

Data Visualization & Generative AI

Principles for building
human-centered
data experiences

Presented by Kent E. Eisenhuth

Staff Product Designer, Waymo, Google

When your sleep score was higher than usual,
your RHR was lower the next day.

Jan 1-31, 2024

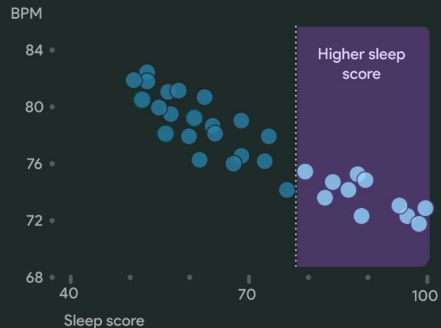
 **78** or higher

 **-2** bpm (avg)

Visualize this relationship

And it happened 11 days last month

Jan 1 - 31, 2024



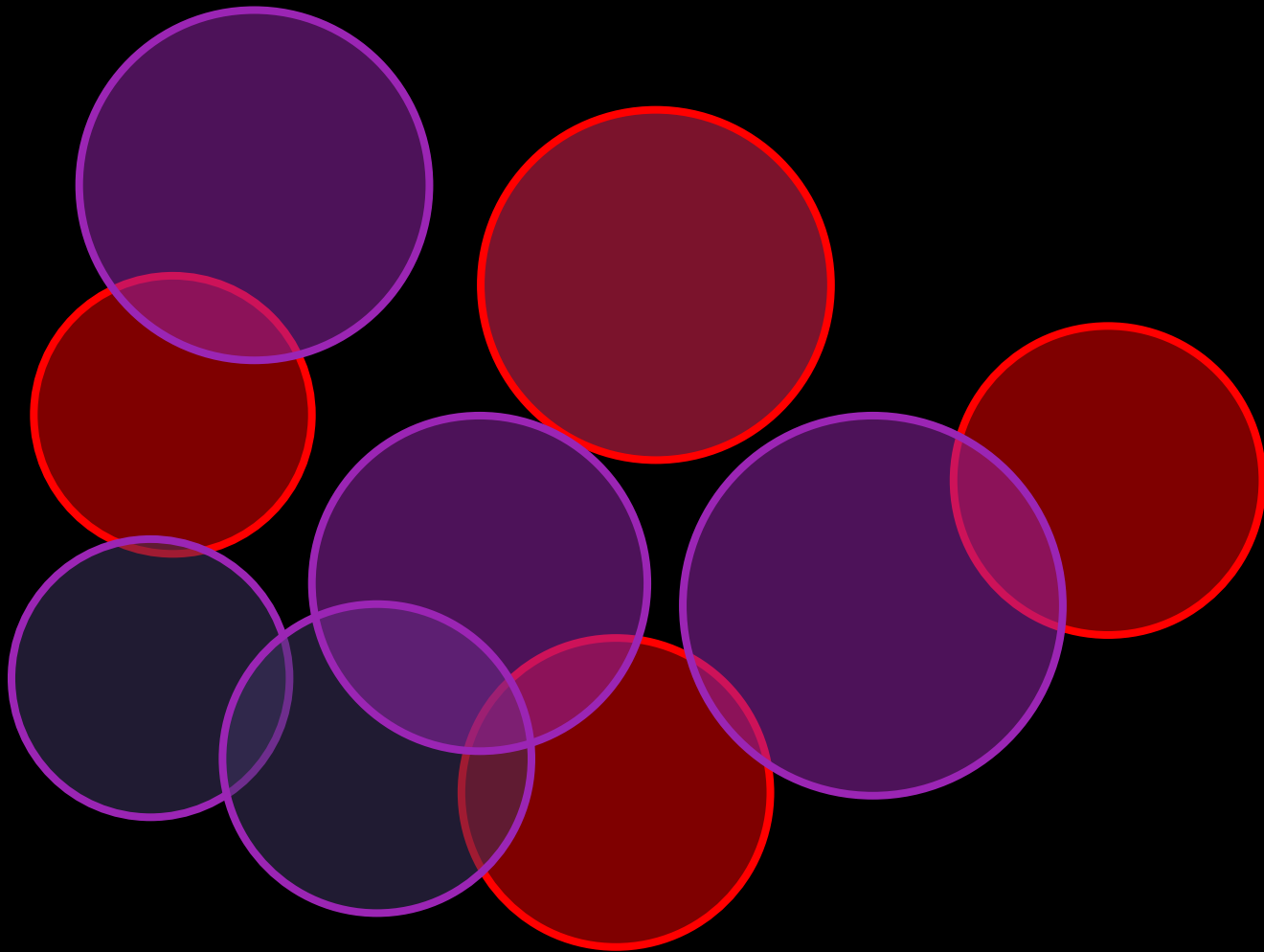


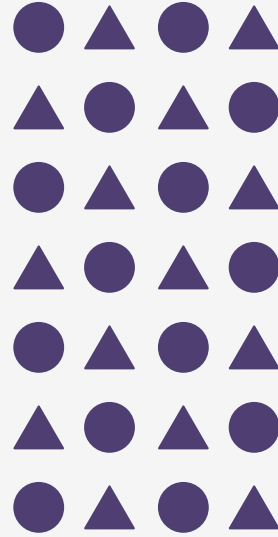
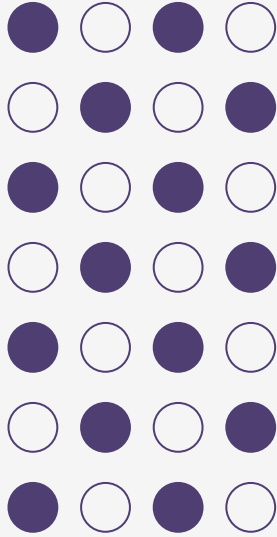
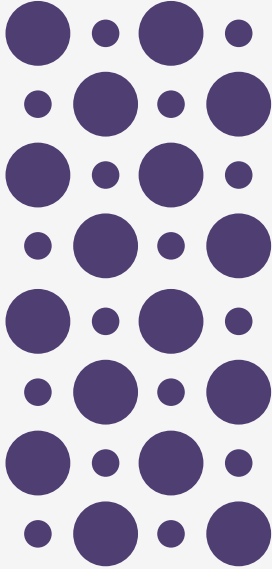
Source: Fitbit by Google

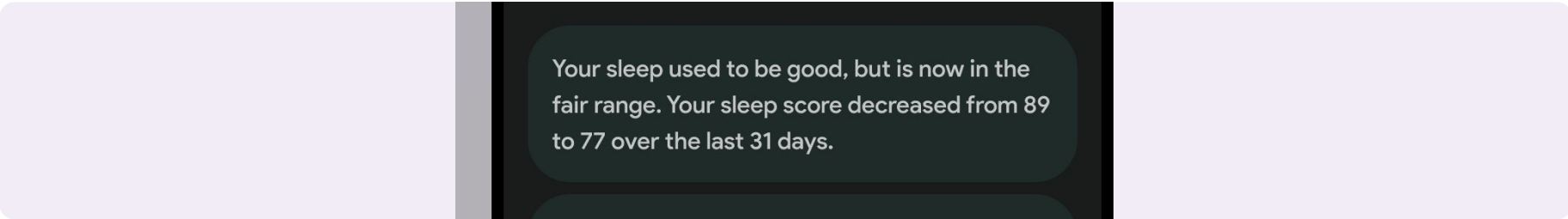
Why datavis?

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A horizontal bar chart with a central dark section containing text. The bar is composed of three segments: a light purple segment on the left, a dark grey/black segment in the middle, and another light purple segment on the right. The text is centered within the dark segment.

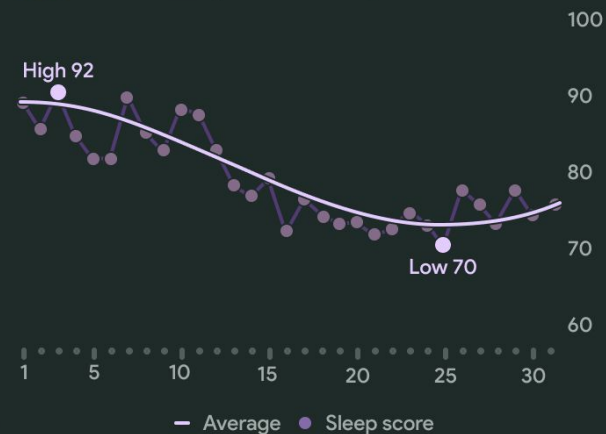
Your sleep used to be good, but is now in the fair range. Your sleep score decreased from 89 to 77 over the last 31 days.

Your sleep used to be good, but is now in the fair range. Your sleep score decreased from 89 to 77 over the last 31 days.

Your sleep score trended down
Jan 1-31, 2024



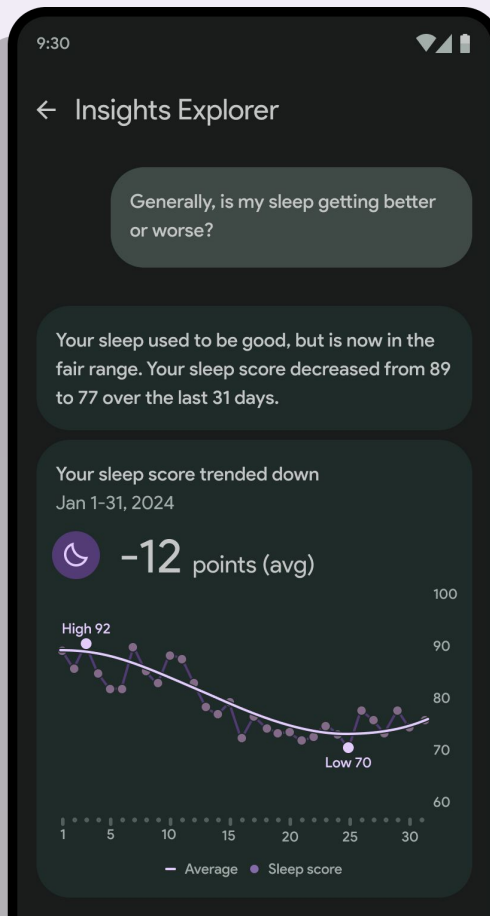
-12 points (avg)

