# BANA6037/5137 – Data Visualization
## Spring Semester 2018 (18FS) / First Half Session
### Section 001

**Instructor:**
Jeffrey A. Shaffer
Vice President, IT and Analytics, Unifund
Adjunct Professor, University of Cincinnati
JeffreyShaffer@gmail.com
513.615.0001
DataPlusScience.com
@HighVizAbility

**Required Course Materials**
*The Big Book Dashboards: Visualizing Your Data Using Real-World Business Scenarios*
    Steve Wexler, Jeffrey Shaffer, Andy Cotgreave, Wiley (*2017*)
**Additional Readings**: Provided by Instructor

**Suggested Reading (not required)**
*Storytelling with Data*
    Cole Nussbaumer, Wiley (2015)
*The Functional Art*
    Alberto Cairo, New Riders (2012)
*The Truthful Art*
    Alberto Cairo, New Riders (2016)
*The Wall Street Journal Guide to Information Graphics: The Dos and Don't of Presenting Data, Facts, and Figures*
    Dona M. Wong, W. W. Norton & Company (2010)
*Information Dashboard Design: Displaying Data for At-a-Glance Monitoring*
    Stephen Few, O'Reilly Media (2013)
*Show Me the Numbers: Designing Tables and Graphs to Enlighten*
    Stephen Few, Analytics Press (2004)
*Visualize This:  The Flowing Data Guide to Design, Visualization, and Statistics*
    Nathan Yau, Wiley (2011)
*Now You See It*, Stephen Few, Analytics Press (2009)

**Suggested Feeds/Blog Subscriptions**
DataPlusScience by Jeffrey Shaffer
Data Revelations by Steve Wexler
Viz of the Day by Tableau Software
Makeover Monday Project by Andy Kriebel and Eva Murray
The Functional Art by Alberto Cairo
Perceptual Edge by Stephen Few
Flowing Data by Nathan Yau
Storytelling with Data by Cole Nussbaumer
VizWiz by Andy Kriebel
Dear-Data.com by Giorgia Lupi and Stefanie Posavec
Dear-Data-Two.com by Jeffrey Shaffer and Andy Kriebel

**Summary**

This course provides an introduction as well as hands-on experience in data visualization. It introduces students to design principles for creating meaningful displays of quantitative and qualitative data to facilitate managerial decision-making.

**Course Objectives**
- Provide an overview and brief history of the practice of data visualization
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- Introduce students to the key design principles and techniques for visualizing data
- Develop an understanding of the fundamentals of communication and alignment around concepts that are required for effective data presentation
- Provide an overview and develop an introductory level of competency on the use of several available software tools that can be used for data visualization
- Allow for project-based opportunities to identify, understand, analyze, prepare, and present effective visualizations on a variety of topics

**Course Prerequisites**
- General computer skills and a familiarity with charting tools like Microsoft Excel are necessary, along with access to the Internet for research and data gathering.
- Direct access to a computer on which the student can install software is highly recommended (see *Required Software* below)
- An understanding of basic charting and statistical terms and practices will be helpful, but not required.

**Student Outcomes**

After taking this course, students should be able to collect and process data, create an interactive visualization, and use it to demonstrate or provide insight into a problem, situation, or phenomenon.

Moreover, students should have the basic knowledge needed to critique various visualizations (good and bad), and to identify design principles that make good visualizations effective. Students should also have a basic understanding of some of the challenges present in making data understandable across a wide range of potential audiences.

Finally, students will have the opportunity to demonstrate their own skills in identifying a visualization that can be improved, completing their own design and/or analysis on the underlying data, and working to publish or promote acceptance of their presentation.

**Course Format**

Students will read class material, study best and worst practices, compare and contrast real-world examples, engage in problem solving, and participate in discussions related to the course material. Students will also practice applying the techniques and best practices discussed to real-world problems.

**Required Software**

A significant amount of time that students spend completing their assignments will involve the use of visualization software. Instruction will be focused and directed based on the capabilities/features of:

- **Tableau Desktop Professional (TFT License), Student License or Tableau Public**
- Microsoft Excel (Win 2007/Mac 2008 or Win 2010/Mac 2011 or Win 2013) - **Optional**
- R, R Studio and Shiny - **Optional**

Students will be able to learn the basic features of one or more of these through training videos that are posted in Blackboard, self-directed studies or by using available resources online.  The instructor is also willing to help with specific questions or techniques as needed.

