Baseball Strategies

Data Science Programming 200
12/10/2024
By: Rohan Kapur

Agenda

01 Background

02 Dataset Cleaning

03 Insights

04 Recommendations

Background of the Project

Background of the Project

Year: Covers data for the 2024 MLB season.
Type: Batters & Pitchers
Source: Baseball Savant's custom leaderboard
Metrics Selection: Insights into performance, tendencies, and results.

Dataset Cleaning

Pitchers Dataframe Shape: (107, 279)

- Key Variables:
  - Pitch Types
  - Pitch Outcomes
  - Statcast Metrics

Batters Dataframe Shape: (129, 182)

- Key Variables:
  - Hit Outcome
  - First Strike %
  - Hit Types

Unfamiliar Technical Data Examples:

- xBA, xSLG,xOBA, xwOBA, xISO

Batters

Questions That I Wanted to Answer

- What is the best indicators to give confidence to steal a base
- Is there any correlation between speed and success of stealing a base
- Which Base is the hardest to steal?

Batter Insights

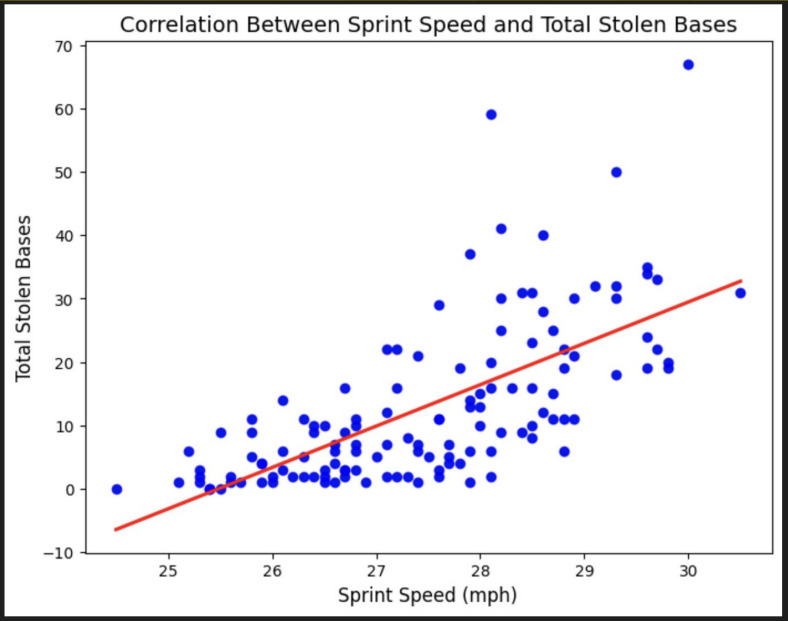
Top 10 fastest players by sprint speed:

	last_name, first_name	sprint_speed
2	Witt Jr., Bobby	30.5
26	De La Cruz, Elly	30.0
128	Peña, Jeremy	29.8
92	Langford, Wyatt	29.8
102	Chourio, Jackson	29.7
87	Young, Jacob	29.7
55	Carroll, Corbin	29.6
70	Duran, Jarren	29.6
32	Rodríguez, Julio	29.6
101	Turner, Trea	29.6

Top 10 players to steal the most bases:

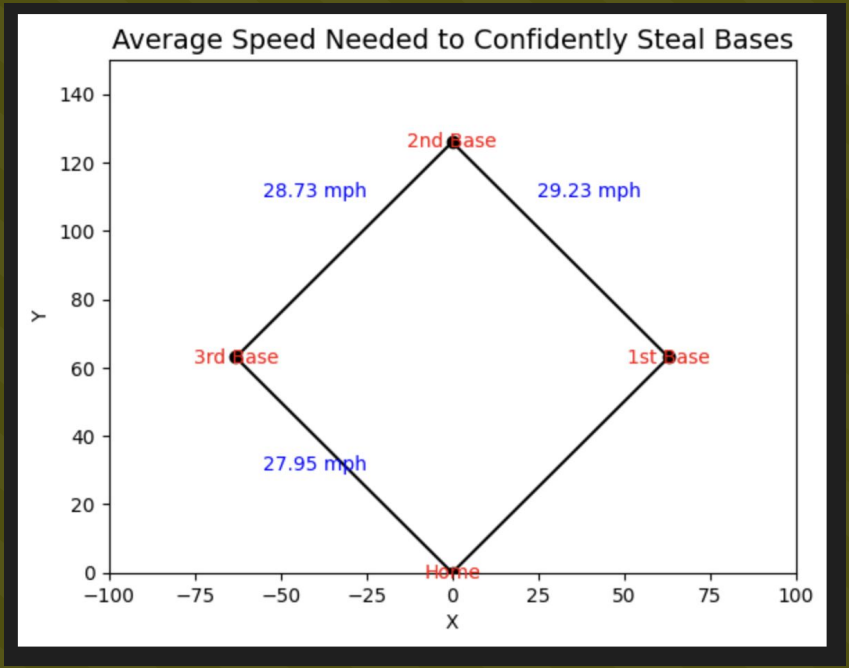
	last_name, first_name	r_total_stolen_base
26	De La Cruz, Elly	67
61	Ohtani, Shohei	59
120	Turang, Brice	50
3	Ramírez, José	41
31	Chisholm Jr., Jazz	40
126	Garcia, Maikel	37
55	Carroll, Corbin	35
70	Duran, Jarren	34
87	Young, Jacob	33
77	Thomas, Lane	32

