plus simple est souvent la meilleure

- Plus il y a d'éléments inutiles dans votre diagramme, plus difficile il sera à lire
- Il faut épurer au maximum
- Les principes de Gestalt peuvent aider à ordonner vos diagrammes

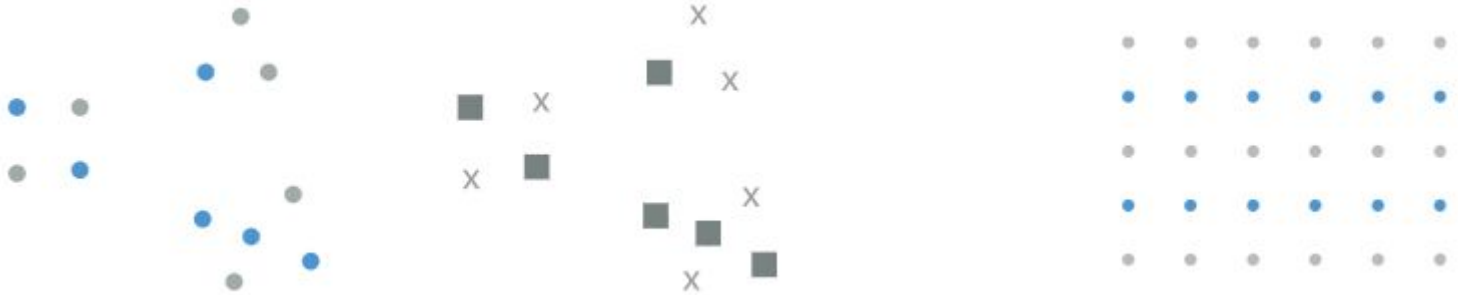
# Les principes de Gestalt - La proximité

- Nous groupons ensemble les objets proches



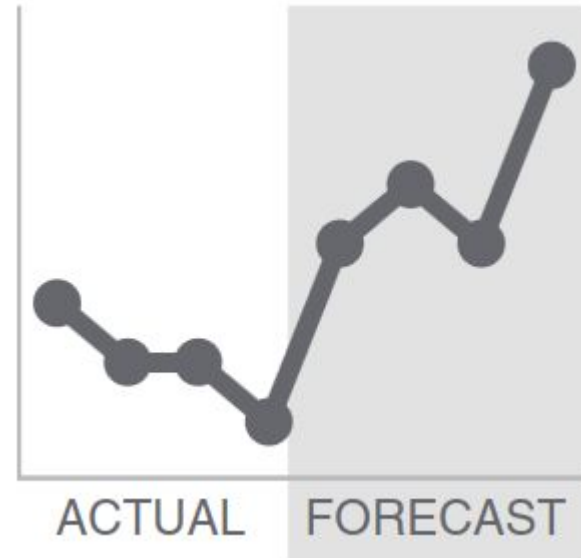
# Les principes de Gestalt - La similarité

- Nous groupons des objets similaires



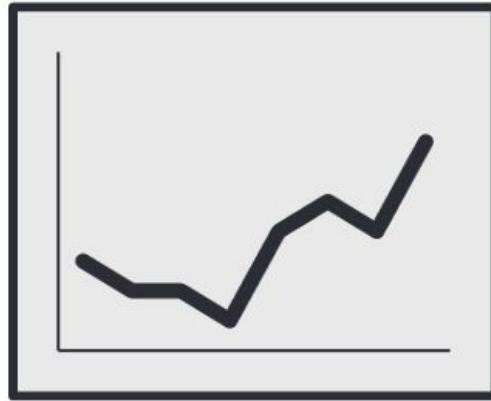
# Les principes de Gestalt - La région commune

- Des objets dans une même frontière nous semblent connectés



# Les principes de Gestalt - La clôture

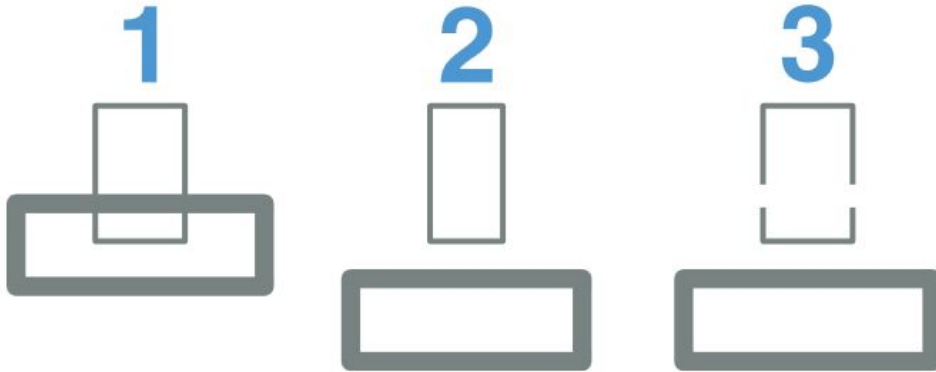
- Nous avons tendance à compléter des formes incomplètes
  - Ce n'est pas la peine de tout mettre pour que notre esprit comprenne





# Les principes de Gestalt - La continuité

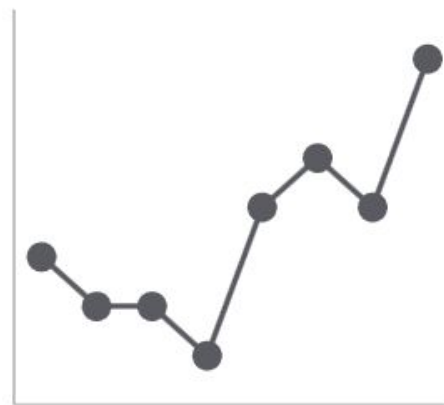
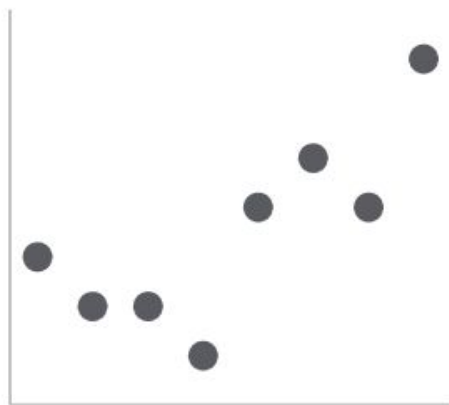
- Nous continuons naturellement les objets suivant le chemin le plus simple (par exemple, s'il passe derrière un autre objet)