**Students may use any technology platform for their projects, as long as work is presentable for in class review, and accessible for review by the course instructor.**  If there is any question about whether work can be accessed for review or presentation (*e.g.,* if it is not created in one of the software tools listed above), you must check with the instructor prior to submitting your work.

Microsoft Windows and Excel can be purchased from the University Bookstore for a nominal charge if needed.  A fully licensed version of Tableau Desktop is made available to each student for the duration of the class, or if preferred, the student may use the freely available Tableau Public software for non-proprietary and non-confidential data.

A full copy of Tableau Desktop is also available to full-time students for free for a year, available from Tableau. Microsoft Excel and Tableau Desktop Professional are available for both Apple Macintosh and Windows operating systems.

**Expectations of Students**
Students are expected to prepare and participate by:

1. Reading scheduled assignments each week
2. Participating in class discussions posted on Blackboard, projects, and quizzes
3. Completing the assigned homework projects by the due date
4. Participate in Group Projects

Students are expected to complete each test, exam, homework, and all other assignments independently.  The student's submissions must represent his or her individual work, and citations must be provided where content from other sources is referenced.  Also, you may not re-use a data set from one project to another; you must start with a completely new data set each time.

Students will be assigned to groups for the purpose of completing specific assignments. It is important that you participate as necessary in the groups to complete assignments. Low participation in your group may affect your final grade for any group assignments.

**Academic Integrity**
If there is a question about the academic integrity of a submission, or if it is believed that a submission does not fully represent the unique work of the student or assigned group members, the instructors will take all appropriate action in accordance with the university policy on Academic Misconduct and Plagiarism (http://www.uc.edu/conduct/Academic_Integrity.html).  This includes issuance of an "F" grade for the course.  Group projects should be collaborative only within your group and not shared between groups.

As with all Lindner College of Business efforts, this course will uphold the highest ethical standards, critical to building character (the C in PACE). Ensuing your integrity is vital and your responsibility. LCB instructors are required to report ANY incident of academic misconduct (*e.g.,* cheating, plagiarism) to the college review process, which could result in severe consequences, including potential dismissal from the college. For further information on Academic Misconduct or related university policies and procedures, please see the UC Code of Conduct (http://www.uc.edu/conduct/Code_of_Conduct.html).

**Counseling Services, Clifton Campus**
Students have access to counseling and mental health care through the University Health Services (UHS), which can provide both psychotherapy and psychiatric services. In addition, Counseling and Psychological Services (CAPS) can provide professional counseling upon request; students may receive five free counseling sessions through CAPS without insurance. Students are encouraged to seek assistance for anxiety, depression, trauma/assault, adjustment to college life, interpersonal/relational difficulty, sexuality, family conflict, grief and loss, disordered eating and body image, alcohol and substance abuse, anger management, identity development and issues related to diversity, concerns associated with sexual orientation and spirituality concerns, as well as any other issue of concerns. After hours, students may call UHS at 513-556- 2564 or CAPS Cares at 513-556- 0648. For urgent physician consultation after-hours students may call 513-584- 7777. For information about services at Blue Ash or Clermont campus see Course Information in Blackboard.

**Title IX**
Title IX is a federal civil rights law that prohibits discrimination on the basis of your actual or perceived sex, gender, gender identity, gender expression, or sexual orientation. Title IX also covers sexual violence, dating or domestic violence, and stalking. If you disclose a Title IX issue to me, I am required forward that information to the Title IX Office. They will follow up with you about how the University can take steps to address the impact on you and the community and make you aware of your rights and resources. Their priority is to make sure you are safe and successful here. You are not required to talk with the Title IX Office. If you would like to make a report of sex or gender-based discrimination, harassment or violence, or if you would like to know more about your rights and resources on campus, you can consult the website www.uc.edu/titleix or contact the office at 556-3349.