Batter Insights




```
Correlation between sprint speed and total stolen bases: 0.6762347094753445
```

Batter Insights



Final Recommendations for Batters

Minimum Requirement to Steal Bases

2nd Base is the requires the most speed

Top Players rely on other skills than speed

Pitchers

Background Information on Pitches

- Fastball
  - A fastball is the most basic and widely used pitch in baseball, characterized by its high velocity and relatively straight trajectory.
    - Four seam, Two seam, Cut
- Offspeed
  - Offspeed pitches are thrown slower than fastballs and designed to disrupt the hitter's timing.
  - Changup, splitter
- Breaking
  - Breaking pitches feature significant spin and movement, often breaking downward or sideways as they approach the plate.
  - Curveball, slider, sweeper

Questions That I Wanted to Answer

- What is the best pitch for a Whiff, Groundball, Strike, Homerun?
- Are there any correlations between pitch types and resulting hits?
- Do any of these contradict with hitting home runs?

Correlation Test I Used

- Correlation Explanation:
- The code calculates the Pearson correlation coefficient between the proportions of different pitch types (fastball, offspeed, breaking) and the target variable whiff_percent.
- The correlation coefficient ranges from -1 to 1:
- 1: Perfect positive correlation (as one variable increases, the other increases).
- -1: Perfect negative correlation (as one variable increases, the other decreases).
- 0: No linear relationship between the variables.

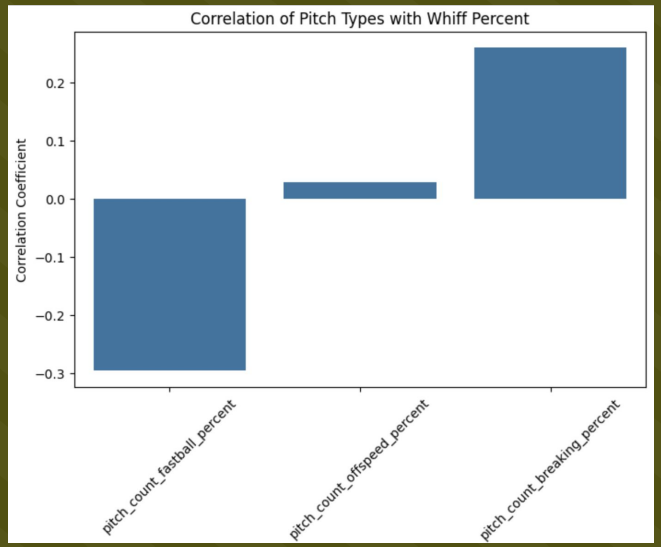
Correlation Test I Used

- Pearson Correlation Test:
- This is a statistical test that measures the linear relationship between two continuous variables.
- It assumes:
- The relationship is linear.
- Both variables are approximately normally distributed.
- There are no extreme outliers that might distort the results.

Correlation Test I Used

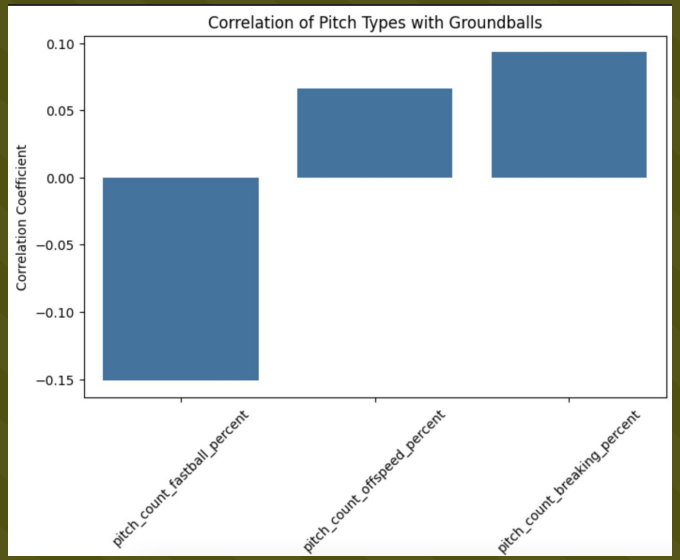
- Interpreting the Results
- High Positive Correlation (e.g., 0.5 or above):
- Suggests that increasing the proportion of a specific pitch type (e.g., fastballs) is strongly associated with a higher whiff_percent.
- High Negative Correlation (e.g., -0.5 or below):
- Suggests that increasing the proportion of a specific pitch type is strongly associated with a lower whiff_percent.
- Weak or No Correlation (e.g., close to 0):
- Suggests little to no relationship between the pitch type and the whiff_percent.