L'axe y est inutile, on le reconstitue

# Les principes de Gestalt - La connectivité

Les objets connectés semblent former un groupe

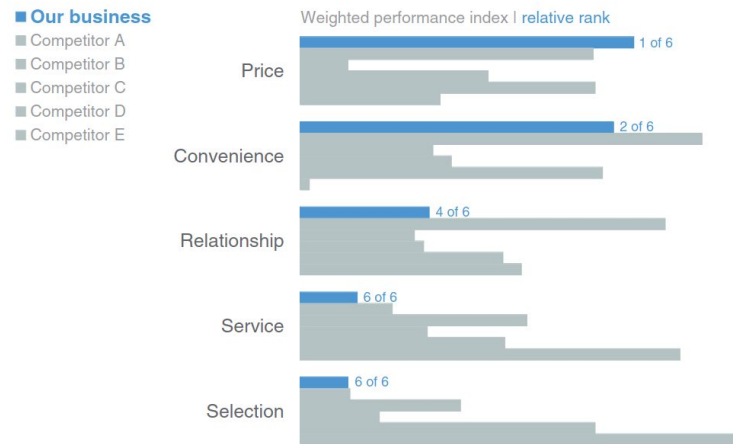


# Quelques éléments pour organiser vos diagrammes

- Aligner d'aligner des éléments pour réduire le désordre
- Utiliser des espaces blancs pour attirer l'attention
- Utiliser un fort contraste pour faire ressortir des éléments



Performance overview



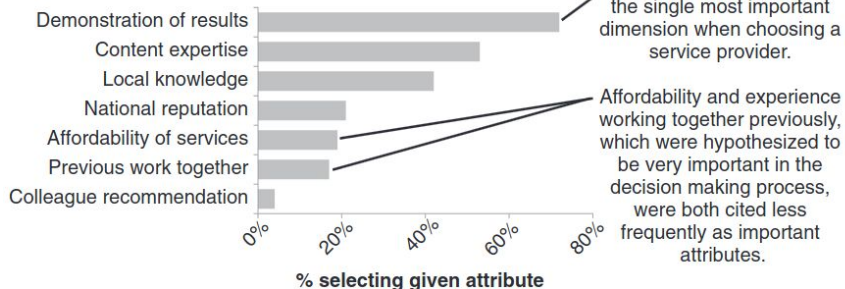
# Quelques éléments pour organiser vos diagrammes

Contraste

Alignement

## Demonstrating effectiveness is most important consideration when selecting a provider

In general, what attributes are the most important to you in selecting a service provider?  
(Choose up to 3)



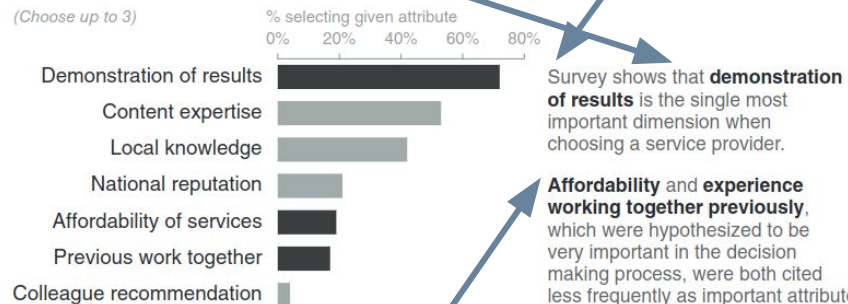
Survey shows that demonstration of results is the single most important dimension when choosing a service provider.

Affordability and experience working together previously, which were hypothesized to be very important in the decision making process, were both cited less frequently as important attributes.

Data source: xyz; includes N number of survey respondents. Note that respondents were able to choose up to 3 options.

## Demonstrating effectiveness is most important consideration when selecting a provider

In general, what attributes are the most important to you in selecting a service provider?  
(Choose up to 3)



Survey shows that **demonstration of results** is the single most important dimension when choosing a service provider.

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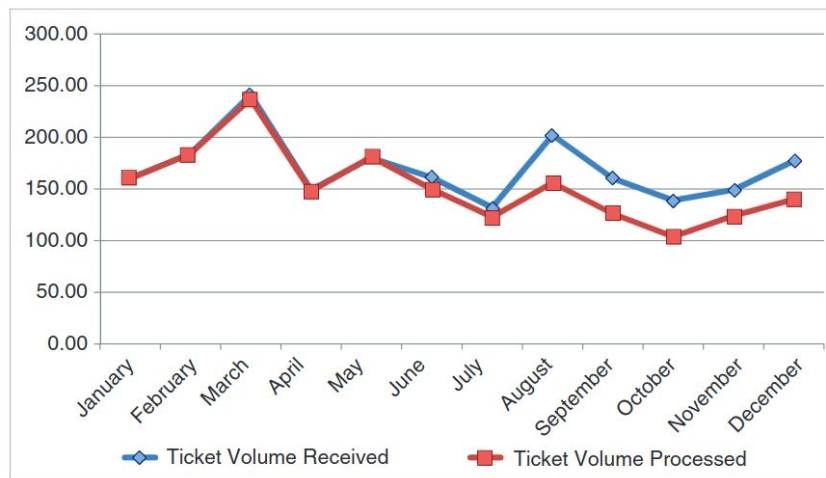
Espace