**Performance Evaluation**

| Course grades will be determined as follows: | **%** | **Points** |
|---|---|---|
| 1) Homework – Halloween Viz (Individual) | 5% | 50 pts |
| 2) Homework #2– Halloween Viz Redesign or Makeover Monday (Individual) | 5% | 50 pts |
| 3) Exam (Individual) | 20% | 200 pts |
| 4) Dear-Data Postcard (Individual) | 10% | 100 pts |
| 5) Project 1 (Group) | 20% | 200 pts |
| 6) Final Project - Final Interactive Data Visualization and Presentation (Group) | 40% | 400 pts |
| Total: | 100% | 1,000 pts |

Extra credit (one opportunity allowed for extra credit per student, see below)    Up to 3%    Up to 30 pts

**Grading Scale**
| | | |
|---|---|---|
| 93% - 100% | A | *Please see the **Grading Rubric** for grading criteria on assignments.* |
| 90% - 92.9% | A- | *Points for the Test will be awarded as marked on the exam.* |
| 87% - 89.9% | B+ | |
| 83% - 86.9% | B | |
| 80% - 82.9% | B - | |
| Below 80% | C | |

Below 70%    F

All students have the same opportunity to earn points in the course.  Any <u>questions regarding grading</u> must be addressed within one week of return of the graded assignment, quiz or exam to the student.

**Group Member Feedback and Grading**
For group projects, the instructor may allow for members to provide feedback on contributions and work effort of other group members.  This feedback may be taken into account in issuing individualized grades for group projects.  In other words, the input of your group members may positively or negatively affect your grade on these projects.

**Extra Credit Assignment**
Each student has an opportunity to earn extra credit by completing one additional assignment.  The subject / topic and data set used must be approved by the instructor, and work on the extra credit assignment must be by **individual only** (no group extra credit assignments).

Students may select one of the two options below for their extra credit assignment.  Please note that you must complete <u>all requirements</u> of the assignment to be eligible for full credit:

1)  Participate in Andy Kriebel's Makeover Monday Project ([http://www.makeovermonday.co.uk](http://www.makeovermonday.co.uk)/)
    a.  Andy Kriebel's makeover Monday dataset is published every Sunday. Use any Sunday dataset and create a makeover of the chart using the provided data.
    b.  Publish your own blog post about your redesign or post to Tableau Public or Twitter

2)  Create a data visualization
    a.  Identify a dataset, for example, information about school's performance in Ohio, economic reports, government or corporate report, etc.
    b.  Create a data visualization using the dataset.
    c.  Publish to Tableau Public and submit the link

3)  Pick a topic from Dear-Data.com or Dear-Data-Two.com and create your own post card. You are welcome to mail it to someone you know, but please take a high resolution picture of both sides of the card to submit for your extra credit assignment.

    See Examples:
    [Dear-Data.com](Dear-Data.com) by Giorgia Lupi and Stefanie Posavec
    [Dear-Data-Two.com](Dear-Data-Two.com) by Jeffrey Shaffer and Andy Kriebel

**Exam**

The test will cover the concepts and material in each of the first 3 classes.  Students will be expected to apply the class readings and lectures in answering the test questions.

The test will be taken in class, **online through Blackboard**. Without **prior** approval, prior to the exam time, make-up opportunities are limited to documented emergencies. Instructor discretion is used in determining whether a situation constitutes an emergency.

**Projects**
Through a variety of projects, we will analyze best practices and compare and contrast with not-so-best practices.  Students will learn to critique good and bad data visualizations and will be required to create and recreate various data visualizations using various sets of data.  The final project will be **interactive** in nature and not simply a static chart. Points will be deducted for final projects that are not interactive.

**Homework**
Homework assignments will be given in this class and are due by the date and time indicated in the syllabus or as indicated by the instructor.

**Submission of Homework and Project Deliverables**
Students must submit all required assignments and supporting work via Blackboard.  The submission time listed in Blackboard will be used to determine whether an assignment is on time or late.  If multiple submissions are received, the final submission will be considered for grading (along with determining if the assignment was submitted on time).  Submissions that are "in progress" or "draft" status in Blackboard at the designated due date and time will not be considered submitted.  For group projects, the designated spokesperson is responsible for submitting all materials on behalf of the group.

**Late Assignments**
Late assignments will receive a deduction of 5% per day, beginning with a 5% deduction for assignments turned in past the date and time due. Assignments more than 3 days late will not be accepted.