Pitcher Insights



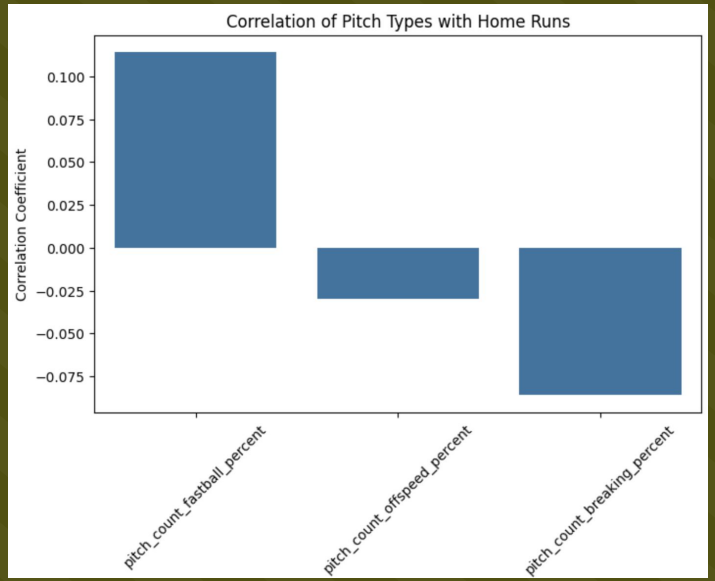
Highest Correlation Value :0.258911

Pitcher Insights



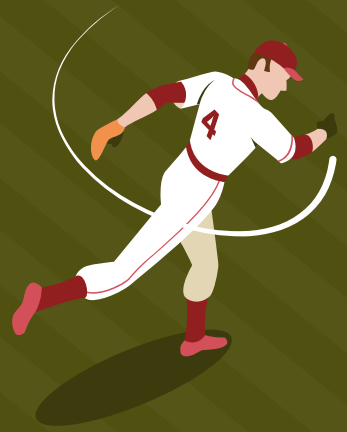
Highest Correlation Value: 0.093283

Pitcher Insights



Highest Correlation Value: 0.114020

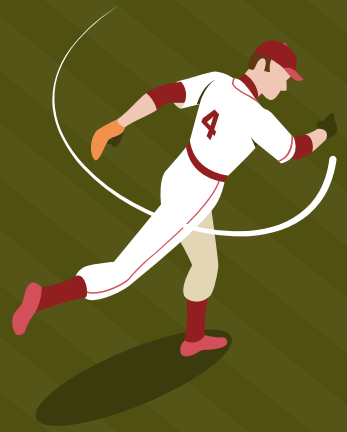
Final Recommendations for Pitchers



When Whiffs Are Beneficial:
From a mental strategy standpoint, whiffs disrupt the batter's rhythm, demoralize the offense, and give the pitcher momentum. From a physical strategy perspective, they conserve energy, reduce the chance of costly batted-ball events, and provide an efficient means of controlling high-pressure situations.

Breaking Pitches Correlate well with Whiff

Final Recommendations for Pitchers



When Groundballs Are Beneficial:
Groundballs are highly effective in situations where double plays are possible, especially with a runner on first and less than two outs. However, inducing them at the wrong time or in the wrong location can backfire.

Breaking Pitches Correlate well with Ground Balls

Limitations

Questions?

Thank you!

Sources

- Baseball Savant. (2024). 2024 Custom Batter Leaderboard. Major League Baseball. Retrieved [insert retrieval date], from https://baseballsavant.mlb.com/leaderboard/custom?year=2024&type=batter
- Baseball Savant. (2024). 2024 Custom Pitcher Leaderboard. Major League Baseball. Retrieved [insert retrieval date], from https://baseballsavant.mlb.com/leaderboard/custom?year=2024&type=pitcher

Main rules

Do you know what **helps** you make your point crystal clear? Lists like this one:

- They're simple
- You can organize your ideas clearly
- You'll never forget to buy **milk**!

And the most important thing: the audience won't miss the point of your presentation

Main concepts

Fair territory

Mercury is the closest planet to the Sun and the smallest one in the **Solar System**—it's only a bit larger than the Moon

Foul territory

Venus has a beautiful name and is the second planet from the Sun. It's hot and has a poisonous atmosphere

Basic equipment

Venus

Venus has a **beautiful** name and is the second planet from the Sun

Mercury

Mercury is the closest planet to the **Sun** and the smallest one of them all

Mars

Despite being red, **Mars** is actually a cold place. It's full of iron oxide dust

Features of the topic

Mars

Mars is actually a very cold place

Neptune

Neptune is the farthest planet from the **Sun**

Jupiter

Jupiter is the biggest **planet** of them all

Saturn

Saturn is a gas **giant** and has several rings

Examples

Mercury

Mercury is the closest planet to the Sun and the smallest one of them all

Venus

Venus has a **beautiful** name and is the second planet from the Sun

Mars

Despite being red, Mars is actually a **cold** place. It's full of iron oxide dust