# Nettoyer un diagramme pas-à-pas

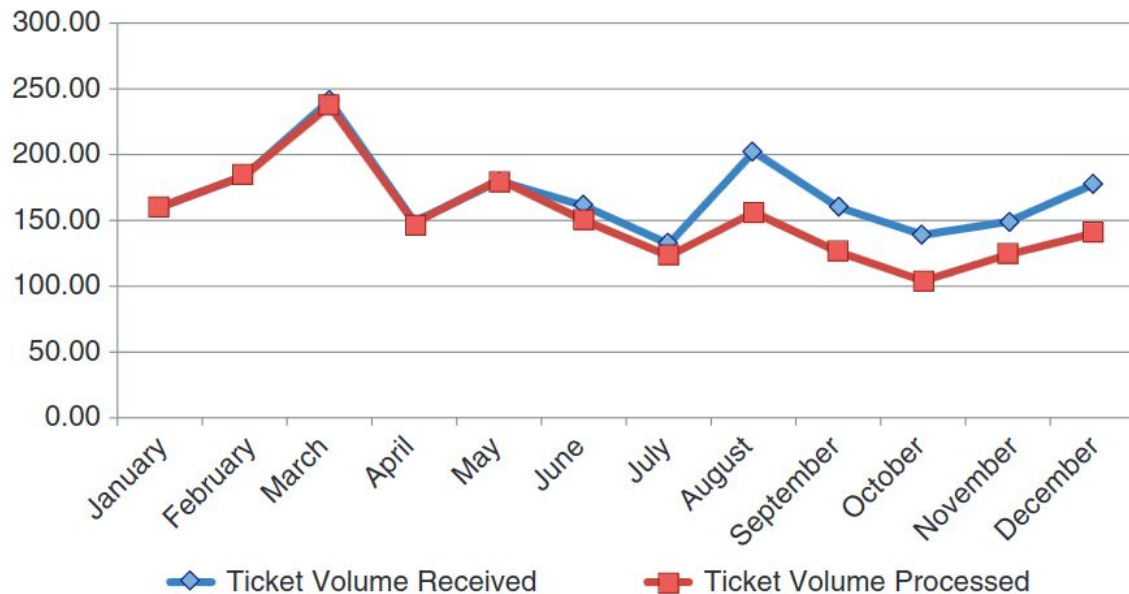
Qui : Les dirigeants d'une entreprise

Objectif : Obtenir deux nouveau employés

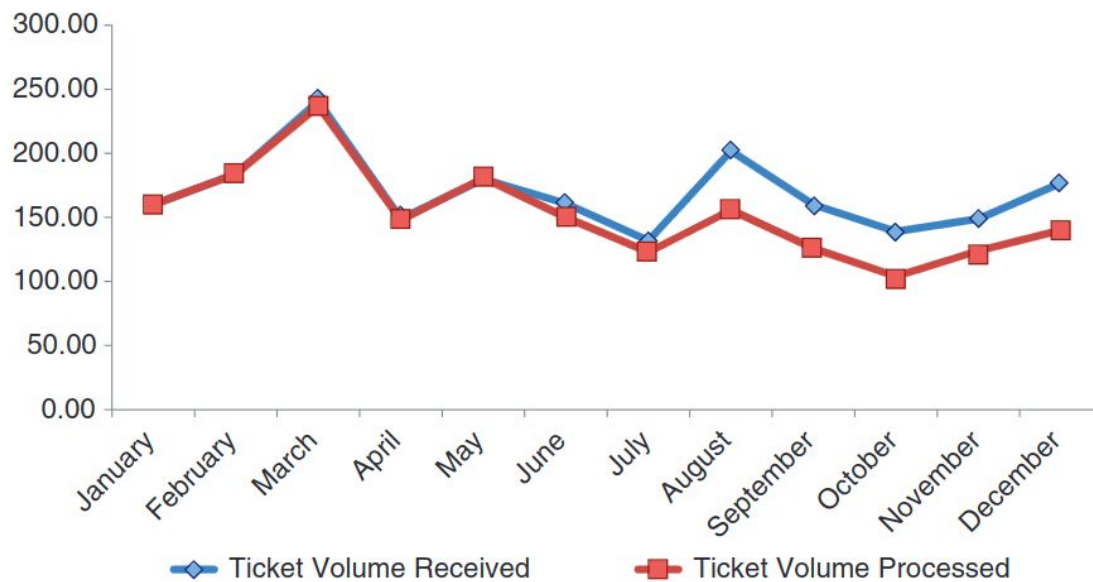
Comment : Avec les données de traitement de tickets