**Adjustments to Assignments, Schedule, and Syllabus**
The scope, timing, and due date/time of any assignments, projects, homework, exams, or any other required work may be adjusted by the instructor as needed to maximize learning opportunities for students and/or better serve the goals of the course.  The syllabus may likewise be modified at the discretion of the instructor.

Any adjustments will be communicated to students in class and on Blackboard with as much advance notice as possible.

**GRADING RUBRICS for BANA6037 Visualization, Project, and Lab Assignments**

| Criteria | 10 – Outstanding | 9 – Proficient | 8 – Basic | 7 (or lower) - Below Expectations |
|---|---|---|---|---|
| **OBJECTIVE** | | | | |
| **Completed assignment per requirements** | All portions of the assignment, including presentations, data preparation, and visualizations were attempted and submitted. This is a pass / fail component. All or no points are awarded. | | | |
| **Data is appropriate and sufficient for the analysis** | The data set chosen or used by is appropriate, correct, and sufficient to support the thesis of the analysis. | Data is appropriate but minor data issues may be present or enhancements may be needed for a proper analysis. | Data is related but not sufficient to support the analysis, or significant data issues prevent a clear reading of the results. | Data has little or no relation to the topic being explored, errors will lead to incorrect conclusion, and/or data issues make the analysis unusable. |
| **Headers, directions, citations, and visual cues are given as guides** | Clear direction is provided. Visual cues, tooltips, and citations are consistently and correctly employed to inform and guide. | Header, footers, and instructions are present, but visual cues may be missing or could be improved. | The user must self-discover functionality. Headers and footers may be missing. Difficult to know what to do. | The user has little or no indication of how to engage. Directions are missing on clear. Missing headers and footers for context and meaning. |
| **Basic visualization rules and best practices are consistently applied and demonstrated** | Chart types are suitable and best options for the analysis. All axes and text are treated appropriately. The application of color is correct and clearly conveys meaning. | Chart types chosen are acceptable, but axes may be cluttered or have rotated text. Color choices communicate meaning but can be improved. | Charts incorrectly used for the purpose intended. Axes are difficult to read and detract from understanding. Color used in a distracting or unsuitable manner. | Difficult to understand what is intended with the chart and data. Color actively distracts and confuses. Chart junk dominates the visualization and the meaning is unreadable. |
| **The visualization allows the user to conduct the intended analysis** | The visualization facilitates quick cognition and leading to a fact-based conclusion or assertion. | Study is required to interpret the data and how it applies to the thesis of the analysis. | The visualization does not directly address the topic or relies on presentation support. | The visualization is completely inappropriate and cannot be used to conduct the intended analysis. |
| **SUBJECTIVE** | | | | |
| **Viz is clean, clear, concise, captivating (Shaffer 4 C's)** | The 4Cs are well represented; the visualization is clear, clean, concise, and captivating. | Aspects of the 4Cs are apparent; opportunity exists for further enhancement. | Multiple aspects of the 4Cs are missing, or have not been well addressed in the visualization. | Significant or complete disregard for the guidance present in the 4Cs, resulting in a poor visualization. |
| **Attractiveness and attention to design and details of craft** | Fonts choices are conscious and consistent, proper grammar and spelling is used, and choice of position, size, and emphasis integrate elements into a visually appealing and engaging whole. | Visualization shows thought and planning, and most aspects work in harmony. May exhibit minor issues with spelling, alignment, or sizing mismatched with importance. | Visualization appears sloppy and may be difficult to understand as a coherent whole. Multiple issues with spelling, font consistency, positioning, or other distracting characteristics. | Little or no apparent thought or given and visualization comes across as disorganized. May be visible through numerous spelling or grammar issues, poor alignment and positioning choices inappropriate font use, etc. |
| **The visualization is usable and actionable (Duell Rules)** | The visualization is targeted to the audience, the story is evident, and the conclusion or action required is clearly apparent. No additional interpretation is needed. | There is a clear message or story conveyed, but the action or conclusion that should be drawn is not definitive. May require interpretation. | The visualization suggests some possibilities, but does not lead to clarity of understanding and therefore action is not possible. | No apparent message or relevancy to the user; no actions can nor should be taken based on the analysis. |
| **Quality, integrity, and impact of the findings and analysis** | The analysis shows a level of quality, integrity, and competency that makes the viz impactful, generating a high level of trust. | The overall conclusions of the analysis seem to be sound, with support by anecdotes or additional evidence. | The analysis shows a trend or suggests a result, but is not trustworthy because of errors in process, omission, or scope. | The analysis appears to be poorly conducted, greatly compromising the integrity of some or all of the visualization. |
| **Overall effectiveness of communication and presentation** | The visualization (or presentation) is delivered in a convincing way that demonstrates confidence, competency, and thoroughness. | Delivery provides a strong argument and is well supported; minor details should be vetted and affirmed. | The presentation and communication leaves concerns or lingering lack of clarity. Work required to review and confirm. | The communication and presentation results in confusion and low level of confidence in the analysis, requiring a significant or complete re-do. |