Recommendations

Mars

Mars is **actually** a very cold place, not hot

Venus

Venus is the second planet from the **Sun**

Neptune

Neptune is the farthest planet from the Sun

Mercury

Mercury is the closest **planet** to the Sun

Saturn

Saturn is a gas **giant** and has several rings

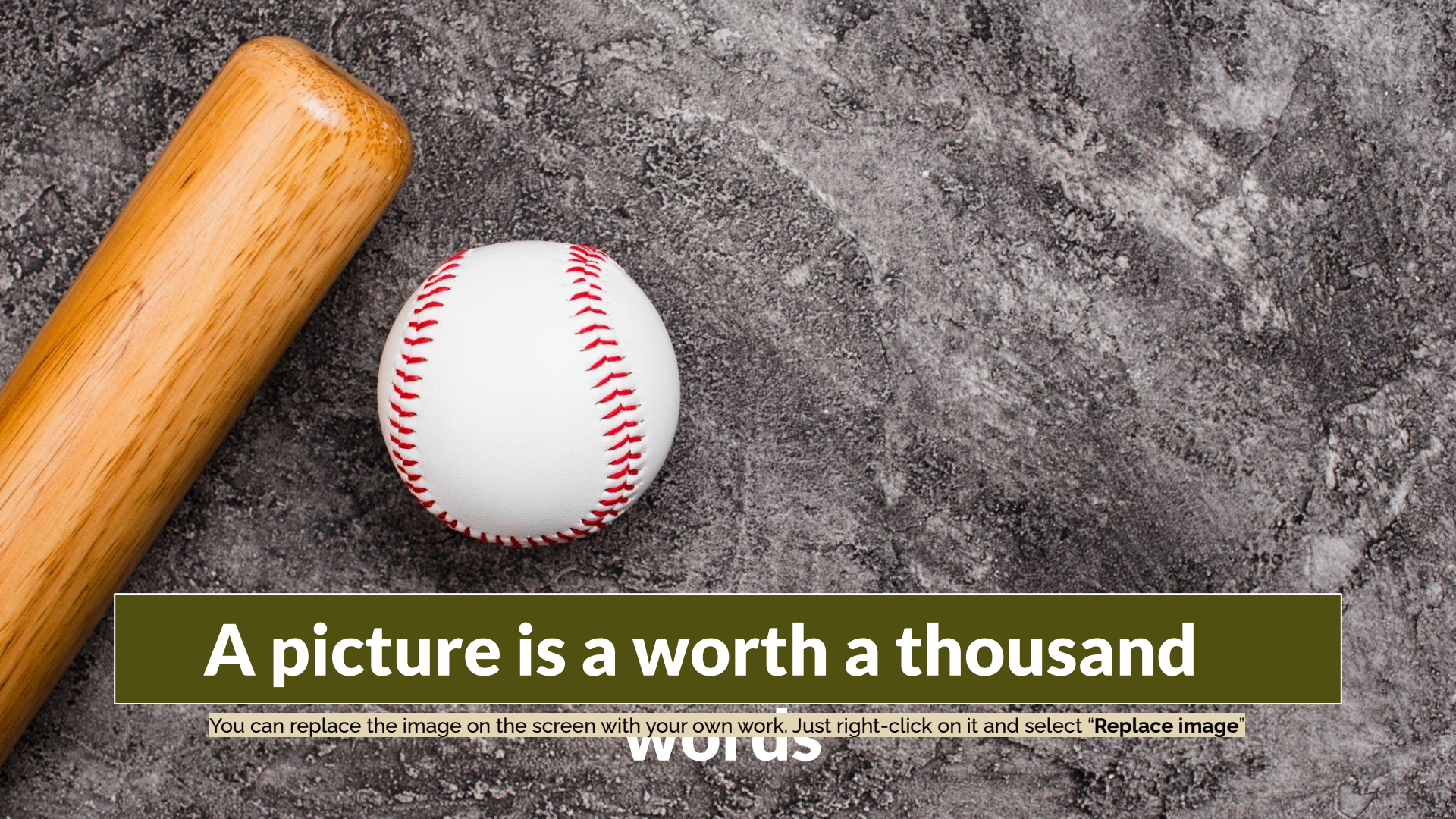
Jupiter

Jupiter is the biggest planet of them all

Practical exercise

Mercury is the closest planet to the Sun and the smallest one in the **Solar System**—it's only a bit larger than the Moon. The planet's name has **nothing** to do with the liquid metal

Awesome words



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A picture always reinforces the concept