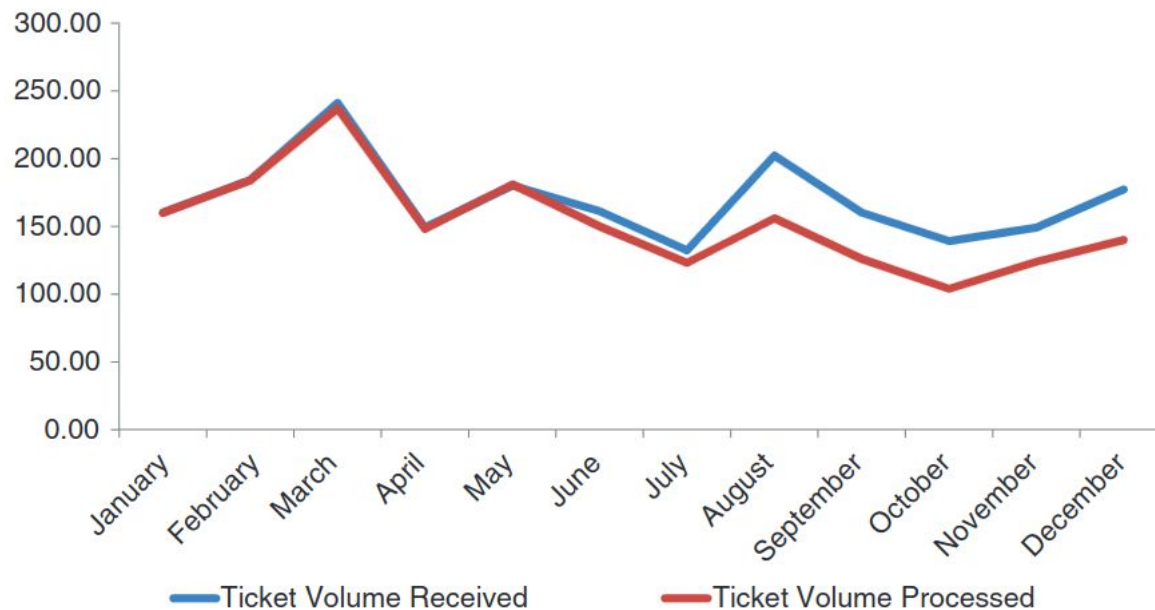
# 1. Enlever les bordures



## 2. Enlever la grille

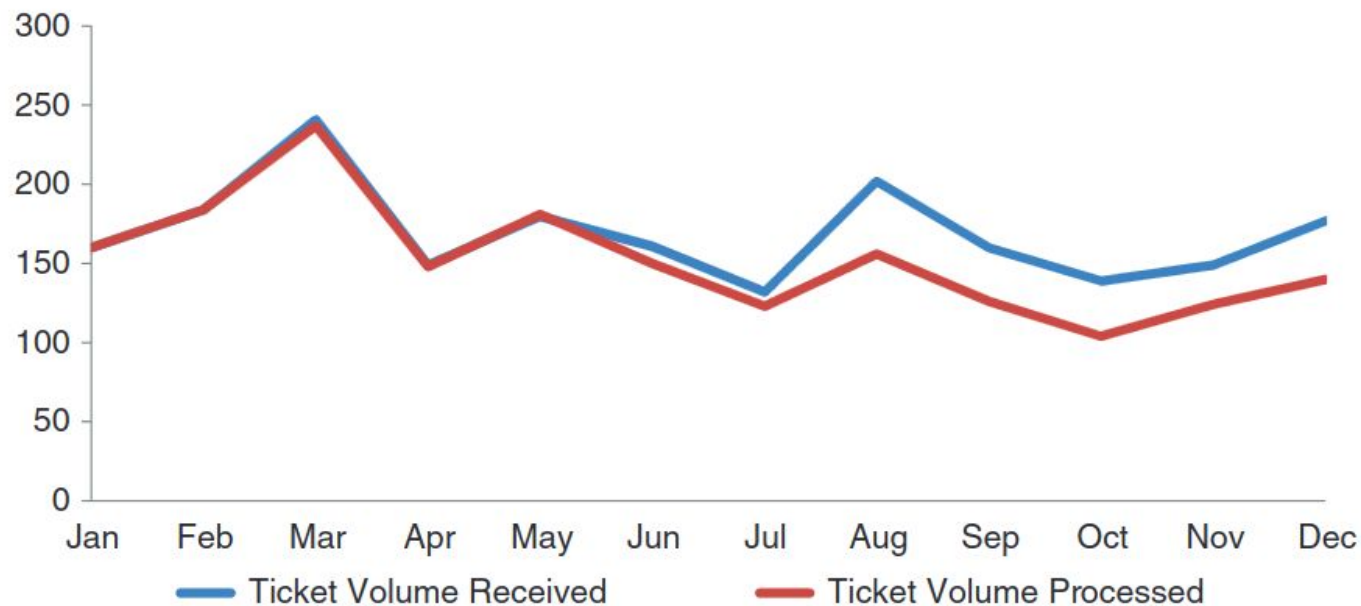


### 3. Enlever le marquage des points

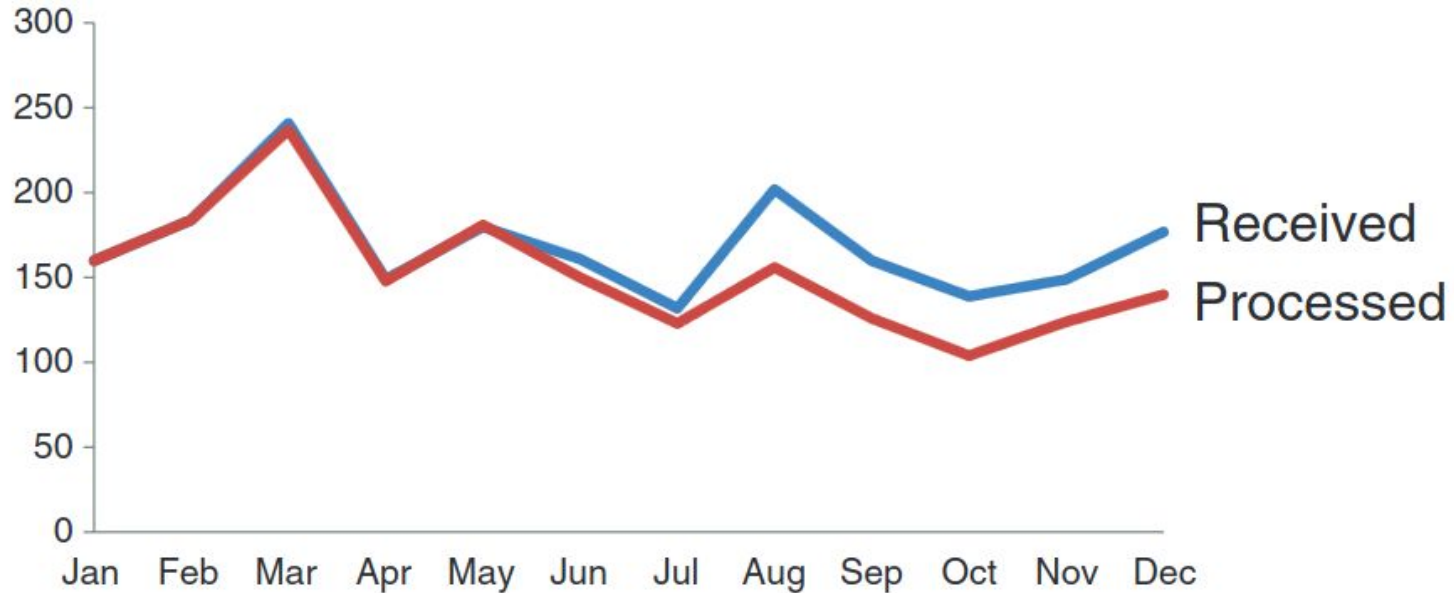




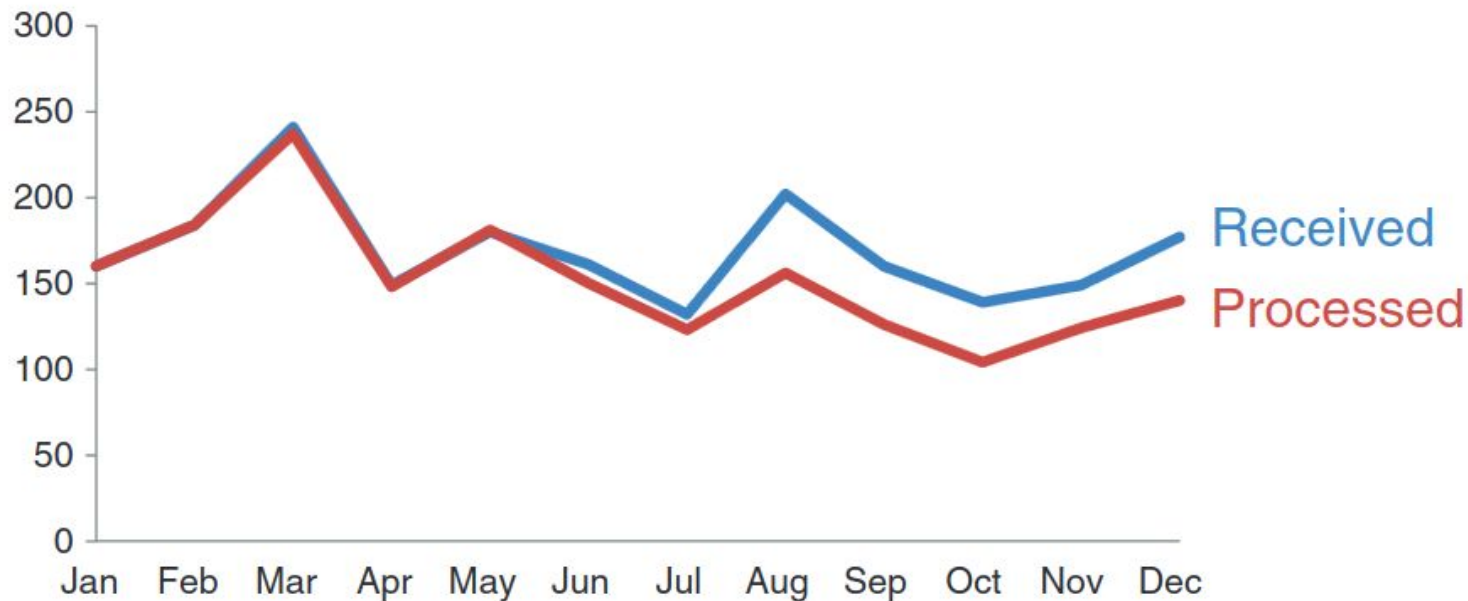
## 4. Nettoyage des axes



## 5. Rapprocher les noms des courbes des courbes



## 6. Utilisation cohérente de la couleur



# Focaliser l'attention de l'audience

## Comptez les 3

756395068473

658663037576

860372658602

846589107830

## Et maintenant ?

756**3**9506847**3**  
65866**3**0**3**7576  
860**3**72658602  
8465891078**3**0

# Quelques astuces pour attirer l'attention



Orientation



Shape



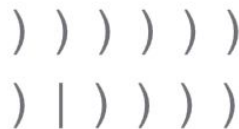
Line length



Line width



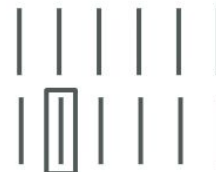
Size



Curvature



Added marks



Enclosure



Hue



Intensity



Spatial position



Motion

# Dans du texte - Vierge

What are we doing well? Great Products. These products are clearly the best in their class. Replacement parts are shipped when needed. You sent me gaskets without me having to ask. Problems are resolved promptly. Bev in the billing office was quick to resolve a billing issue I had. General customer service exceeds expectations. The account manager even called to check in after normal business hours. You have a great company – keep up the good work!