| Week | Topic | Tasks |
|---|---|---|
| **#1**<br><br>1/8/2018<br>through<br>1/14/2018<br><br><br><br><span style="color:red">Saturday<br>1/13/2018<br>UC Closed</span> | **Lectures:**<br>• Brief Introduction<br>• What is Data Visualization and why is it important?<br>• Visual Perception<br>• Brief History of Data Visualization<br>• Design Principles – Preattentive Attributes and Thinking Systems<br>• Picking the Right Tool for the Job<br>**Readings:**<br>• Netiquette<br>• Common Pitfalls<br>• Graph Selection Matrix<br>• Shaffer 4C's and Clean Examples<br>**Tableau Training:**<br>• 1.1 Getting Started<br>• 1.2 Understanding Pill Types<br>• 1.3 Analyzing Intro<br>• 1.4 Formatting Intro<br>• 1.5 Parameters | <span style="color:red">DUE: Install Tableau Desktop Professional (license key provided) prior to first class.</span><br><br>FOR NEXT CLASS<br>Read Shaffer 4C's and Clean Examples<br>Homework #1: Prepare a data visualization using Halloween Trick or Treater data set (provided)<br>Due at beginning of Class #2<br><br><span style="color:red">Due Data Extended to January 24th due to class cancellation.</span> |
| **#2**<br><br>1/15/2018<br>through<br>1/21/2018<br><br><br>Saturday<br>1/20/2018 | **Lectures:**<br>• Review Halloween Exercise<br>• Data Quality<br>• Facilitating Discovery<br>• Actionable Visualizations and the *Duell Rules*<br>**Readings:**<br>• The Big Book of Dashboards<br>    Chapter 1 (pages 3-36)<br>    Chapter 30 (pages 339-351)<br>**Tableau Training:**<br>• 3.1 Dashboard Development<br>• 3.2 Sharing Tableau Viz<br>• 3.3 Tableau Online<br>• 3.4 Authoring for Interactivity | <span style="color:red">DUE: HOMEWORK 1<br>(Trick or Treater data visualization)<br>Due at beginning of class</span><br><br>FOR NEXT CLASS<br>Read Juice Analytics Whitepaper<br>(3 parts)<br>Read Chapters from the Big Book of Dashboards<br>Redesign HW#1 **OR**<br>Participate in Makeover Monday<br>Due at beginning of Class #3 |