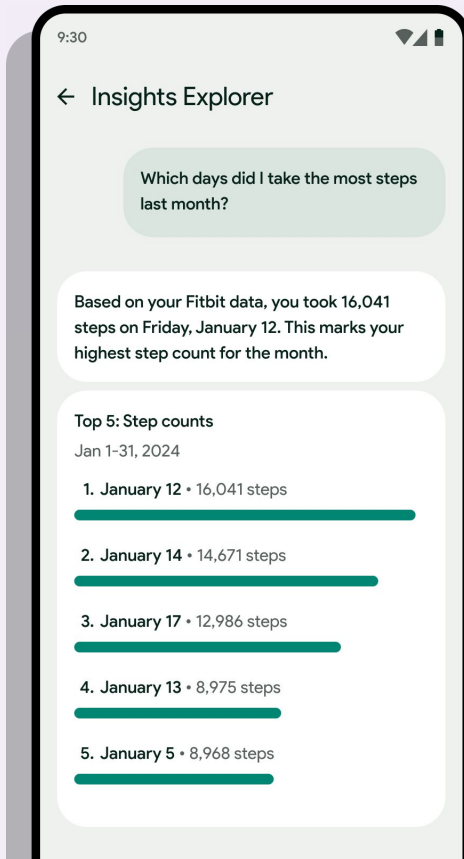
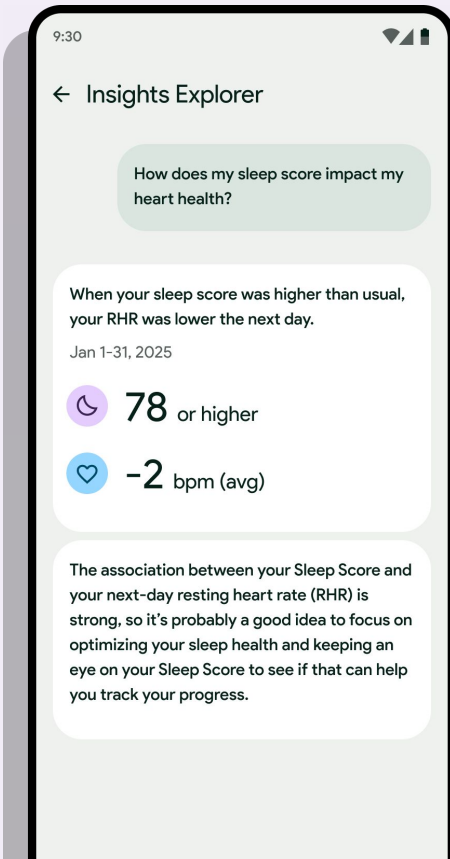
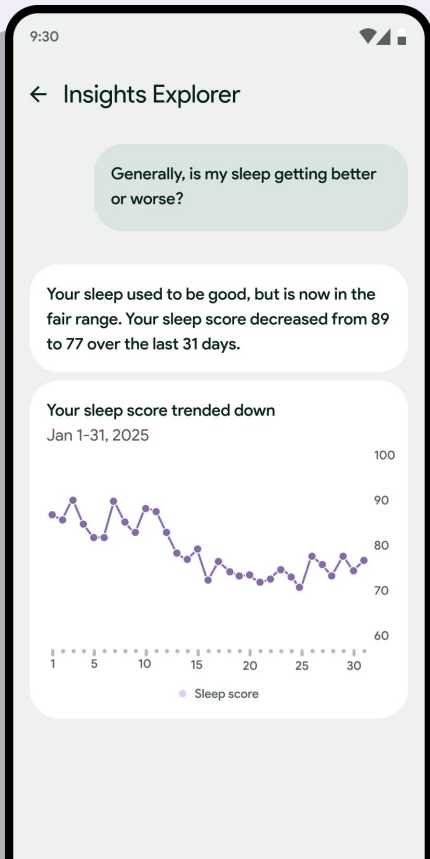


Takeaways from UX research

There are clear reasons to prioritize generative AI charting

- Charting visuals help reinforce text-based insights
- Triangulating metrics is a key need in our user base





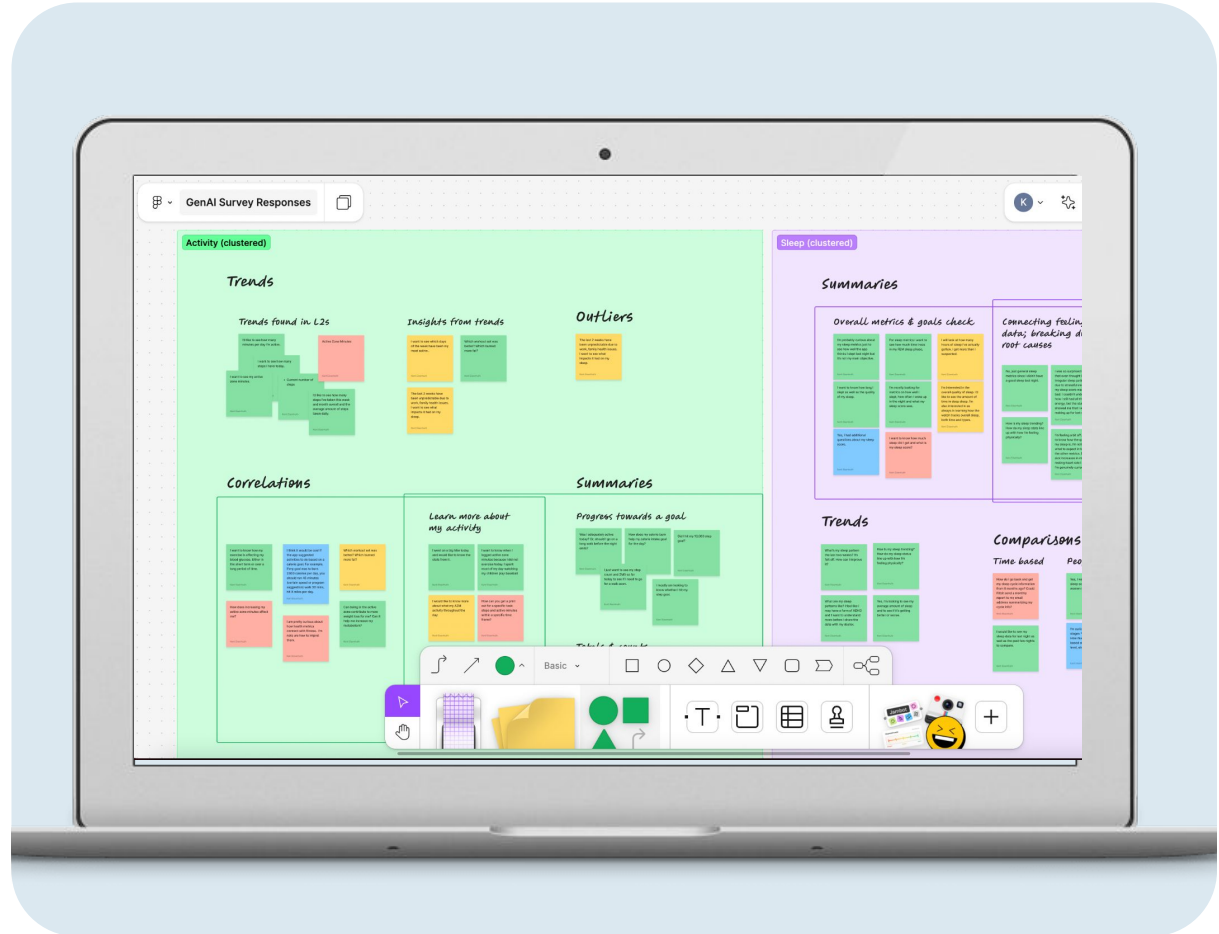
Process

Getting started with a
human-centered design process

What questions would people ask of an LLM?

Popular insights based on findings from a study with over 2,000 participants.

- Correlations
- Trends
- Rankings
- Benchmarks
- Outliers



Choosing a chart

1. Query

What is the question?

2. Insight type

What type of insight will be included with the response?

Trends

Correlations

Best/worst

Performance

Choosing a chart

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Correlations

Best/worst

Performance

3. Characteristics

What are the characteristics of the insight?

Show changes over time

Show long term correlations

Show immediate correlations

Display a ranked list

Compare to a target range

Compare to cohort

Choosing a chart

1. Query

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What type of insight will be included with the response?

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4. Visualization

How do we visualize the response?

