

EXPT NO:4	
DATE: 20.01.2026	

Visual encoding of data

PRE-LAB QUESTIONS

1. How does the human visual system process visual variables?

The human visual system quickly perceives color, size, shape, position, and motion, enabling rapid pattern recognition and comparison in visual data.

2. Why is improper encoding misleading in analytics?

Improper encoding can distort data meaning, hide patterns, exaggerate differences, and lead to incorrect conclusions or decisions.

3. What are perceptual limitations in visualization?

Perceptual limitations include difficulty distinguishing similar colors, limited attention span, visual clutter, and inability to accurately judge area or volume.

4. How does color choice affect interpretation?

Color influences emphasis, grouping, emotional response, and readability; poor color choices can cause confusion or misinterpretation of data.

5. Why should AI dashboards be perceptually optimized?

Perceptually optimized dashboards improve clarity, speed of understanding, reduce cognitive load, and support accurate human-AI decision making.

OBJECTIVE: To apply effective visual encoding principles for meaningful data communication.

SCENARIO: A city traffic department analyzes accident data to identify high-risk zones and accident severity patterns.

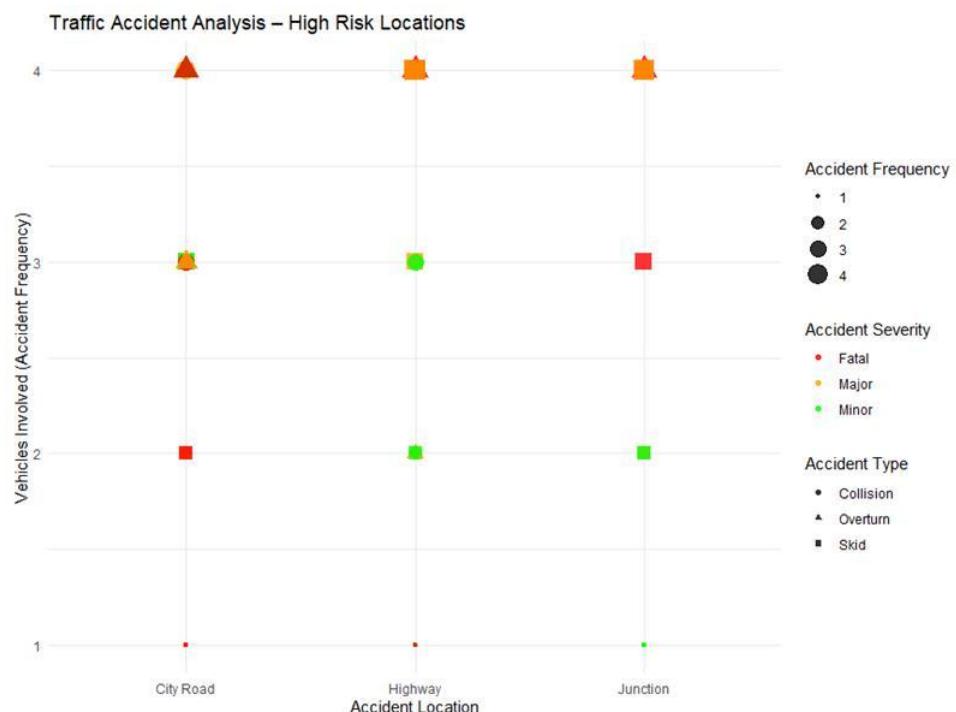
IN-LAB TASKS (Using R Language) • Encode severity using color gradients • Represent accident frequency using size • Use shape to indicate accident type

CODE:

```
# =====
# Roll No: 23BAD076
# =====
library(ggplot2)
accident_data <- read.csv("4.traffic_accidents.csv")
head(accident_data)

ggplot(accident_data, aes(
  x = Location,
  y = Vehicles_Involved
)) +
  geom_point(
    aes(
      color = Severity,
      size = Vehicles_Involved,
      shape = Accident_Type
    ),
    alpha = 0.8
  ) +
  scale_color_manual(
    values = c(
      "Minor" = "green",
      "Major" = "orange",
      "Fatal" = "red"
    )
  ) +
  labs(
    title = "Traffic Accident Analysis - High Risk Locations",
    x = "Accident Location",
    y = "Vehicles Involved (Accident Frequency)",
    color = "Accident Severity",
    size = "Accident Frequency",
    shape = "Accident Type"
  ) +
  theme_minimal()
```

OUTPUT:



POST-LAB QUESTIONS

1. Which visual variable best conveys severity and why?

Color best conveys severity because it is quickly perceived by the human eye and effectively highlights differences in risk levels (e.g., green for minor, red for fatal).

2. How can poor encoding mislead policy decisions?

Poor encoding can hide critical trends, exaggerate impacts, or misrepresent data, leading policymakers to take incorrect or ineffective actions.

3. What precautions should be taken for color-blind users?

Use color-blind-safe palettes, combine color with shapes or labels, avoid red-green contrasts, and ensure sufficient contrast.

4. How does visual encoding affect AI explainability?

Clear visual encoding makes AI outputs transparent and interpretable, helping users understand model behavior, while poor encoding reduces trust and clarity.

5. Suggest improvements for large-scale public dashboards.

Use simple layouts, interactive filters, scalable visuals, clear legends, and accessibility-friendly design to ensure effective communication for diverse users.

LEARNING OUTCOME: Students learn perceptually effective visual communication for AI systems.

ASSESSMENT

Description	Max Marks	Marks Awarded
Pre Lab Exercise	5	
In Lab Exercise	10	
Post Lab Exercise	5	
Viva	10	
Total	30	
Faculty Signature		