# Dans du texte - Gras

**What are we doing well?** Great Products. These products are clearly the best in their class. Replacement parts are shipped when needed. You sent me gaskets without me having to ask. Problems are resolved promptly. Bev in the billing office was quick to resolve a billing issue I had. General customer service exceeds expectations. The account manager even called to check in after normal business hours. You have a great company – keep up the good work!

# Dans du texte - Couleur

What are we doing well? Great Products. These products are clearly the best in their class. Replacement parts are shipped when needed. You sent me gaskets without me having to ask. Problems are resolved promptly. Bev in the billing office was quick to resolve a billing issue I had. General customer service exceeds expectations. The account manager even called to check in after normal business hours. You have a great company – keep up the good work!

# Dans du texte - Italique

What are we doing well? Great Products. These products are clearly the best in their class. *Replacement parts are shipped when needed.* You sent me gaskets without me having to ask. Problems are resolved promptly. Bev in the billing office was quick to resolve a billing issue I had. General customer service exceeds expectations. The account manager even called to check in after normal business hours. You have a great company – keep up the good work!

# Dans du texte - Taille

What are we doing well? Great Products. These products are clearly the best in their class. Replacement parts are shipped when needed. **You sent me gaskets without me having to ask.** Problems are resolved promptly. Bev in the billing office was quick to resolve a billing issue I had. General customer service exceeds expectations. The account manager even called to check in after normal business hours. You have a great company – keep up the good work!

# Dans du texte - Séparation spatiale

What are we doing well? Great Products. These products are clearly the best in their class. Replacement parts are shipped when needed. You sent me gaskets without me having to ask.

Problems are resolved promptly.

Bev in the billing office was quick to resolve a billing issue I had. General customer service exceeds expectations. The account manager even called to check in after normal business hours. You have a great company – keep up the good work!

# Dans du texte - Séparation spaciale

What are we doing well? Great Products. These products are clearly the best in their class. Replacement parts are shipped when needed. You sent me gaskets without me having to ask. Problems are resolved promptly. Bev in the billing office was quick to resolve a billing issue I had. General customer service exceeds expectations. The account manager even called to check in after normal business hours. You have a great company – keep up the good work!

# Dans du texte - Entourer

What are we doing well? Great Products. These products are clearly the best in their class. Replacement parts are shipped when needed. You sent me gaskets without me having to ask. Problems are resolved promptly. Bev in the billing office was quick to resolve a billing issue I had. General customer service exceeds expectations. The account manager even called to check in after normal business hours. You have a great company – keep up the good work!

# Dans du texte - Souligner

What are we doing well? Great Products. These products are clearly the best in their class. Replacement parts are shipped when needed. You sent me gaskets without me having to ask. Problems are resolved promptly. Bev in the billing office was quick to resolve a billing issue I had. General customer service exceeds expectations. The account manager even called to check in after normal business hours. You have a great company – keep up the good work!



# Dans du texte - Combinaison

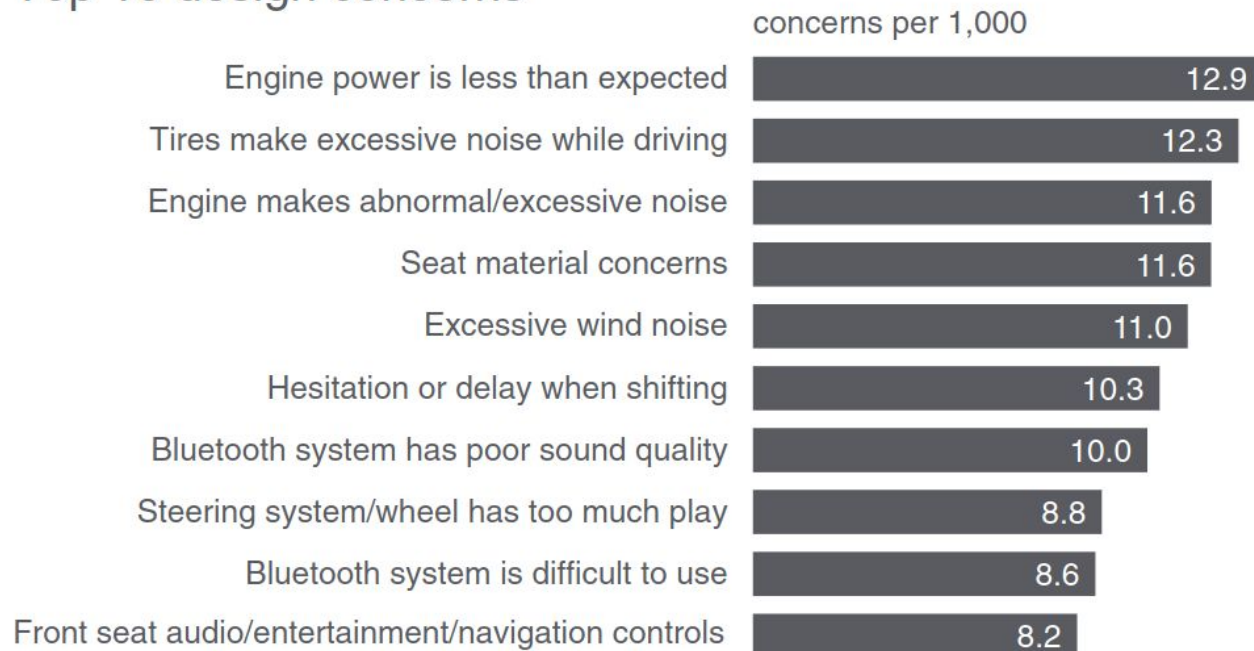
## What are we doing well?

Themes & example comments

- **Great products:** "These products are clearly the best in class."
- **Replacement parts are shipped when needed:**  
"You sent me gaskets without me having to ask, and I really needed them, too!"
- **Problems are resolved promptly:** "Bev in the billing office was quick to resolve a billing issue I had."
- **General customer service exceeds expectations:**  
"The account manager even called after normal business hours.  
*You have a great company - keep up the good work!"*