Area chart



Bar histogram



Line chart



Infographic



Heat map



Punch card



Calendar



Scatter chart



Bar chart



Gauge



Mapping queries to charts

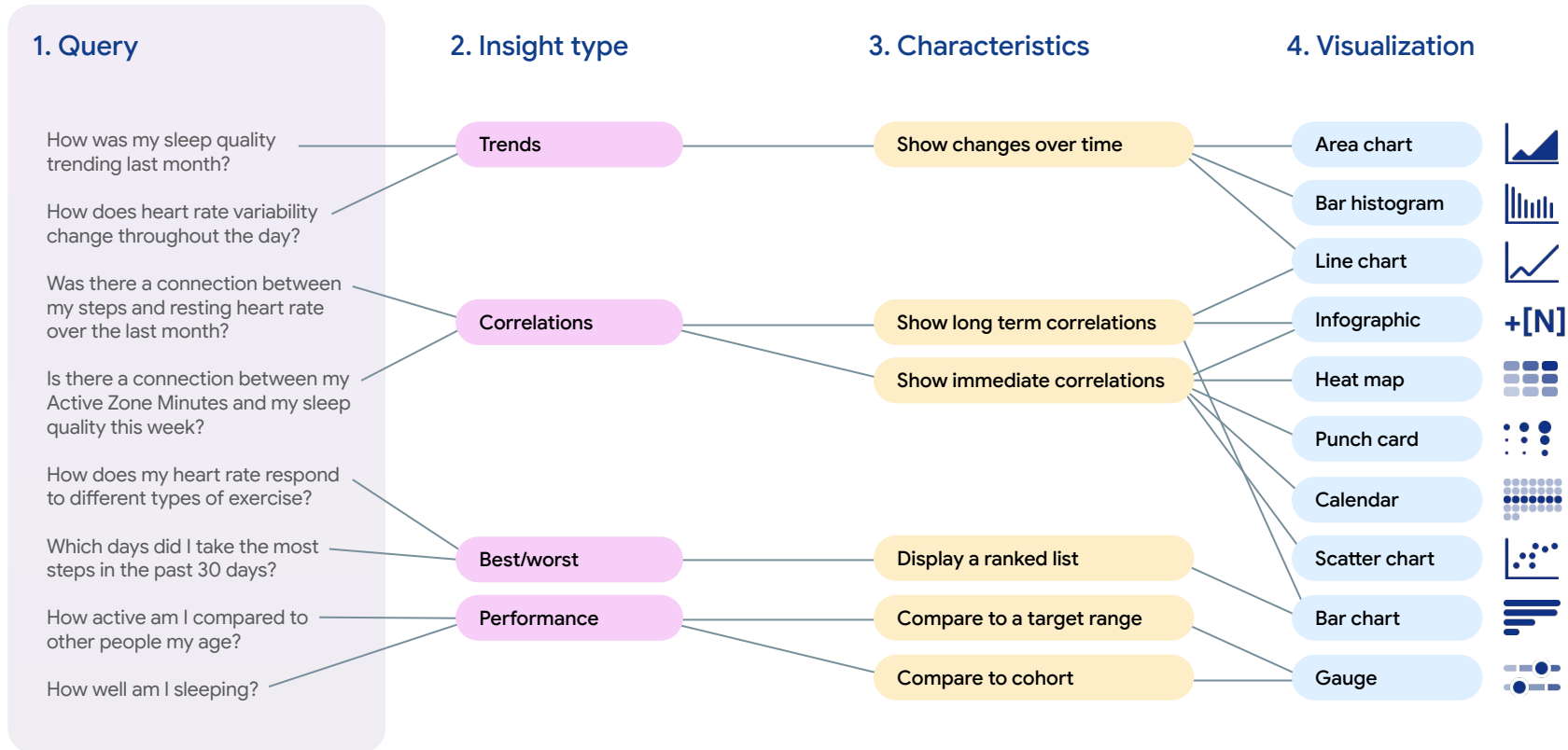
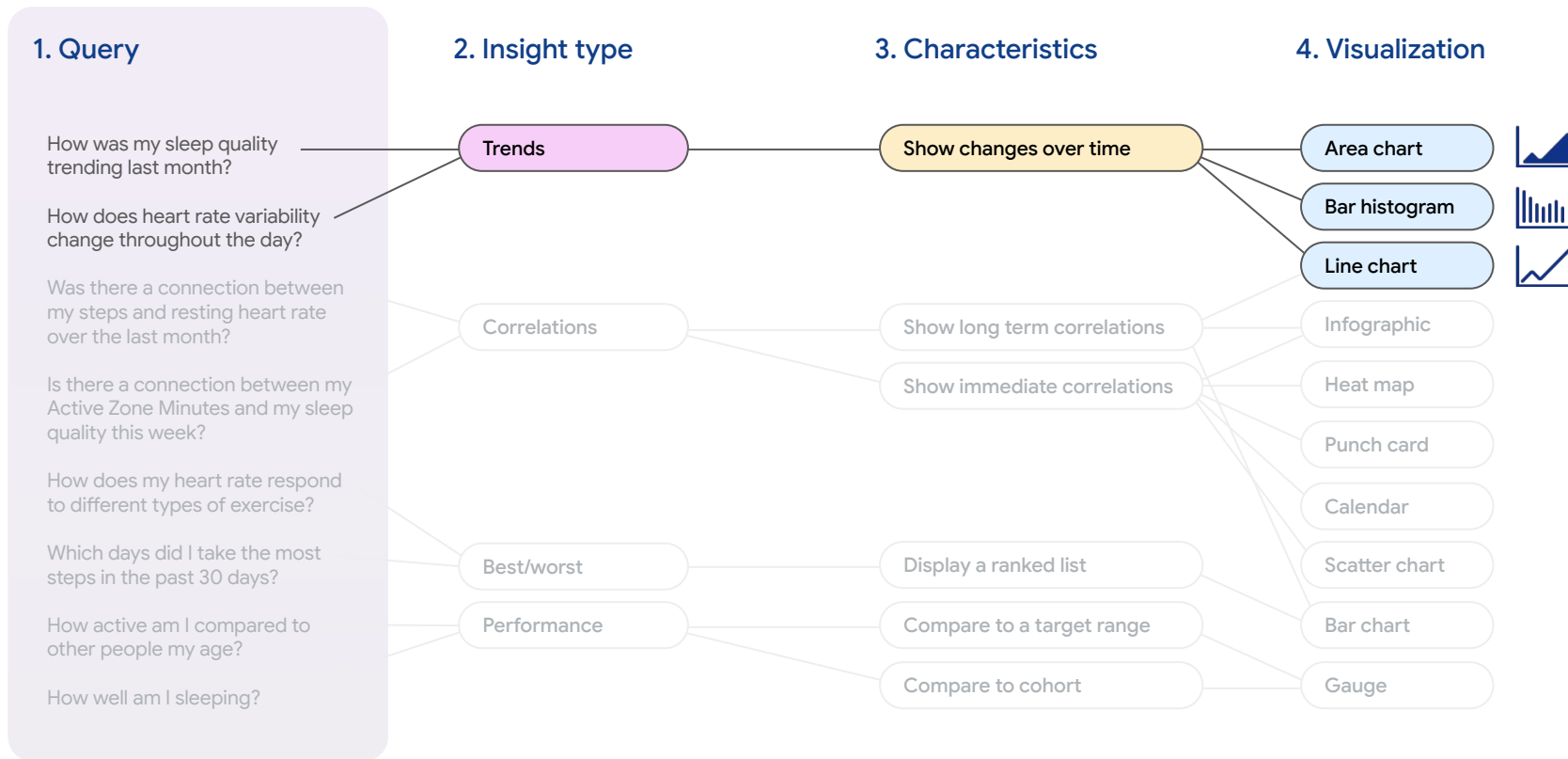
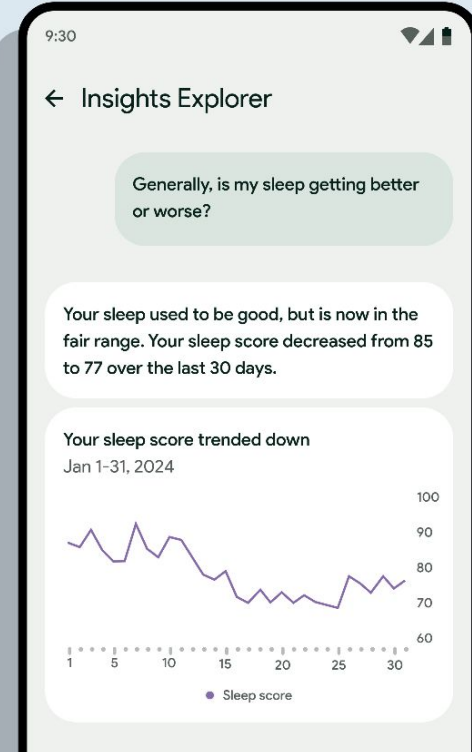
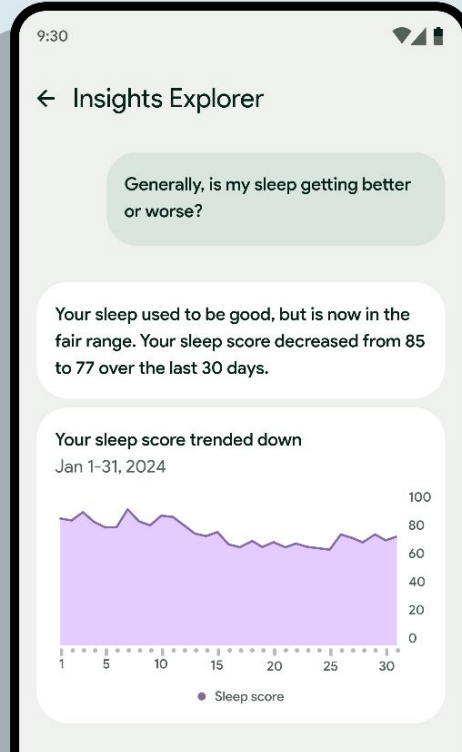
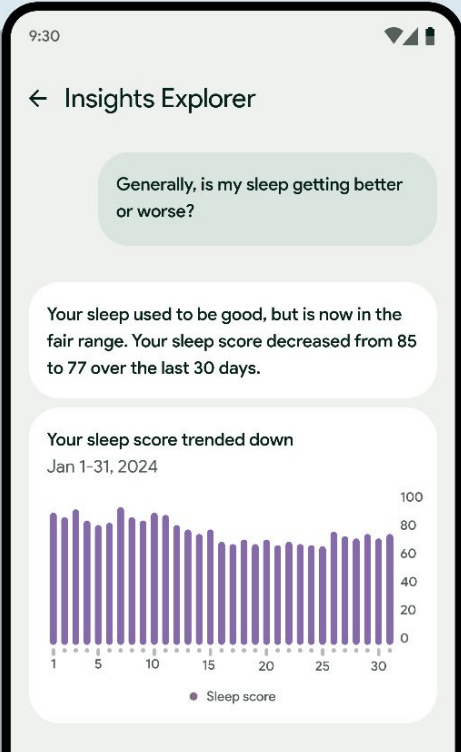
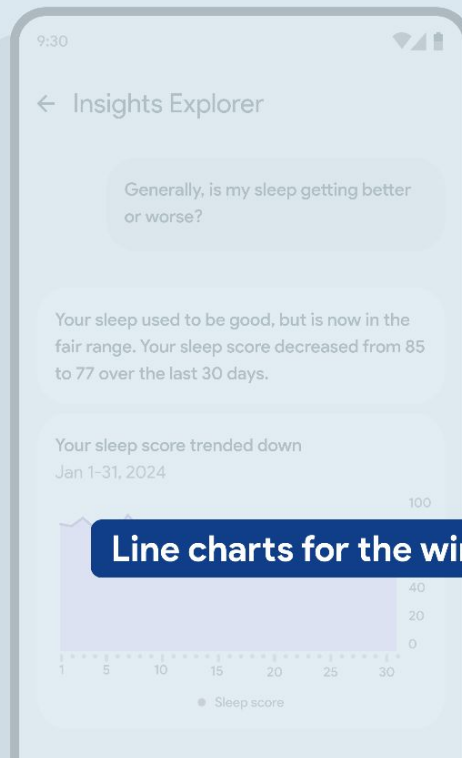
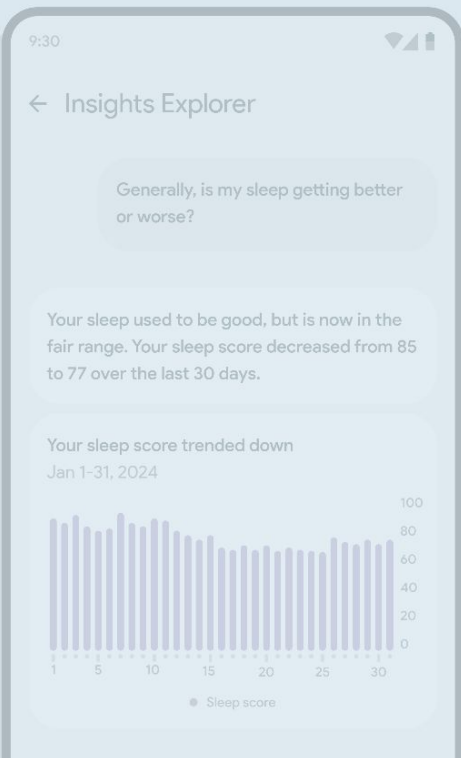


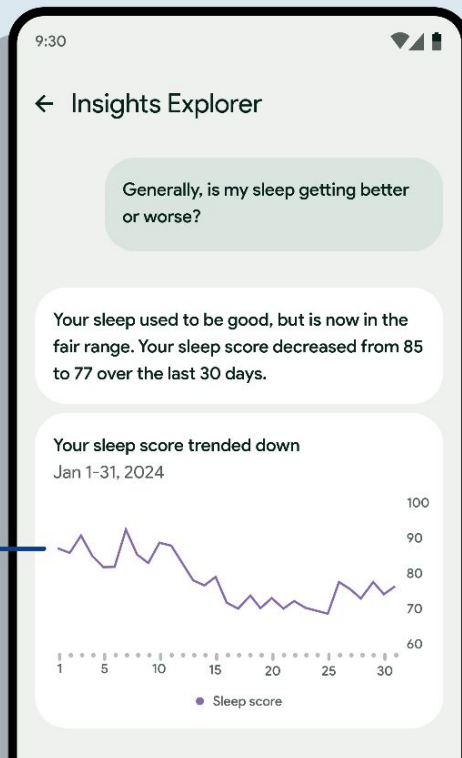
Chart options for displaying trends







Line charts for the win!



