



# DS 650 Data Visualization and Interpretation

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**Instructor:**

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**Office Hours:** 1:30pm - 3pm Thursday. Questions/Appointments via email are welcome

\*My TA team and I will try our best to respond to all emails/Inbox messages within 24 hours.

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## General Course Information

### Course Description

The course will focus on training students in data visualization theory, techniques, and tools. Students will learn why and how visualization can be applied in the human-centered data science pipeline, as well as its various uses, including exploratory data analysis and the communication of data-driven insights. They will gain practical experience in interpreting, critiquing, and comparing visualization techniques by using real-world data sets and case studies. Students will also develop interactive visualization interfaces as part of the class project. They will gain a broad understanding of how visualization can enhance trust and interpretation of data. The students will read and learn about recent progress in the areas of information visualization, visual analytics, and human-data interaction.

### Prerequisites/Co-requisites

None

### Course Learning Outcomes (CLOs)

You will notice throughout the course that many pages are marked with "CLOs". These refer to the Course Learning Outcomes. These markers are in place to help you clearly identify the relationship between learning outcomes (what you should be able to do at the end of the course) and the learning materials and activities.

**By the end of the course, students will be able to:**

1. Explain why visualization is an important reasoning device in the age of generative AI.
2. Translate analytical tasks to visualization-specific syntax and semantics.
3. Analyze the degree of visualization interpretability with respect to human perception and cognition.
4. Explain trade-offs among design principles like effectiveness, expressiveness, etc.
5. Compose visualization dashboards for real-world case studies.
6. Implement interactive visualizations using Tableau, D3 or Python.
7. Communicate visualization-driven insights concisely through written, verbal, and visual formats.

## Materials

No textbook required

### Supplemental References (but not required)

1. Visualization Analysis and Design (AK Peters Visualization Series), Tamara Munzner
2. Interactive Data Visualization for the Web: An Introduction to Designing with D3 2nd Edition, Scott Murray
3. The Visual Display of Quantitative Information, Edward Tufte
4. Storytelling with Data: A Data Visualization Guide for Business Professionals, 2015, Cole Nussbaumer Knaflic

### Web and Software Resources

Course portal: [canvas.njit.edu](https://canvas.njit.edu)

Tableau: <https://www.tableau.com/academic/students>

Python libraries: <http://seaborn.pydata.org/index.html> and <https://dash.plotly.com/>

## Course Work

### Weekly Expectations

**Course Workload:** This course values your time and effort, aiming to provide a rewarding learning experience. To get the most out of this course, you should dedicate approximately 7.5 hours per week to the course.

This course is organized into weekly modules. The **first quarter** (4 weeks) will be devoted to learning basic visualization concepts, and students will complete 3-4 hands-on assignments, which will be graded based on completion. Students should use these assignments as practice for quizzes and the midterm, which will be in the **second quarter**. In the last quarter, we will focus on implementation (using Tableau or Python or D3) of the techniques as part of their group projects. Group projects enable students to learn in a collaborative environment, enhancing their implementation and problem-solving skills.

### Learning Activities and Assessments

Final grades will be based on the following percentages:

Category	Percent of Final Grade
Quizzes	20%
Assignments and Attendance	15%
Midterm	30%
Project	35%

**Assignments:** Assignments will be given almost every week to provide you with an opportunity to apply the course concepts for that week. These activities are designed to help you practice and prepare for the quizzes and projects. For example, you will be asked to critique visualizations, explain why they adhere to certain design principles, and explain why alternative visualizations may better address design trade-offs.

**Quizzes:** The course will include multiple quizzes. These quizzes will ask you to apply course concepts in a hands-on way. All quizzes will consist of questions similar to those you have seen in assignments. You are not required to implement techniques using any programming language or a tool for the quizzes. Implementation is evaluated based on project deliverables.

**Midterm:** The assignments and quizzes in the initial half of the course will adequately prepare you for the midterm. In the midterm, you will be required to sketch, critique, and explain solutions for complex data analysis or human decision-making problems, based on real-world scenarios. The midterm will assess your critical thinking skills and your ability to apply the concepts you have learned in practical scenarios, preparing you for the project deliverables.

**Projects:** The course project will have at least 4 deliverables. These deliverables will comprise: 1) tasks and requirements specification, 2) design space analysis, 3) dashboard implementation, and 4) a recorded presentation describing the key project outcomes.

You will have opportunities to iterate and revise your work based on feedback from peers and instructors.