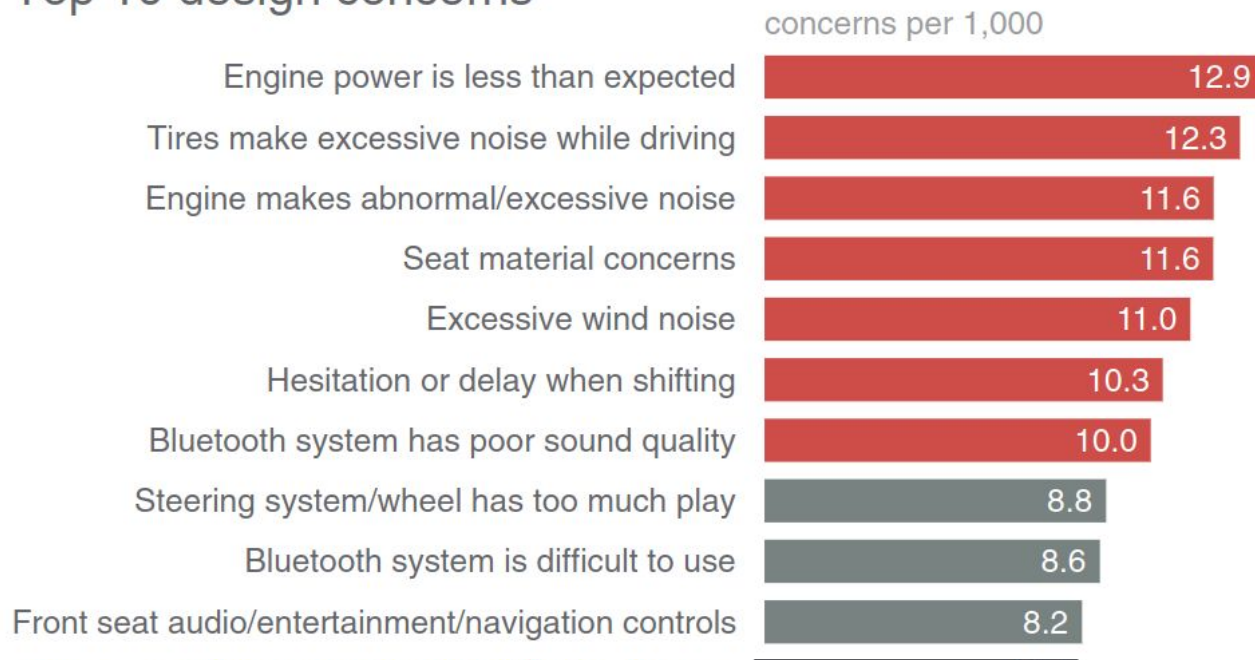
# Dans un diagramme - Vierge

## Top 10 design concerns



# Dans un diagramme - Couleur

## Top 10 design concerns



# Dans un diagramme - Couleur

## Attention avec les couleurs

- Ne pas en utiliser trop
- Utiliser les couleurs de manière cohérente
  - Couleurs associées à des concepts
- Attention aux daltoniens (8% des hommes, <1% des femmes)
- Les couleurs peuvent être associées à des émotions
- Faire écho aux couleurs de l'entreprise

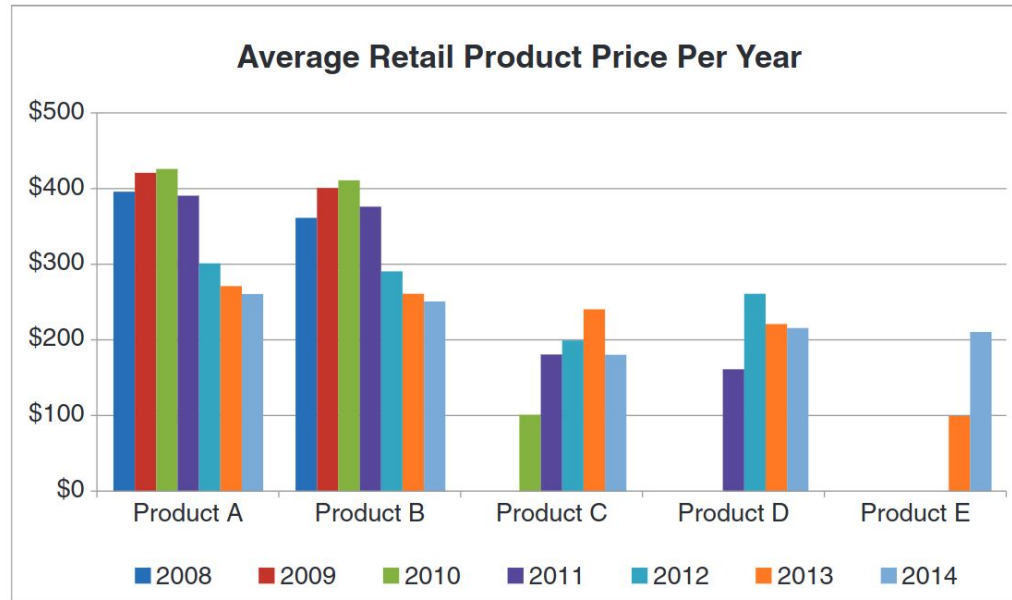
# Raconter une histoire

# Raconter une histoire

- Tous les exemples vus servent à supporter une idée
- L'idée doit venir comme une histoire avec un début, un milieu, et une fin

# Exemple - Données “brutes”

Price has declined for all products on the market since the launch of Product C in 2010



# Exemple

In the next **5 minutes...**

## OUR GOAL:

- 1 Understand **how prices have changed over time** in the competitive landscape.
- 2 Use this knowledge to **inform the pricing of our product**.

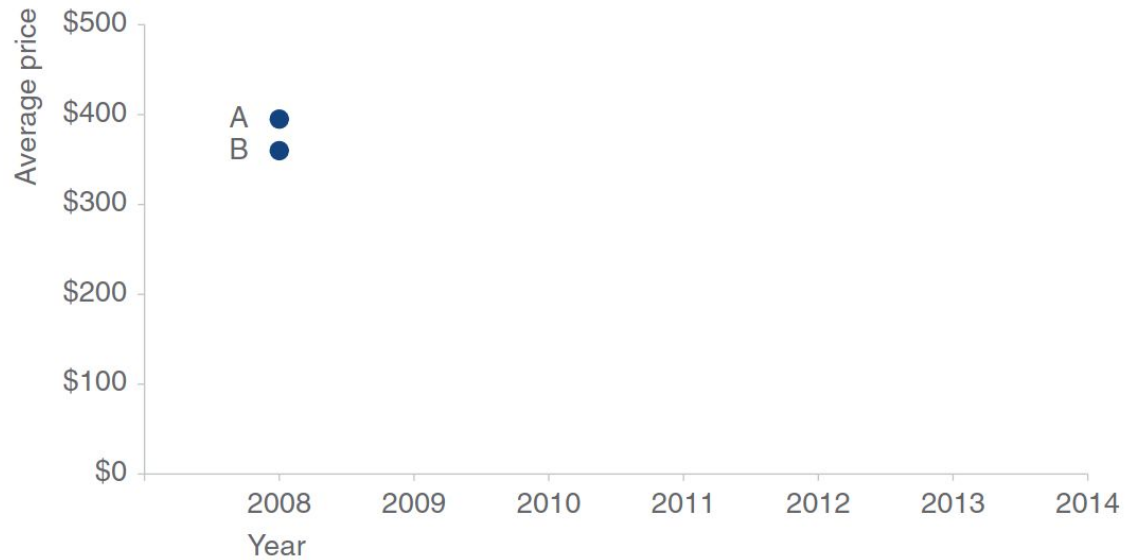
We will end with a **specific recommendation**.