Principle 1

Start with the insight. Everything else will follow.

Begin by understanding the questions people are asking of their data, not the chart. Select the visualization that most effectively addresses the user's inquiry.

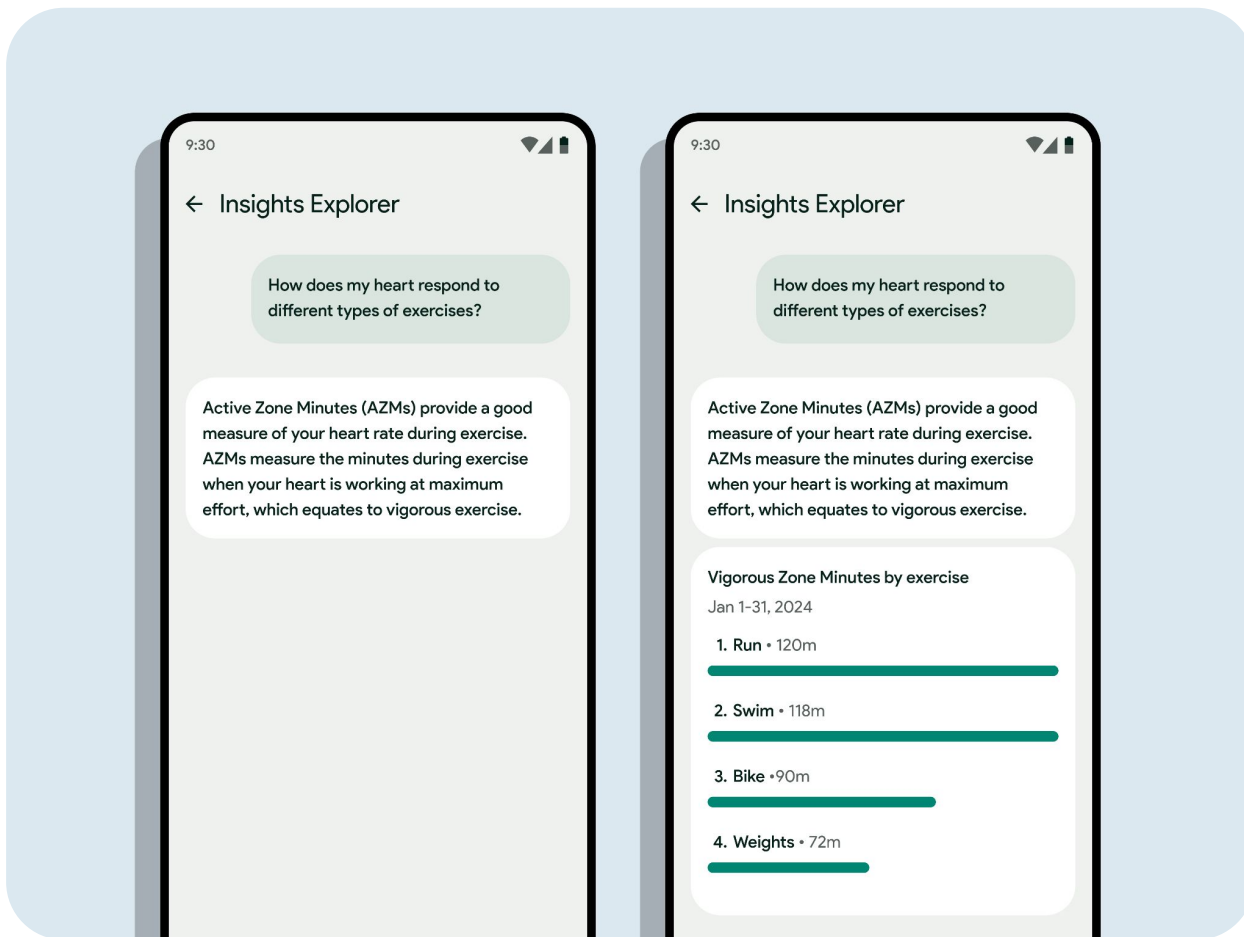
Lessons Learned

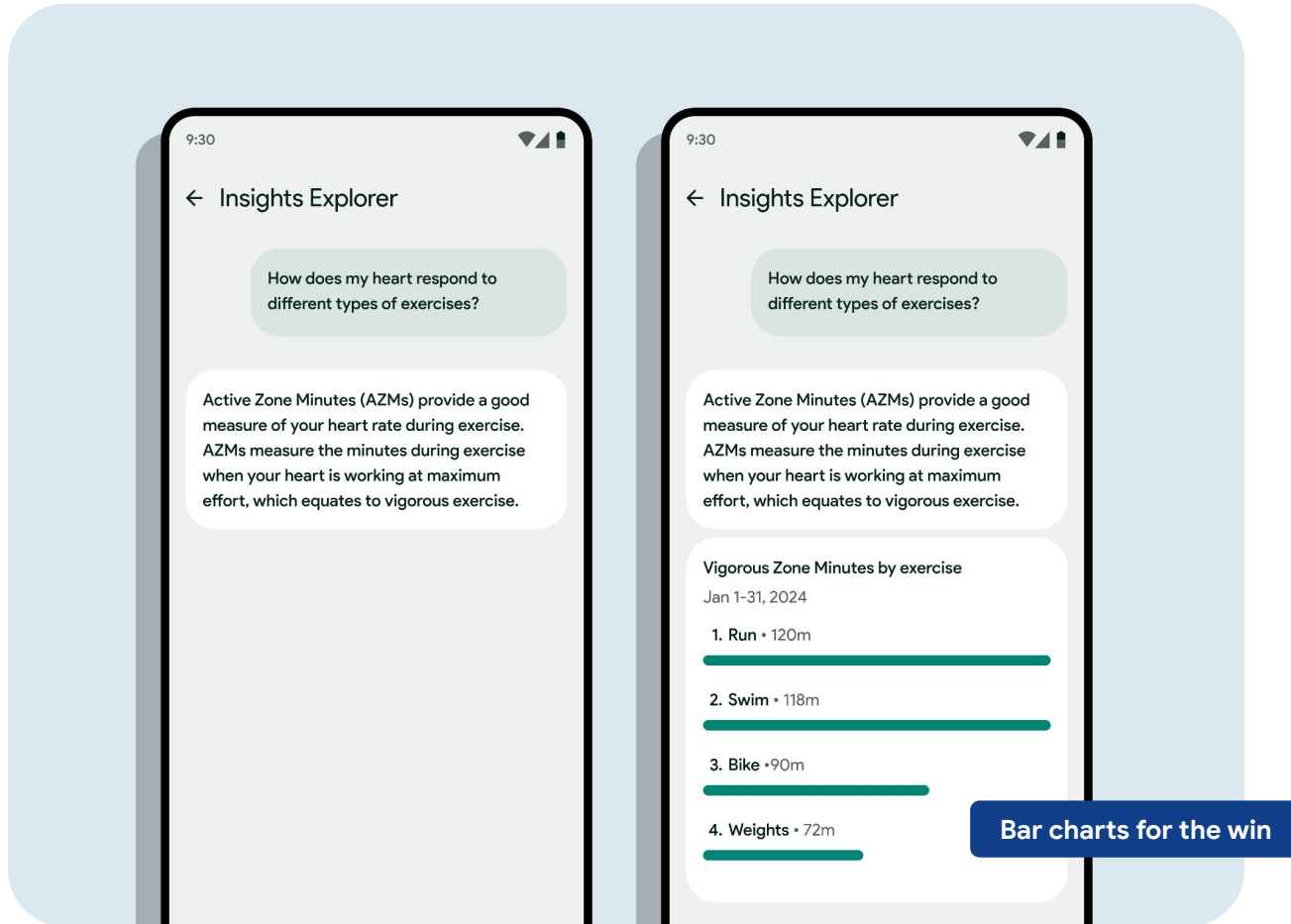
Findings from research & experiments

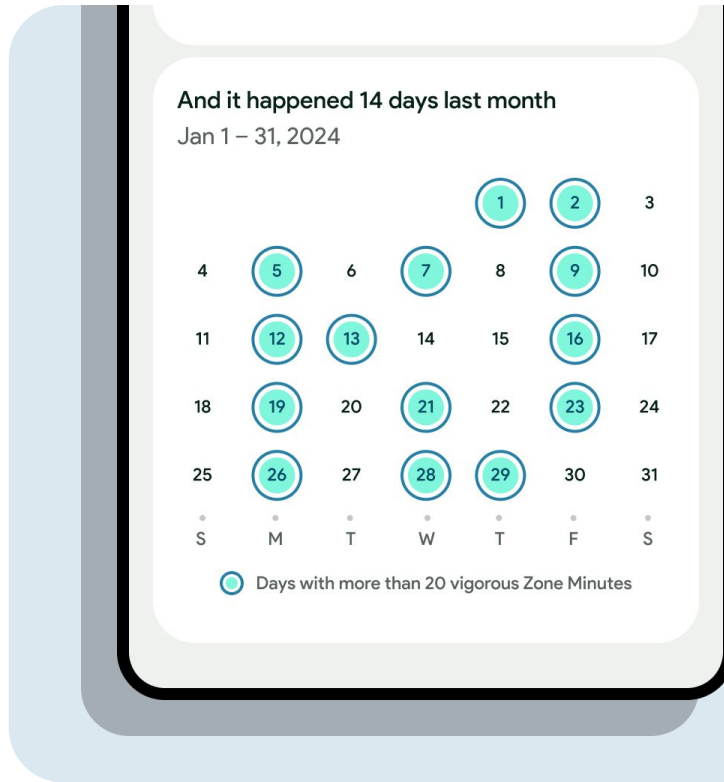
Principle 2

Choose charts your audience recognizes

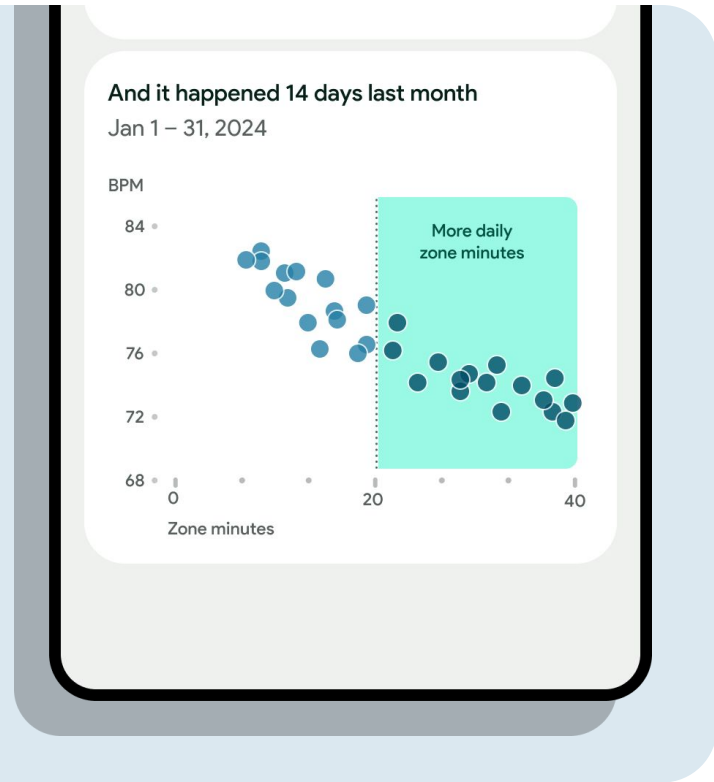
Unfamiliar charts can be confusing, especially for those less experienced with data visualization. If a chart doesn't make information easier to understand at a glance, it's likely not serving its purpose.