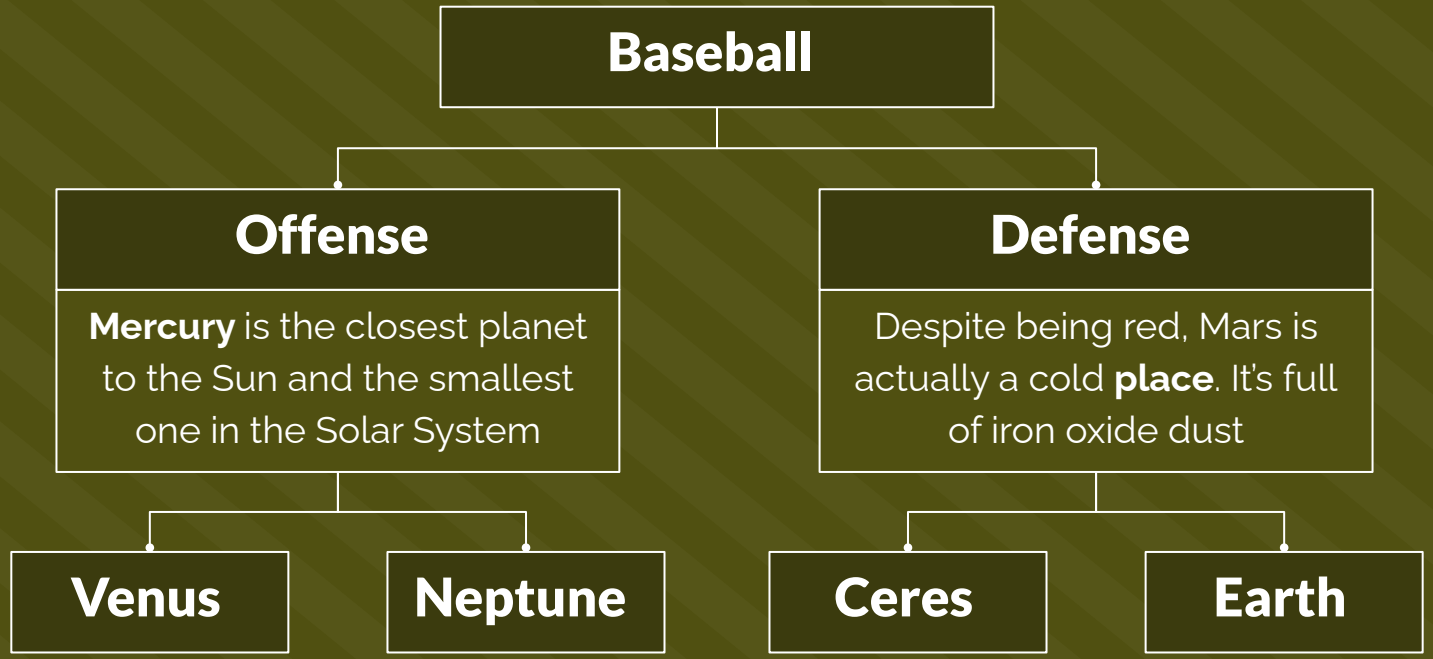
Images reveal huge amounts of data, so remember: use an image instead of a long text. Your audience will appreciate it

Brainstorming - Baseball glossary

A	
B	Balk
C	
D	Defense
E	
F	Foul
G	
H	

I	Inning
J	
K	
L	
M	
N	
O	Out
P	

Position details



For subjects/Theme

Mars

Mars is **actually** a very cold place, not hot

Neptune

Neptune is the farthest **planet** from the Sun

Jupiter

Jupiter is the **biggest** planet of them all

Saturn

Saturn is a gas giant and has several **rings**

Ball toss sequence

First

Mercury is the closest planet to the Sun

Next

Venus is the second planet from the Sun

Next

Despite being red, Mars is actually a cold place

Next

Jupiter is the biggest planet of them all

End

Saturn is composed of hydrogen and helium

Classification

	1º	2º	3º
Defense	Yes	No	Yes
Offense	No	Yes	No
Description	**Venus** is the second planet from the Sun	Mercury is the **closest** planet to the Sun	Jupiter is the **biggest** planet of them all

Cause and effect

Mars

Mars is actually a very cold **place**, not hot

Venus

Venus is the second planet from the Sun

Mercury

Mercury is the **closest** planet to the Sun

Cause

Effect

Neptune

Neptune is the farthest **planet** from the Sun

Saturn

Saturn is a gas **giant** and has several rings

Jupiter

Jupiter is the **biggest** planet of them all

Where can you learn?

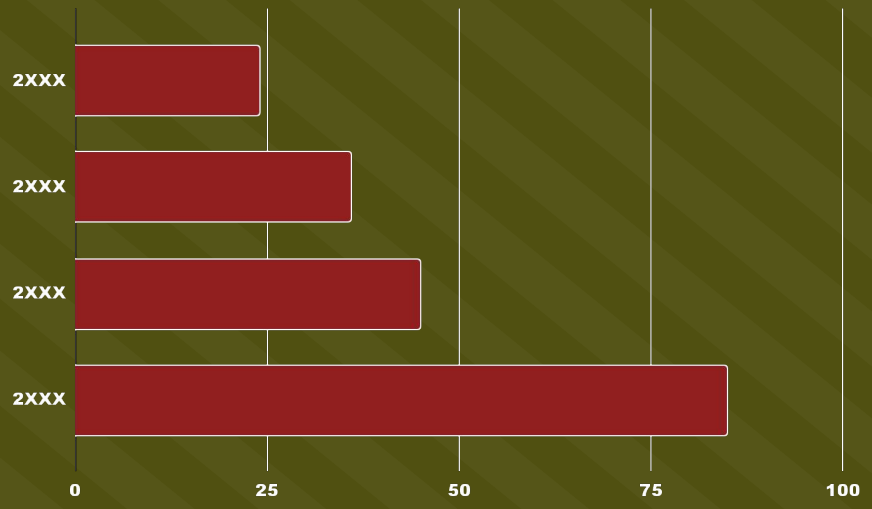
Mars

Mars is actually a very cold place, not **hot**

Mercury

Mercury is the closest planet to the Sun

Progress with our workshop



Mercury

Mercury is the closest planet to the Sun and the smallest one in the Solar System. This planet's name has nothing to do with the **liquid** meta