# Exemple

Products A and B were launched in 2008 at price points of **\$360+**

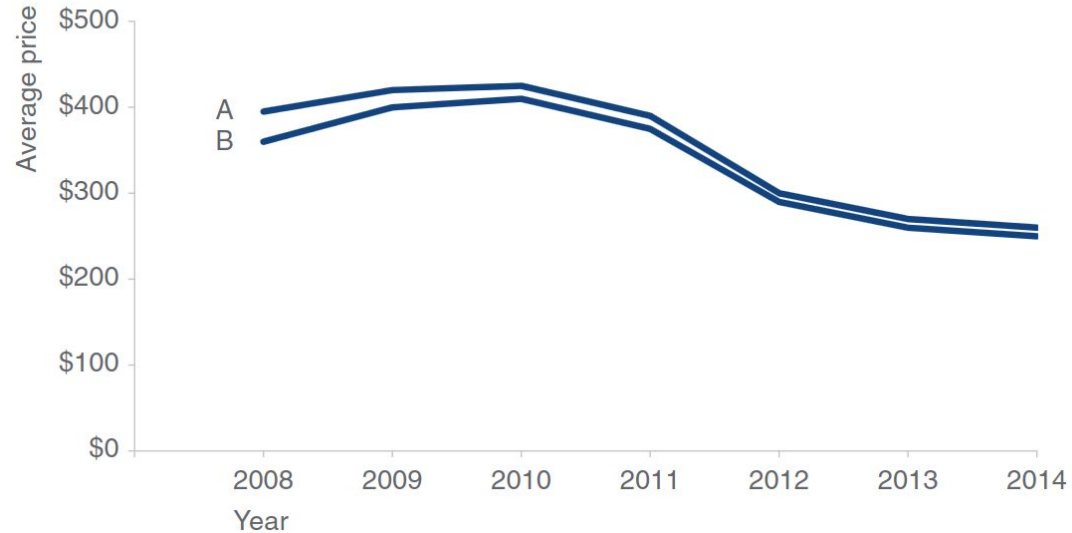
Retail price over time



# Exemple

They have been priced similarly over time, with B consistently slightly lower than A

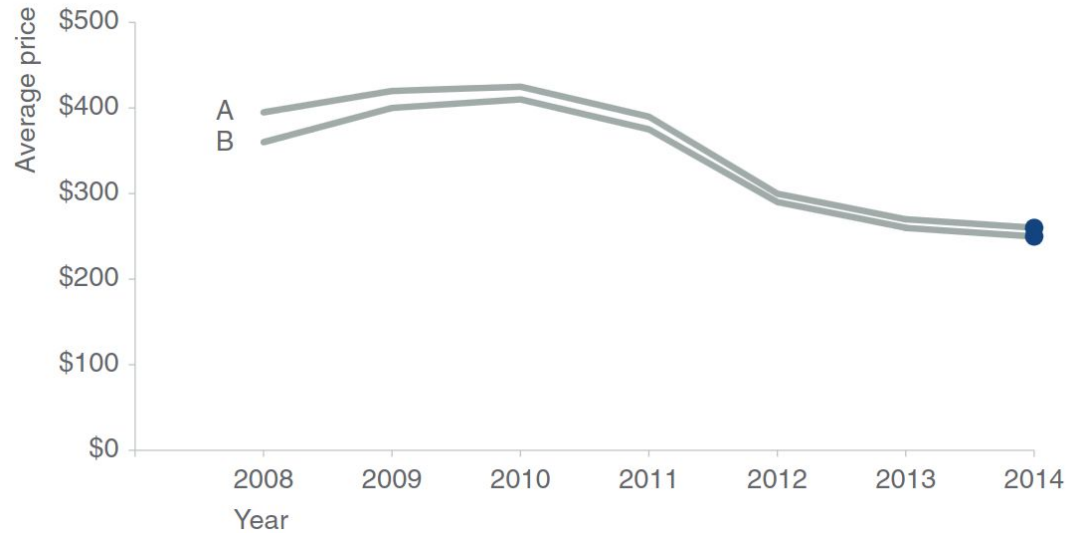
Retail price over time



# Exemple

In 2014, Products A and B were priced at **\$260** and **\$250**, respectively

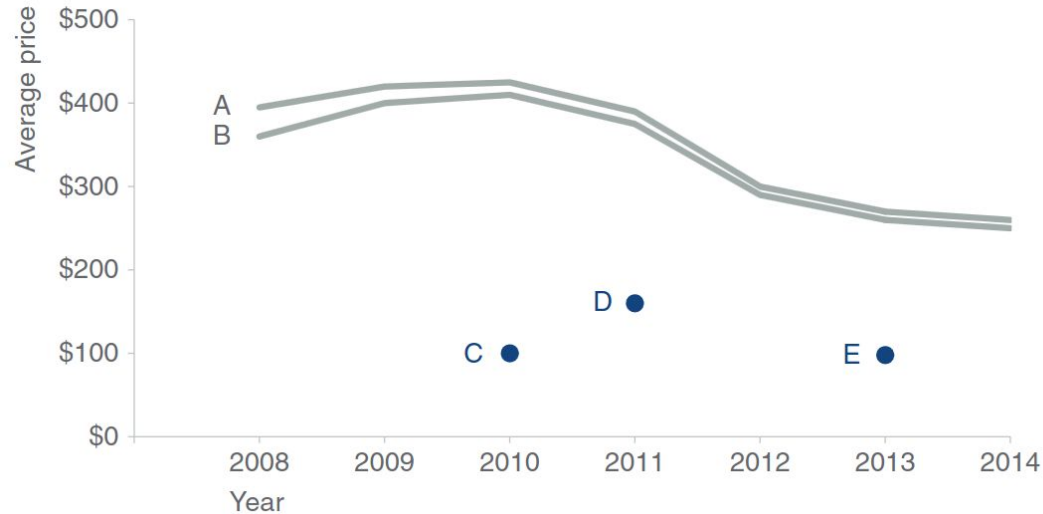
Retail price over time



# Exemple

Products C, D, and E were each introduced later at **much lower price points**...