Do - Use visualizations that are familiar to people

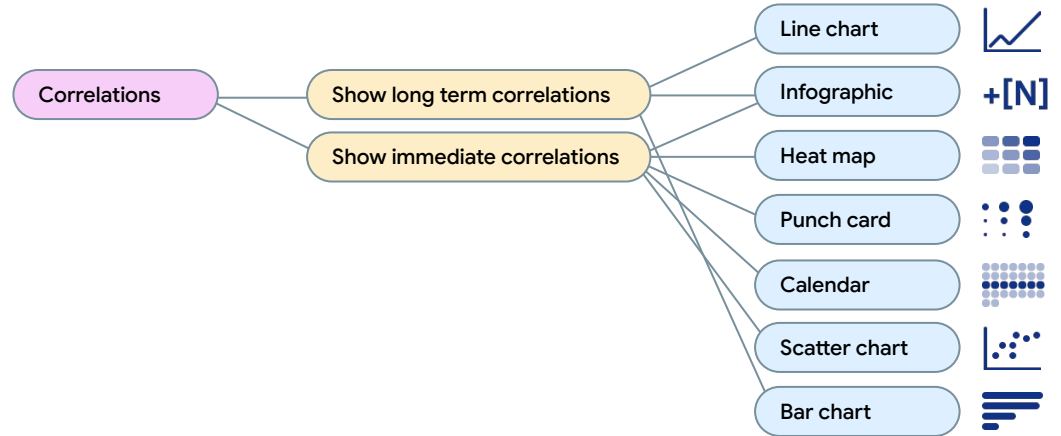
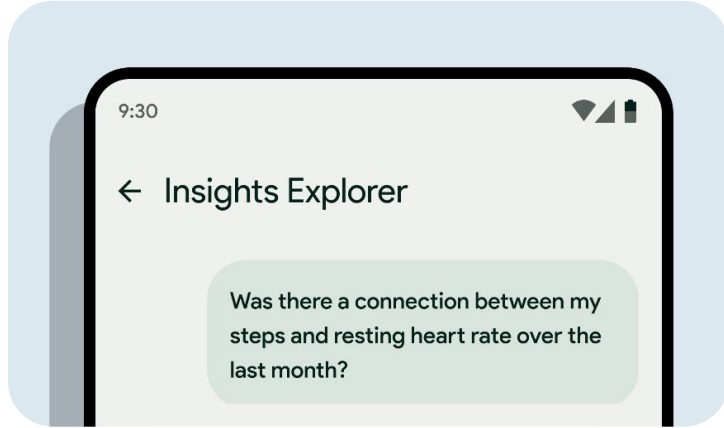


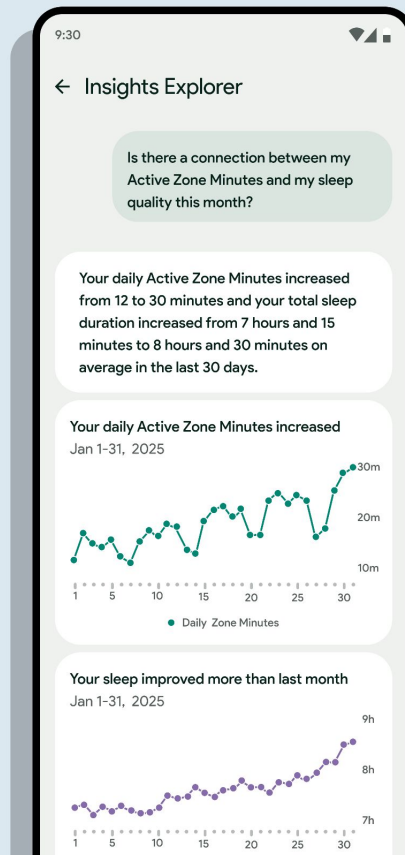
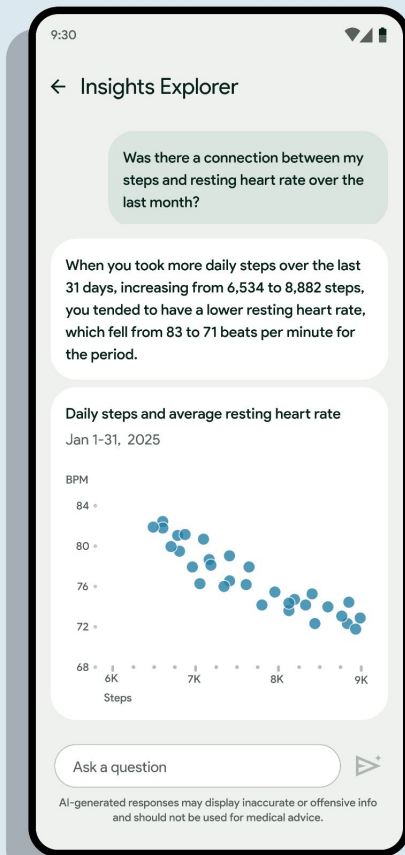
Don't - Avoid complex visualizations that are less familiar to your target audience.

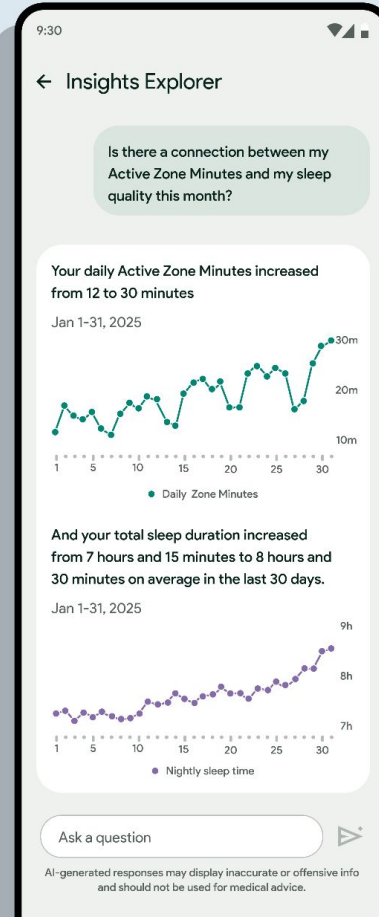
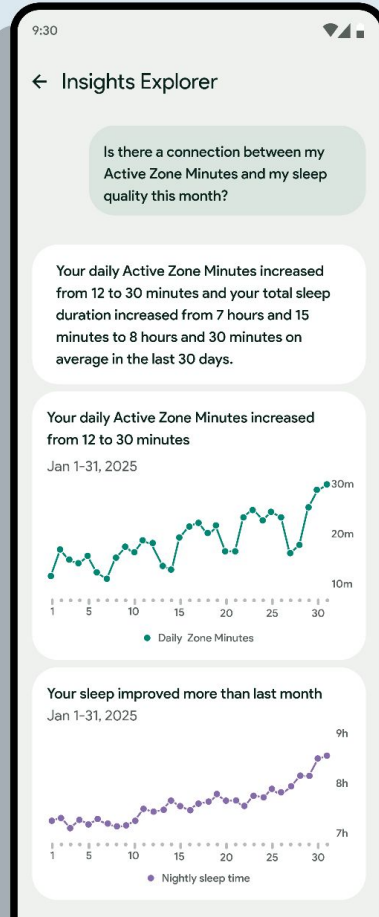
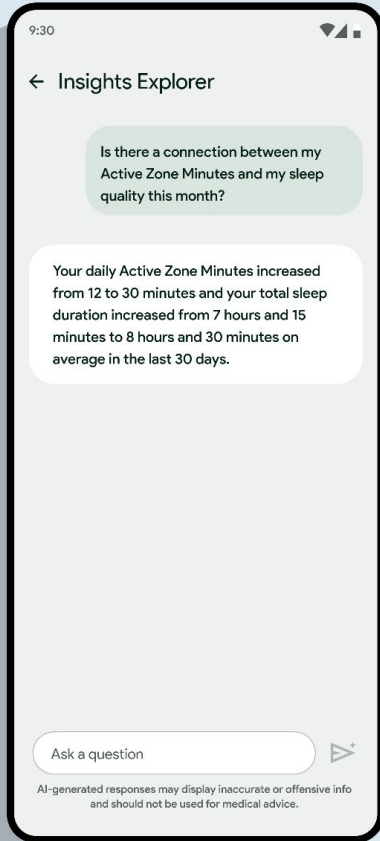
Principle 3

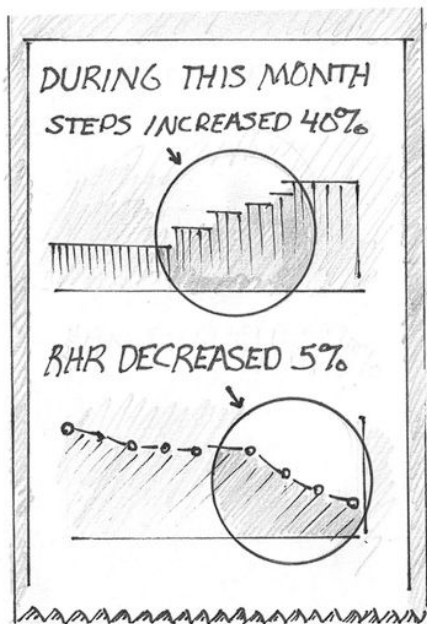
Consider chartless alternatives

Sometimes the best chart is no chart. Prioritize clarity over complexity. If a chart doesn't clearly convey the insight, opt for simpler alternatives. Typography, images, or icons can often highlight key takeaways more effectively.