Follow the link in the graph to modify its data and then paste the new one here. **For more info, click here**

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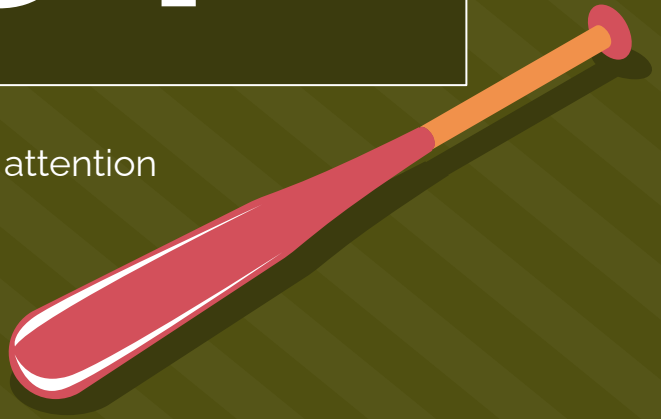
256,584

Big numbers catch your audience's attention



Question and answer

Question

Is Mercury the **closest** planet to the Sun and the smallest one in the Solar System? Note that it's a bit larger than the **Moon**

Answer

Venus has a beautiful name and is the second planet from the Sun. It's hot and has a **poisonous** atmosphere

Timeline for training

01

Mars is **actually** a very cold place

02

Jupiter is the **biggest** planet of them all

03

Neptune is the farthest planet from the **Sun**

04

Saturn is a gas giant and has several rings

Parts and whole

The whole object

Mercury is the closest planet to the Sun and the **smallest** one in the entire Solar System

Parts of the object

Mercury

Mars

Saturn

Venus

Jupiter

What happen if the parts were missing

Venus has a **beautiful** name and is the second planet from the Sun. It's hot and has a poisonous atmosphere

What's the function of the part?

Saturn is a gas giant and has several rings. It's composed mostly of **hydrogen** and helium

Thanks

Do you have any questions?

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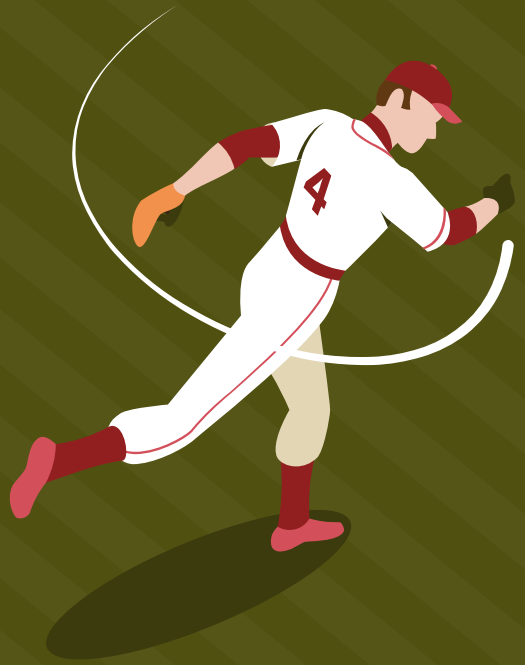

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Vectors

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- Icon Pack: Baseball | Fill

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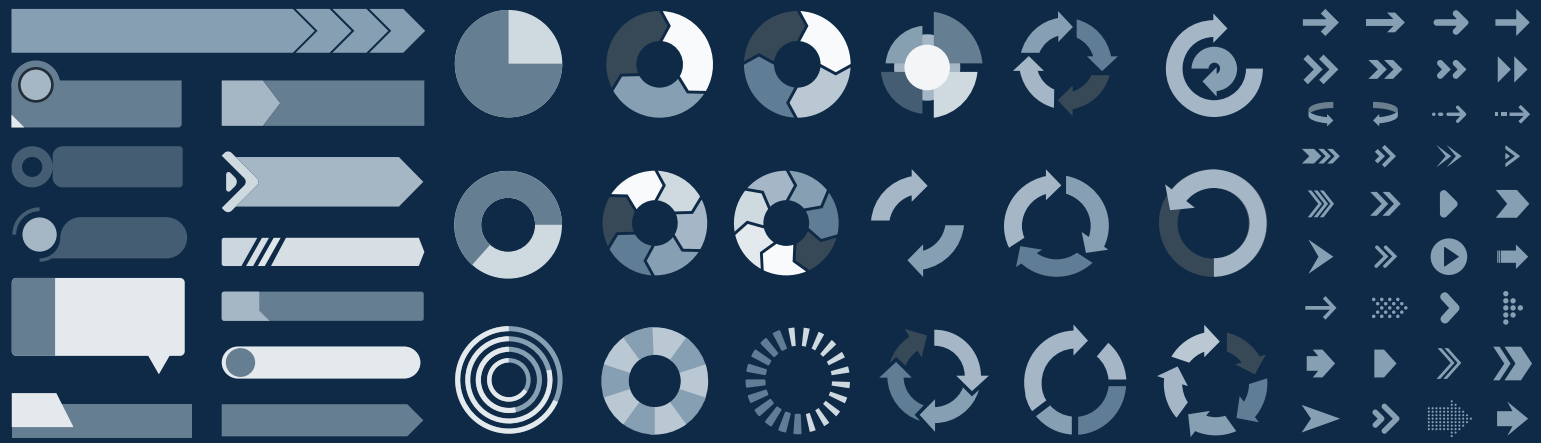