| Week | Topic | Tasks |
|---|---|---|
| | • 3.5 Storypoints Dashboards and Stories<br>**Videos:**<br>• Tableau Data Reshaper How To | Due Data Extended to January 30<sup>th</sup> due to class cancellation. |
| #3<br><br>1/22/2018<br>through<br>1/28/2018<br><br><br>Saturday<br>1/27/2018 | **Lectures:**<br>• Chart Types and Pie Charts<br>• Compare and Contrast<br>• Chart Junk and Data to Ink Ratio<br>• Message and Chart Types<br>• Color and Color Blind<br>**Readings:**<br>• The Big Book of Dashboards<br>    Chapter 33 (pages 391-395)<br>    Chapter 34 (pages 397-403)<br>    Chapter 35 (pages 405-409)<br>• Juice Analytics Whitepaper Part 3<br>• Save the Pies for Dessert<br>**Visit Dear-Data.com & Dear-Data-Two.com (Module 4 assignment)**<br>**Tableau Training:**<br>• 4.1 Introduction to Calculations<br>• 4.2 Date Calculations<br>• 4.3 String Calculations<br>• 4.4 Table Calculations | DUE: Redesign of HW#1 or Makeover Monday<br>Due at beginning of class<br><br><u>FOR NEXT CLASS</u><br>Study for exam<br>Read Chapters from the Big Book of Dashboards<br>Review all lecture and reading content from classes 1-3.<br>Take Exam on Blackboard |
| #4<br><br>1/29/2018<br>through<br>2/4/2018<br><br><br>Saturday<br>2/3/2018 | **Lectures:**<br>• Infographics<br>**Readings:**<br>• The Big Book of Dashboards<br>    Chapter 31 (pages 353-380)<br>**Tableau Training:**<br>• 4.5 Benfords Law (Optional)<br>• 4.6 R Integration with Tableau (Optional)<br>**Videos:**<br>• Dear Data Two Presentation from Tableau Conference (60 mins)<br>• Hans Rosling (20 mins) | DUE: Exam using Blackboard<br>Take Exam any time prior to class #4<br><br>Due Data Extended to February 10<sup>th</sup> due to class cancellation.<br><br><br><u>FOR NEXT CLASS</u><br>Create a Dear-Data Postcard. |

| Week | Topic | Tasks |
|---|---|---|
| | • Hans Rosling's 200 Countries, 200 Years, 4 Minutes - The Joy of Stats - BBC (5 mins)<br>• Mariano Rivera Cutter: The Mechanics of His Signature Pitch – NY Times (4 mins)<br>• Journalism in the Age of Data (53 minutes)<br>• Data Wrangler (4 mins)<br>• Presentation by Alberto Cairo on Infographics (10 mins) | Pick any week from the Dear-Data.com or Dear-Data-Two.com project and create a postcard. |
| #5<br><br>2/5/2018 through 2/11/2018<br><br><br><br>Saturday 2/10/2018 | **Lectures:**<br>• Design Font and Graphics<br>• Mapping and Geocoding<br>**Readings:**<br>• The Big Book of Dashboards<br>  Reference Scenarios for your projects (Chapters 2-29)<br>**Tableau Training:**<br>• 2.1 Basic Mapping<br>• 2.2 Background Images Advanced<br>• 2.3 Custom Geocoding<br>• 2.4 WMS Servers<br>• 2.5 Advanced Mapping Techniques<br>**Videos:**<br>• Inge Druckrey: Teaching to See (36 mins)<br>• Silenc – visualization (2 mins) | <span style="color:red">DUE: Dear-Data Postcard<br>Due at beginning of class<br>Post Images to Blackboard or<br>Bring postcard to Class to turn in</span><br><br>FOR NEXT CLASS<br>PROJECT 1 COMPLETED<br>Due at beginning of class |
| #6<br><br>2/12/2018 through 2/18/2018<br><br><br><br>Saturday 2/17/2018 | **Lectures:**<br>• Social Alignment (35 mins)<br>• Thinking Critically About Data Analysis<br>• Owning Your Data Story<br>**Readings:**<br>• The Big Book of Dashboards<br>  Reference Scenarios for your projects (Chapters 2-29)<br>**Work on Final Projects and Presentations** | <span style="color:red">DUE: PROJECT 1 (Team)<br>Due at beginning of class<br>(teams will not present in class)</span><br><br>FOR NEXT CLASS<br>Final Project Due<br>Visualizations and Presentation<br>(teams will present in class)<br>Due FRIDAY 2/23 at 10:00 P.M.<br>(the evening prior to class) |

| Week | Topic | Tasks |
|---|---|---|
| #7<br><br>2/19/2018<br>through<br>2/25/2018<br><br><br><br>Saturday<br>2/24/2018 | **Final Data Visualization Project presentations**<br>• Presentation (ex. PowerPoint, Prezi, Tableau Storypoints)<br>• Interactive Visualization (ex. Tableau)<br>• Video presentations (ex. Blog entry on Blackboard, YouTube link) | DUE: FINAL PROJECT<br>**Visualizations and Presentation Due FRIDAY 2/23 at 10:00 P.M. (the evening prior to class) Teams Present in Class #7** |