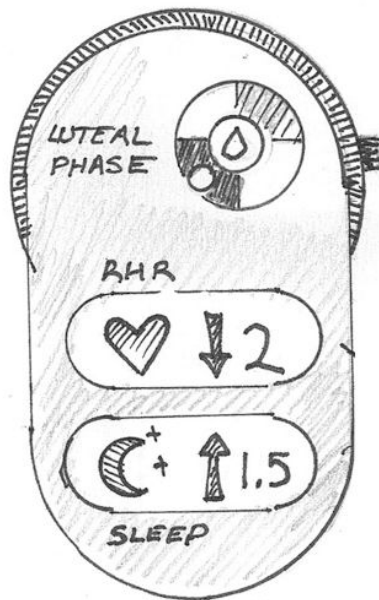


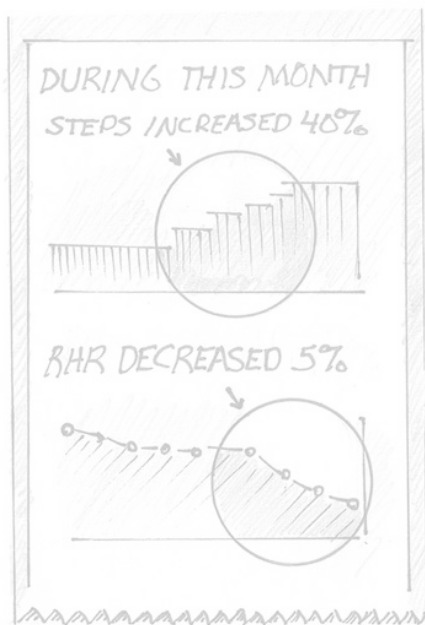




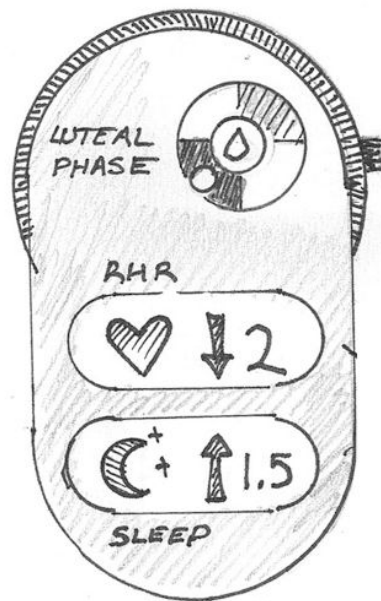


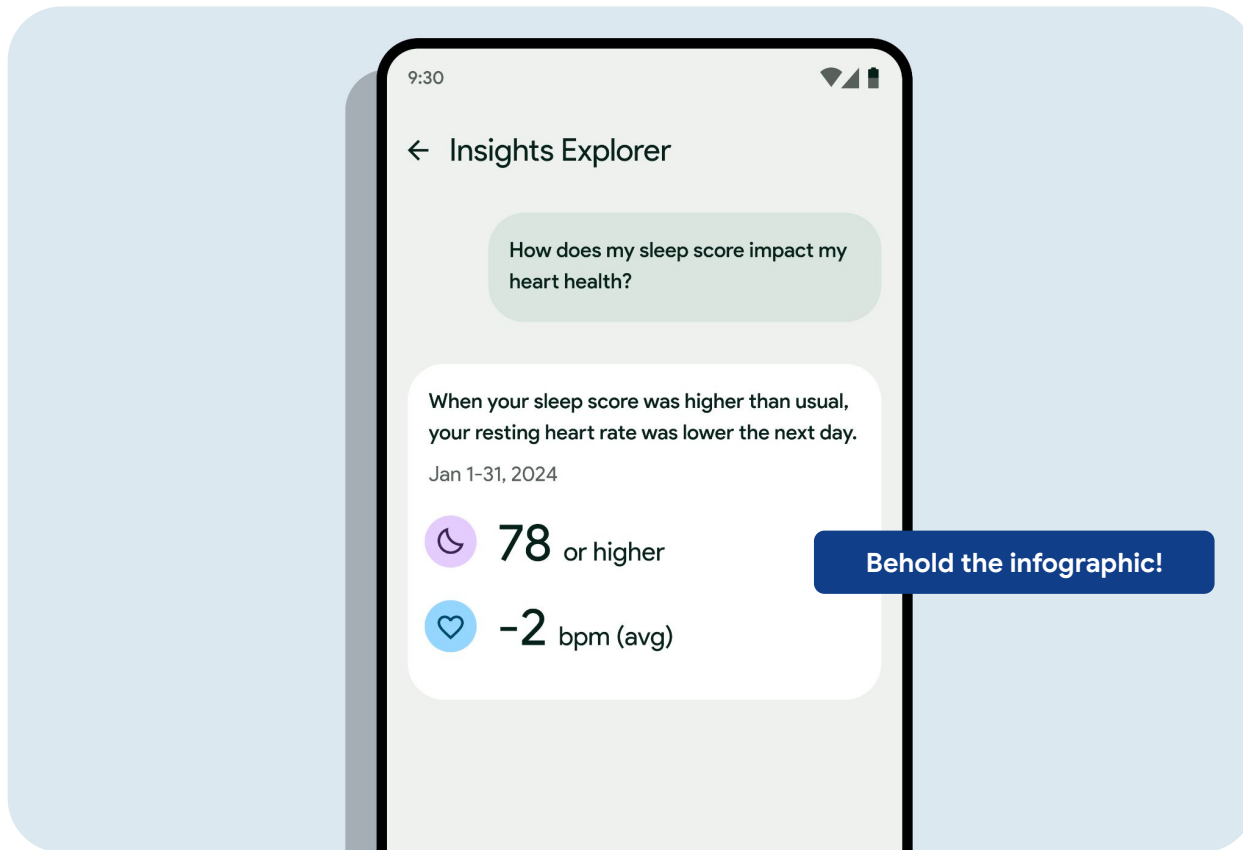
INSIGHT
FROM TEXT
+
ANNOTATED
CHARTS





INSIGHT
FROM TEXT
+
ANNOTATED
CHARTS





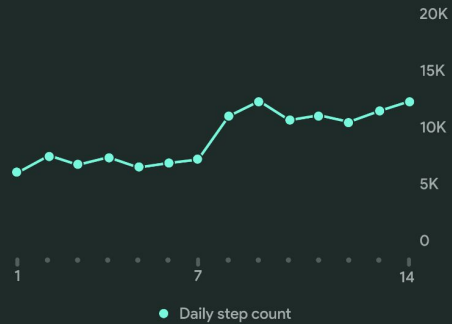
Principle 4

Guide people through their data

Highlight key information within the data by integrating labels, annotations, icons, images, and visual cues directly into the chart. Strategically position these elements to emphasize the specific insights provided within the LLM's response.

How has my step count changed in the past two weeks?

Your average step count increased
June 1-14, 2024



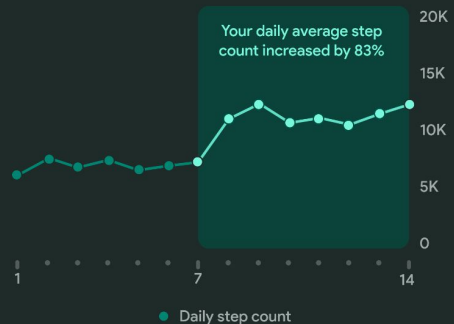
How has my step count changed in the past two weeks?

Your average step count increased

June 1-14, 2024



+5100 steps (avg)



Principle 5

Enable data exploration & follow-up.

Give a snapshot of the key findings upfront for those wanting a quick overview. Then, provide interactive elements and additional charts that allow deeper exploration of the underlying metrics and data points for those seeking a more in-depth understanding.



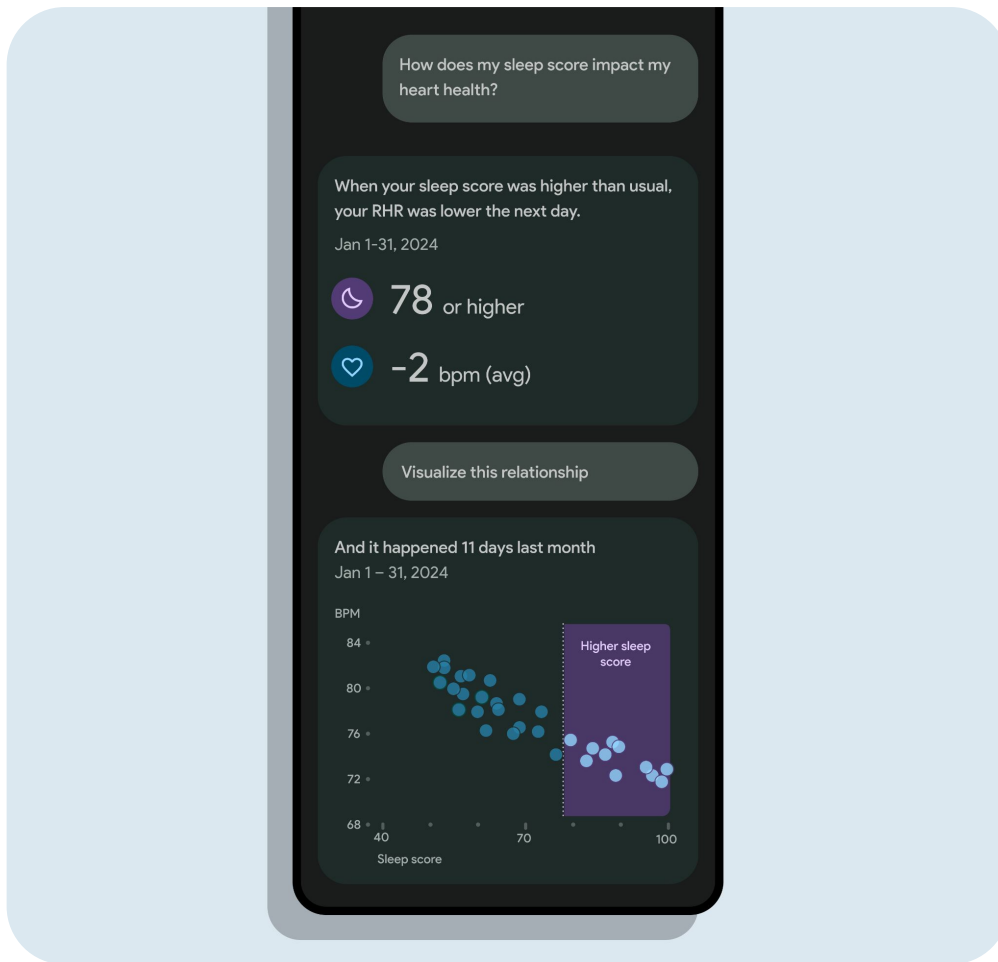
Generally, is my sleep getting better or worse?