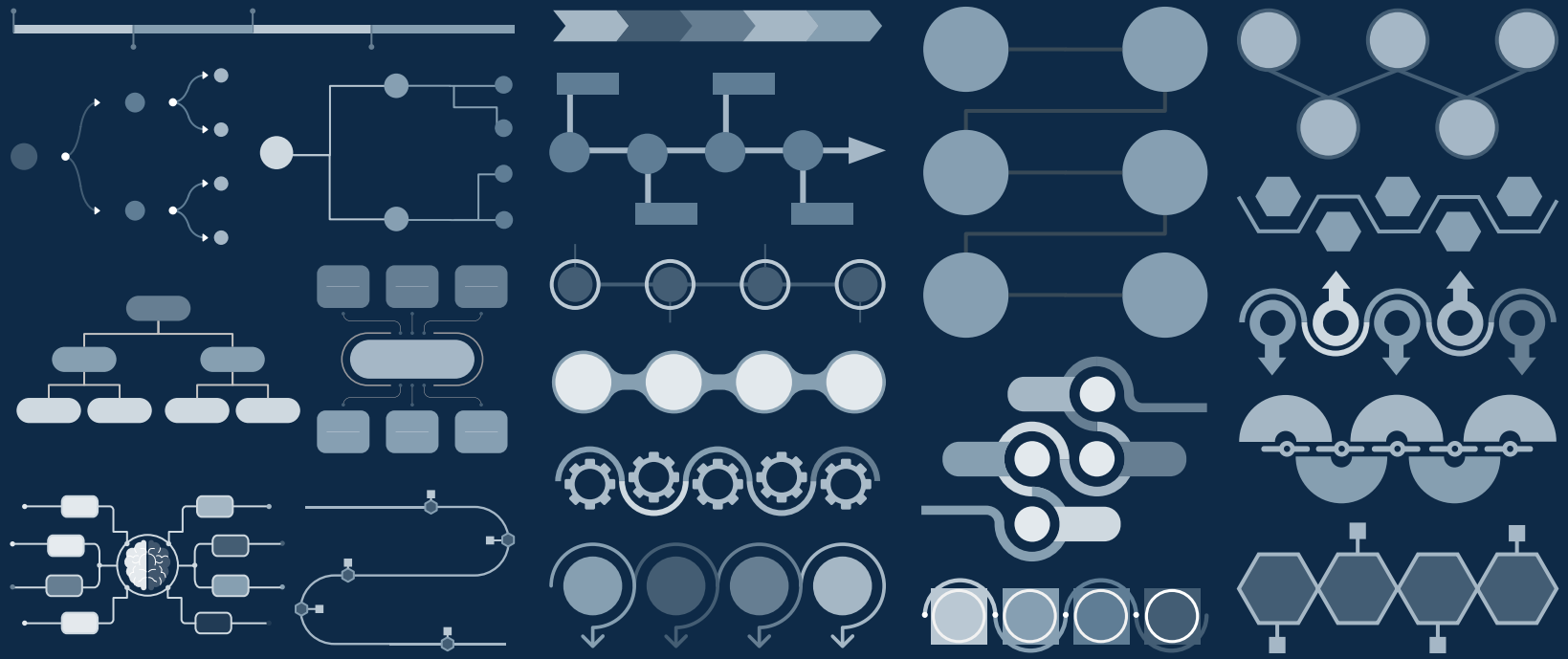

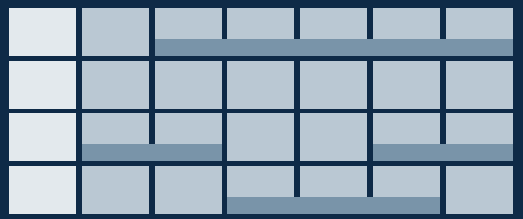

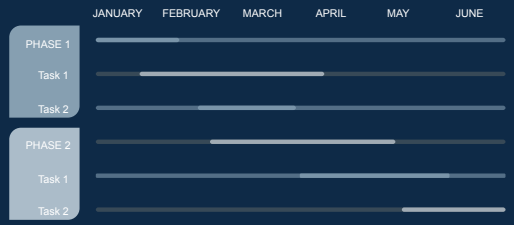
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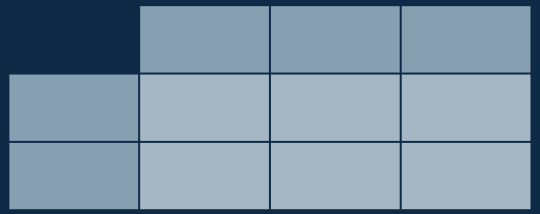