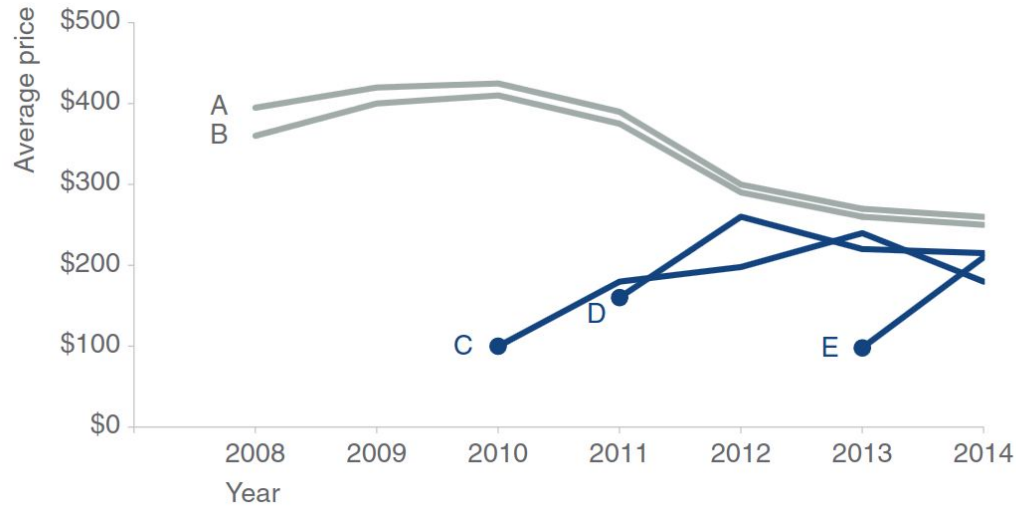
Retail price over time



# Exemple

...but all have **increased in price** since their respective launches

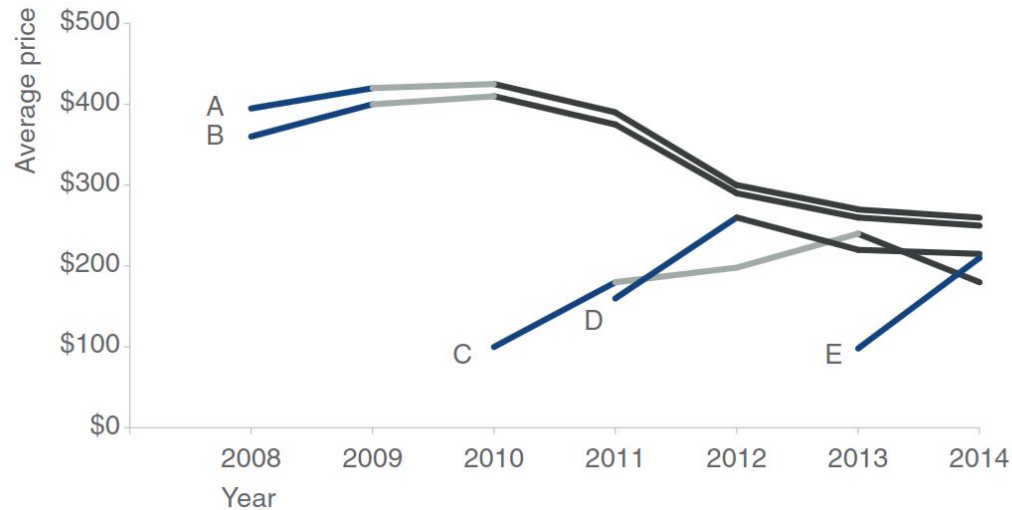
Retail price over time



# Exemple

In fact, with the launch of a new product in this space, we tend to see an **initial price increase**, followed by a **decrease** over time

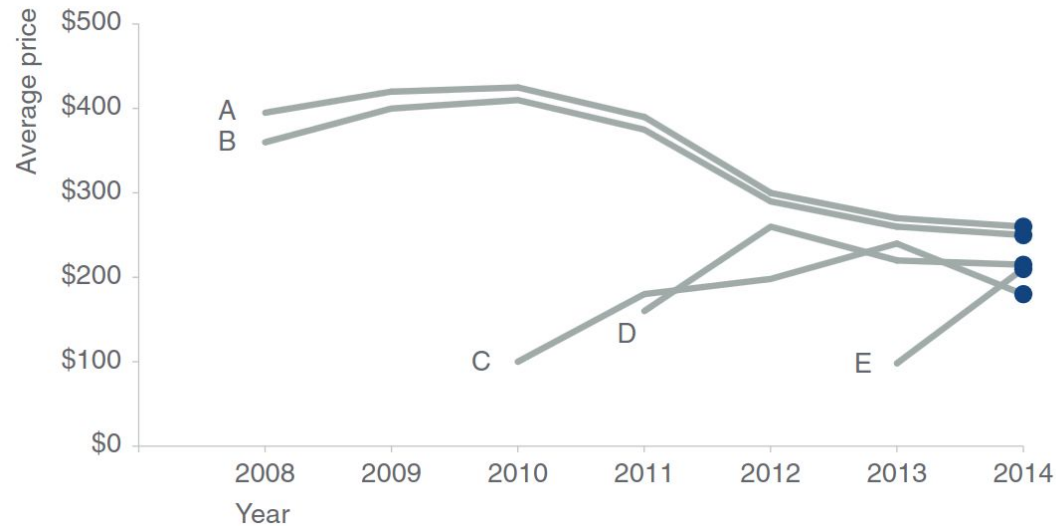
Retail price over time



# Exemple

As of 2014, retail prices have converged, with an **average retail price of \$223**, ranging from a low of \$180 (C) to a high of \$260 (A)

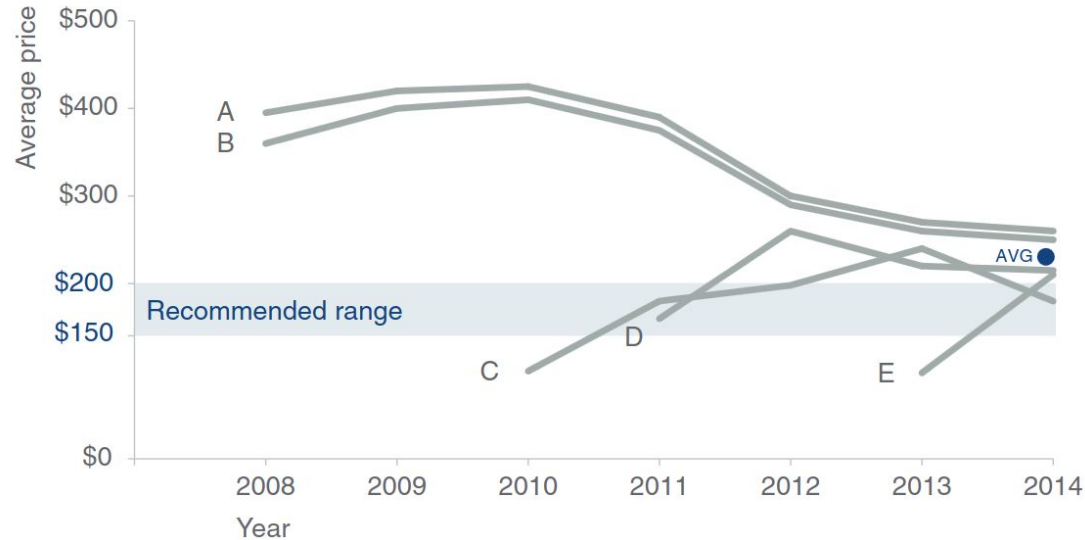
Retail price over time



# Exemple

To be competitive, we recommend introducing our product *below* the \$223 average price point in the **\$150–\$200 range**

Retail price over time





# En route vers le TP !