Your sleep used to be good, but is now in the fair range. Your sleep score decreased from 85 to 77 over the last 30 days.

Sleep score • 85

Jan 8, 2024





Principle 6

Embrace Scale

Provide a full picture of the data, even when there are thousands of data points. Simplifying the data too much risks overlooking crucial details that contribute to the overall understanding.

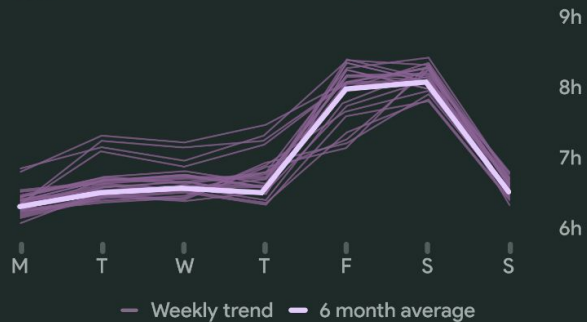
What days do I get the most sleep each week?

You sleep longer on Fridays and Saturdays

Jan 1 - Jun 31, 2024



+45 min (avg)



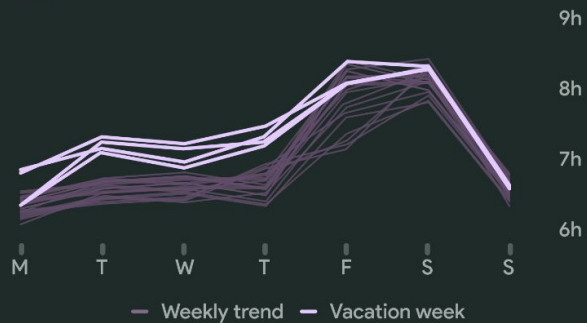
How do my weekly sleep patterns change when I'm out of town?

You sleep a bit longer during vacation weeks

Jan 1 - Jun 31, 2024



+30 min (avg)



Design Craft

What does good actually look like?

Principle 7

Exceed expectations

Explore how design details can increase accessibility, boost engagement, enhance comprehension and make the overall experience truly unique for your product.



Photo Credit: "Dear Upstairs Neighbor" by Google DeepMind

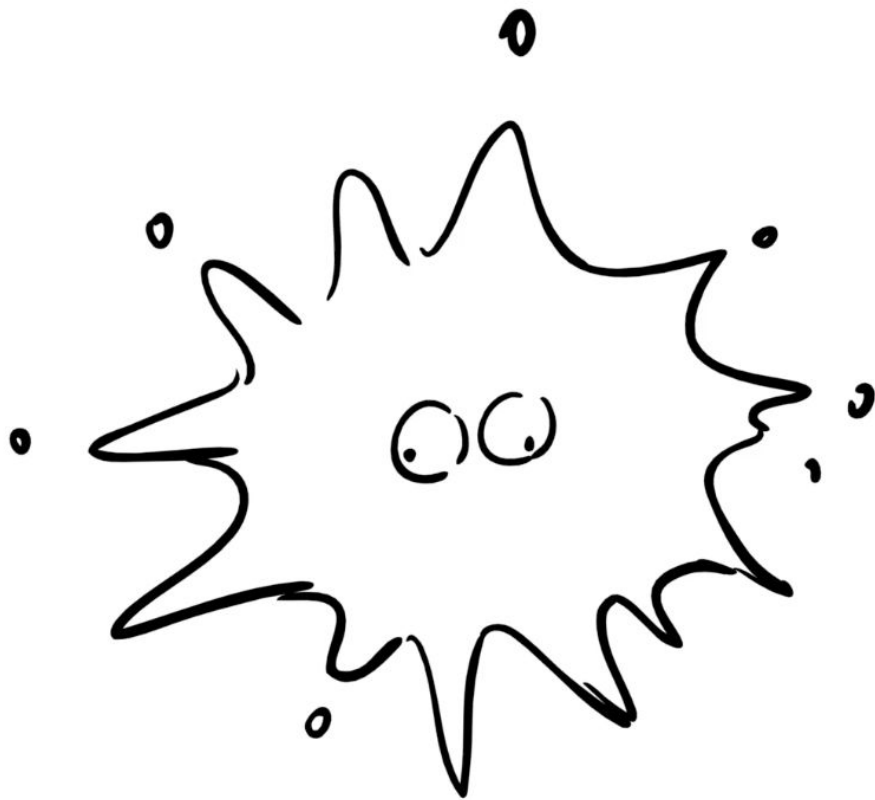


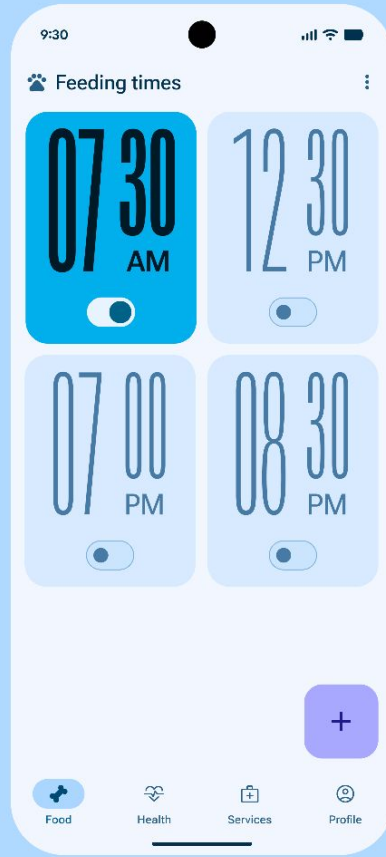
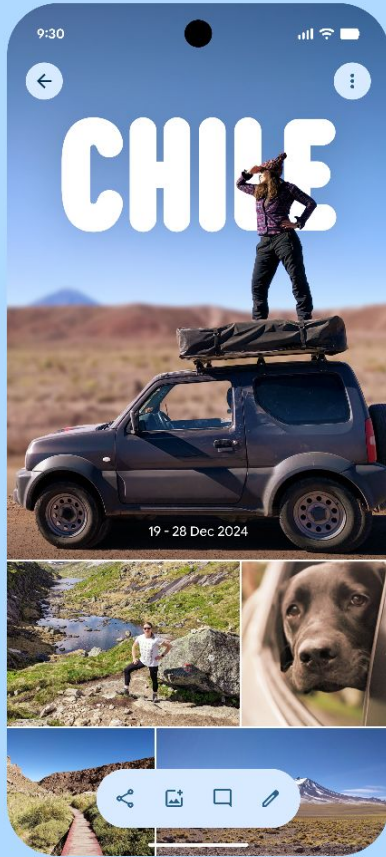






Image Credit: "Dear Upstairs Neighbor" by Google DeepMind

What did we **learn** from the DeepMind short film example?