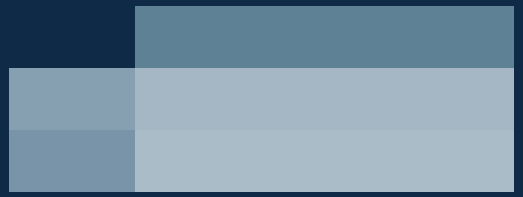

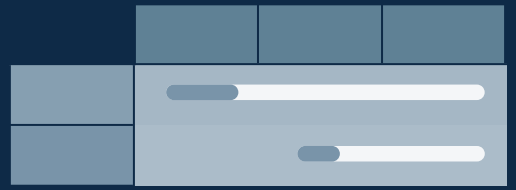

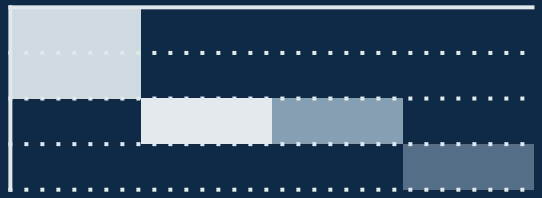

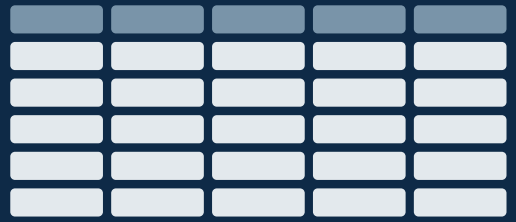

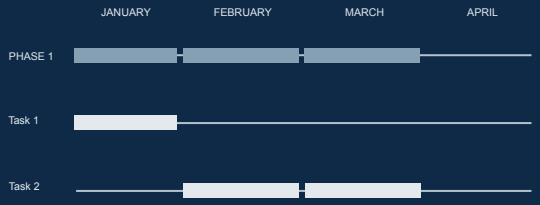
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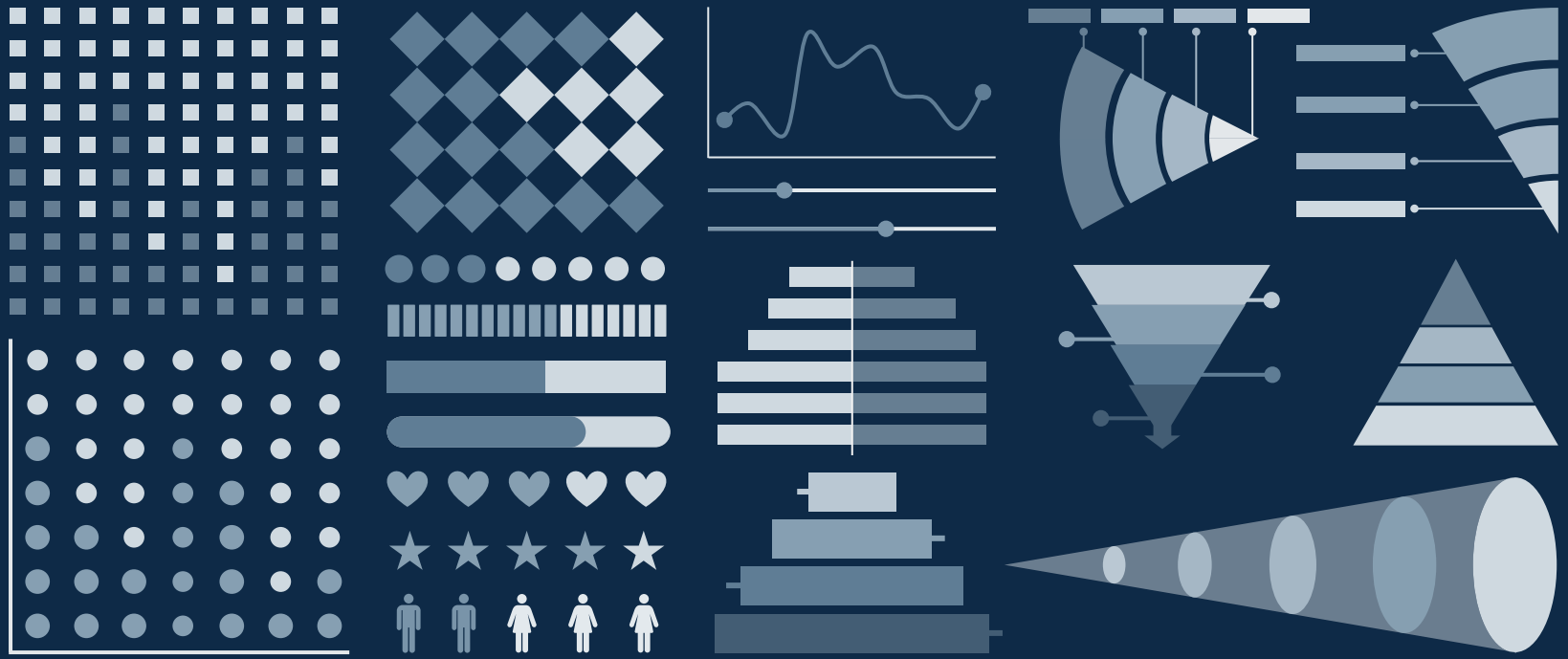

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