## Feedback

I will deliver feedback on each assignment using the comments feature in Canvas.

In data visualization, the process is more important than the outcome, meaning that in an academic course, the focus is more on how you can reason about the need for and the effectiveness of visualization techniques and less on whether you got the correct answer. Often, there is no single correct answer but multiple viable solutions. As long as you can reason about your solution by applying the principles learned in the class, you will be doing well in the course. This will need a combination of computational thinking as well as design thinking (putting the user first and thinking about the solution from a user's perspective) skills. I hope you will all learn and develop these skills as part of this course, which will be the most significant takeaways that you can apply in any real-life, data-driven problem-solving scenario.

## Grading Policy

[NJIT Graduate Grades](#)

### Letter to Number Grade Conversions

Grades will be rounded to the nearest whole number before being assigned according to the following scales.

The following grades are used for graduate courses:

- A: 90-100

- **B+**: 85-89
- **B**: 80-84
- **C+**: 75-79
- **C**: 70-74
- **F**: Below 70

Note: There is no D grade for graduate courses.

## **Exam Information**

This course does not have any final exams. Per the NJIT [Online Course Exam Proctoring Policy](#), this course will use authentic assessment, meaning you will be assessed and graded on your ability to deliver real-world outputs as well as your participation and feedback to other students.

## **Late Work Policy**

There is a 20% deduction for late submissions on assignments and 30% for late group project submissions. Students should contact the instructor if they are facing challenges completing assignments or project submissions at least 72 hours before the submission deadline. All other requests will not be accepted.

## **University Policies and Resources**

### **Academic Integrity**

“Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the [NJIT academic code of integrity policy](#).”

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at [dos@njit.edu](mailto:dos@njit.edu)”

### **Responsible use of Generative AI**

Generative AI, for academics and the general public alike, provides us with power, like never before, to enable machines to understand and execute human instructions. But, as the saying goes, *with great power comes great responsibility*. At this point, the academic community is still determining how to strike a balance between the freedom to utilize generative AI and the need for students to creatively produce solutions to complex data analysis problems without relying on the AI to do so. In this course, the policy for the responsible use of generative AI is grounded in two simple rules:

- Rule 1) Unless explicitly allowed in a quiz/assignment/project deliverable, you should refrain from the use of generative AI, and

- Rule 2) Whenever explicitly asked to use Generative AI tools (e.g., ChatGPT), you need to submit the full version of the human prompts and AI responses.  
 If students don't adhere to either Rule 1 or Rule 2, the plagiarism policy will be applied.

## Requesting Accommodations

The Office of Accessibility Resources and Services collaborates with administrators, faculty, and staff to offer reasonable accommodations and support for students with disabilities. To receive services, students must provide medical documentation.

If you are in need of accommodations due to a disability, please contact the [Office of Accessibility Resources and Services](#) to discuss your specific needs.

## Resources for NJIT Online Students

NJIT is dedicated to your success. Various academic support centers and services are available to help you excel in your course and program. For more information, visit the "Student Services" page in Canvas, which also includes technical support details.

## Course Schedule

Note: All due dates are in Eastern Standard Time (EST/EDT).

[Change your Canvas settings to show due dates in your local time zone.](#)

Module	Topic(s)
Week 1 9/2	Introduction: Definitions, Interpretation & Misinterpretation
Week2 9/9	Visual Encoding & Design Principles
Week 3 9/16	Color & Class Assignment
Week 4 9/23	Quiz 1 (9/23) & Visualization Techniques-1
Week 5 9/30	Tableau (9/30) & Visualization Techniques- 2
Week6 10/7	Project Discussion, Problem-Solving with Tableau (10/9)
Week7 10/14	Class Assignment & Visualization Techniques-3
Week8 10/21	Midterm (10/21 & 10/23)
Week9 10/28	Design Critiquing-1 (in Project Groups)

<b>Module</b>	<b>Topic(s)</b>
<b>Week10 11/4</b>	Gestalt Laws & Project Presentations (Deliverable 2 with Implementation)
<b>Week11 11/11</b>	Tableau Animations & Interactions (11/13) & Dashboard- 1
<b>Week12 11/18</b>	Quiz-2 & Project Dashboard Class Assignment
<b>Week13 11/25</b>	Dashboard-2
<b>Week14 12/2</b>	Tableau lecture 3 (12/2) & Project Dashboard Critiquing
<b>Week15 12/9</b>	Project final deliverable preparation and presentations
<b>Final exam week</b>	Project final deliverable DUE