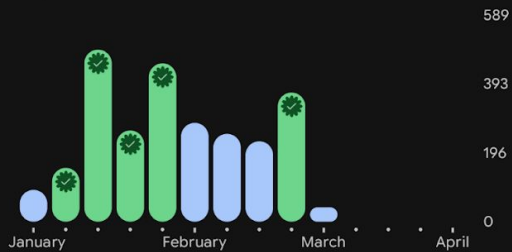
← Cardio load

Jan-Mar



43% more than last quarter

You earned 261 cardio load per week on average and hit your target 5 times



Jan-Mar

Total per week

This week

40

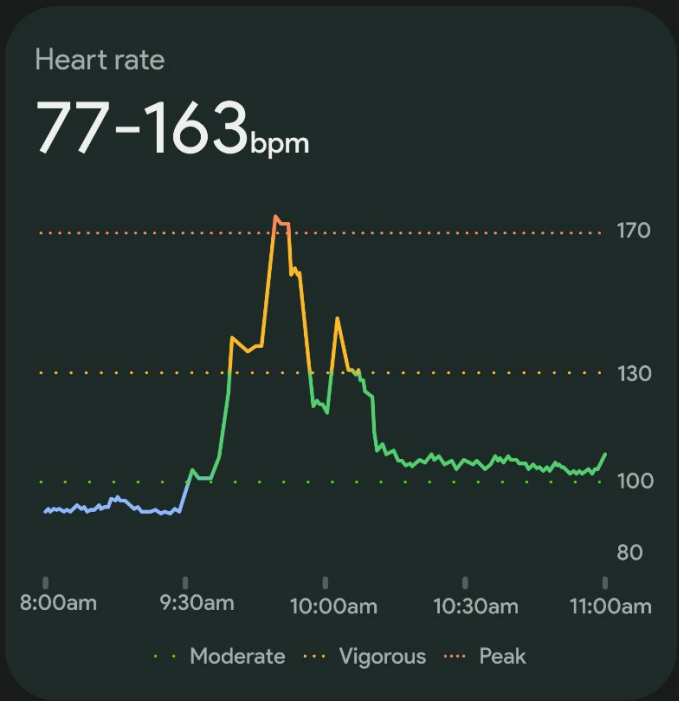
11% of target

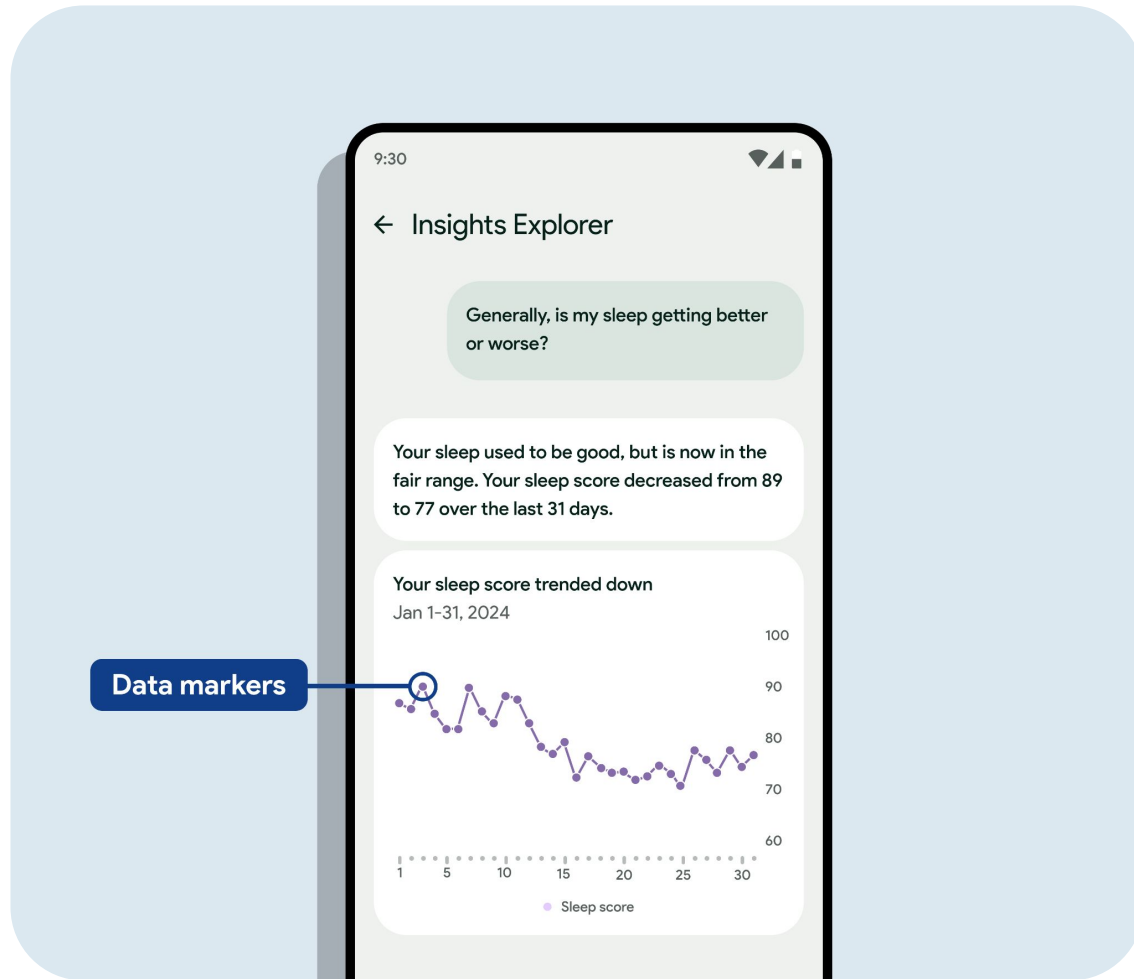
Feb 22-28

368

106% of target

Dotted threshold line





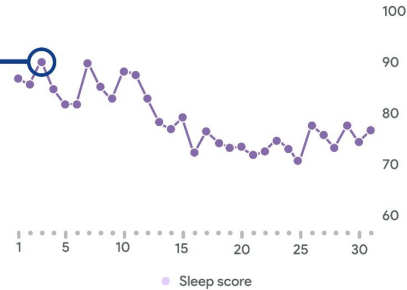
9:30

← Insights Explorer

Generally, is my sleep getting better or worse?

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Your sleep score trended down
Jan 1-31, 2024



Data markers

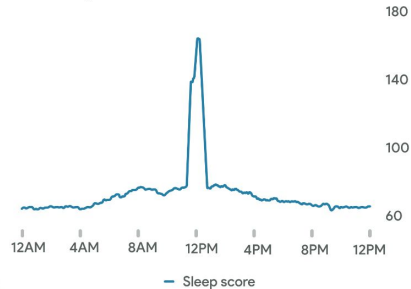
9:30

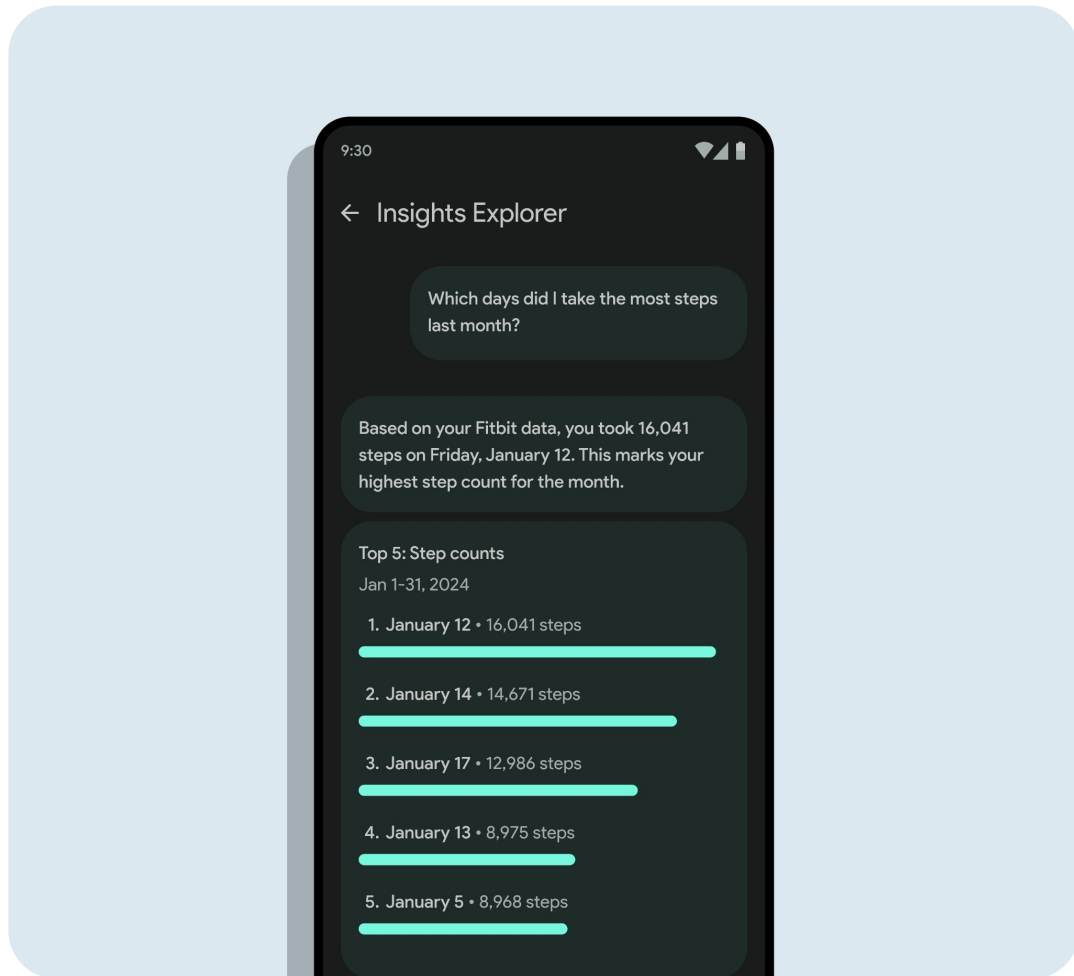
← Insights Explorer

Were there any identifiable trends in my heart rate yesterday?

For the most part, your heart rate was steady yesterday. It looks like it was elevated during your run at 12:00 PM, ranging from 72 - 160 bpm, which is what someone your age should expect during regular exercise.

Your heart rate
Yesterday





One more thing

The last principle

Principle 8

Remember, build for people, not machines

These experiences are designed to empower individuals, not just inform. The approach is personalized, meeting individuals where they are, with a tone of voice and design elements that resonate and motivate.

The guiding principles

- 1 Start with the insight. Everything else will follow
- 2 Choose charts your audience recognizes
- 3 Consider chartless alternatives
- 4 Guide people through their data
- 5 Enable data exploration and follow-up
- 6 Embrace scale
- 7 Exceed expectations
- 8 Remember, build for people, not machines

Thank you!

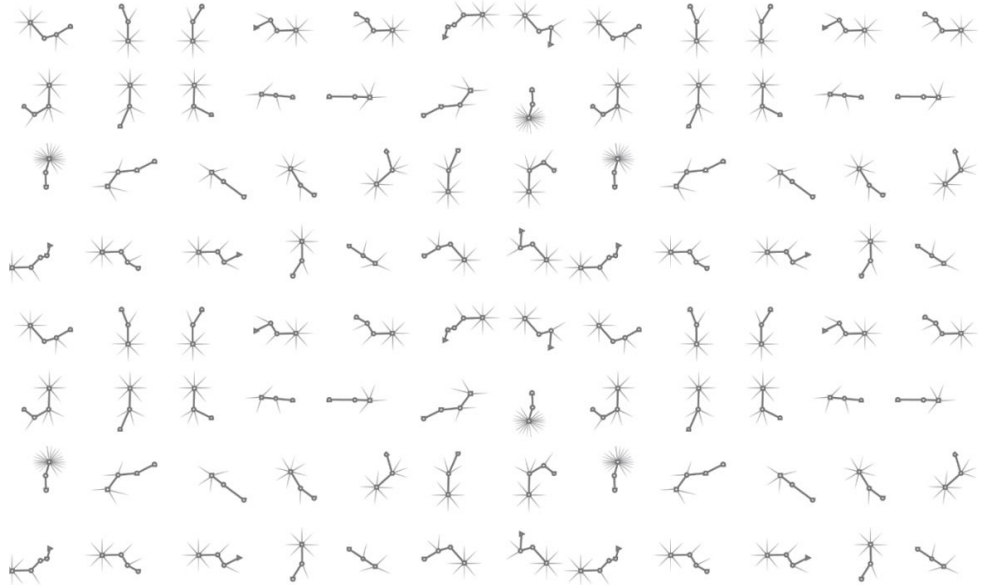
Acknowledgements

- Alex Lin
- Alicia Korn
- Andrew Carter
- Brennan Brown
- Carlota Romero
- Dominique Meury
- Glenn Entis
- Joscelin Cooper
- Josh Ellis
- Katie Normandin
- Lisa Kaggen
- Naghmeh Rezaei
- Matthew Morrison
- Sid Ananthakrishnan

Available Spring 2027

Data Visualization in the Age of AI

An A K Peters Book





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- kent.eisenhuth@gmail.com

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