

**Change My Mind:**  
*Applying Bayesian Techniques to Decision Making*  
**MATH COLL 300, Section 01**  
**Fall 2018**

<u>Time &amp; Location:</u>	Fall 2018 Tu/Th, 2:00pm-3:20pm Room: N/A
<u>Instructor:</u>	Professor A (Math Teacher, Primary Research Area: Applications of Bayesian Inference) Professor B (Psychology Teacher, Primary Research Area: Social Judgement Theory) Office: N/A E-mail: castrusser@email.wm.edu Office hours: N/A
<u>Textbooks:</u>	Silver, Nate. (2012). The signal and the noise: why so many predictions fail—but some don't. New York, Penguin Press. ISBN-13 978-1846147524  Kahneman, D. (2011). Thinking, Fast and Slow. New York: Farrar, Straus, and Giroux. ISBN-13 978-0374533557

**Objectives & Format:**

The class serves to educate students on two current ideologies for decision making. The first is Bayesian Inference, where both past information joins in congruence with current data to form a unified opinion. Throughout this class, students will be forced to “update” their opinions, this means that they must integrate their previous opinion/knowledge base with the new information put in front of them to form an “updated” opinion. The second ideology is the findings of Social Judgement Theory. Social Judgement Theory is a branch of psychology that focuses on what causes people to change their mind/form other opinions. Students will be forced to reflect on their “updates” to analyze if their opinions are changing in a logical way. Students will be asked whether or not they are changing their opinions too much based on presented information, the common bias of ignoring statistical base rates, or if they are not changing their opinion enough, this could be due to many different biases such as confirmation bias.

After educating students on these two techniques and the potential pitfalls they may fall into in their everyday decisions, students will be asked to put these two models to the test. Students will be asked to present their answer to a question of their choice. Each student will gather the opinions of the class and along with their own knowledge attempt to present a strong and enjoyable answer to their question. The listening students will then be asked to adapt their own belief system based on the content of each presentation.

This class serves as a Coll 300 class, meaning that this class is for students who did not study abroad. This class aims to present a wide variety of topics and opinions, similar to those encountered in foreign locations. Students are encouraged to take a deeper look at how and why they make the decisions and form the opinions that they currently hold. After taking this class students should better understand how to form a convincing argument, and how to adjust their thoughts based on current information. Ultimately, this class should be both an informative and fun analysis of students' current opinions and thoughts.

## Requirements:

*Initial Thought Papers:* Before each class, students will be prompted to write an “Initial Thought” paper on the topic at hand. These papers are meant to be an establishment of a baseline opinion/thought, or in Bayesian speak an establishment of a prior. These papers can be as long or as short as needed, depending on students’ current knowledge and fluency with the topic at hand. Papers must be posted to Blackboard before each class begins. These papers should not be a point of stress and can be written in a “stream of consciousness” form.

*Update Papers:* After each class, students will be prompted to update their “Initial Thought” paper, in the form of a so-called “Update” paper. In Bayesian speak this would serve to establish the posterior opinion. Students are encouraged to make their “Update” papers as honest as possible. If a student feels wildly different about the topic at hand, explain what changed. While, if a student feels as if almost nothing has changed, explain why they stayed the same. As students begin to understand more techniques and potential biases behind why they feel a certain way, students are encouraged to explore what prevented them from changing, or what caused such a wild change in opinion. These papers are encouraged to be as explorative and as open-ended as possible. “Update” papers must be posted to Blackboard before the start of the next class.

*“Change My Mind” Presentation:* Every student in this class is required to prepare a “Change My Mind” presentation. First the student will come up with a question that they would like to answer. This question can range from a serious question to one that is potentially humorous. You will see Professor A and B give a “Change My Mind” presentation on the validity of pineapple on pizza. Students are encouraged to be creative with this question and have fun exploring their topic. Students will then pose this question to the class. Each class member is expected to write an “Initial Thought” paper answering this question. The presenting student must then compile enough information for a 30 minute presentation exploring the answer to this question. This student can use other students’ “Initial Thought” papers, outside research, personal experience, or really any “data” to try and sufficiently answer this question. Don’t worry, the presenting student will get the opportunity to reflect on their presentation by writing an “Initial Thought” about their expectations for their presentation and an “Update” paper at the end of their presentation, allowing for reflection on their strengths and weaknesses. After each presentation, students will both express their opinions and evaluations of the presentation both in class and in the form of an “Update” paper, expressing whether or not their answer to this question changed based upon the presented information. Overall, we hope that this process starts students thinking about both how to approach answering a question, and how to adjust and change their overall opinion after the presentation of certain evidence.

### Grading policy

Professor A and B have created a grading scale for this class, but have chosen to keep it hidden for reasons (Bayesian in nature) that should soon become apparent. This grading scale will be combined with a final “Update” paper where a student gives themselves their perceived grade as well as any reasoning behind this grade. Students final grades will be a combination of these two grades, the specific combination of these two grades will depend on how convincing each student is able to reason their deserved grade.

Note: Students should not worry about grades in this class, simply doing all “Initial Thought” and “Update” papers on time, combined with an interesting “Change My Mind” presentation will most likely result in the student receiving their desired grade.

## Tentative course schedule

Date	Topic	Homework
Th, Aug 30	Introduction to the Class (Syllabus is read, expectations for class are explained)	Initial Thought Paper 1: What do your current expectations for this class? Initial Thought Paper 2: What are the capabilities and limitations of statistics and modeling? (If you know nothing about modeling feel free to say you have no clue)
Tu, Sept 4	Introduction to the Rule of Bayes, Bayesian Inference, Brief Discussion on Frequentist vs. Bayesian Methods. (Would be similar/refined version of first presentation, merely providing background information and a few interesting examples)	None
Th, Sept 6	Area of Research: Applying Bayesian inference to ____ (This would ideally be some area of research/interest of the professor and they would explain their research in the area and their conclusions)	Update Initial Thought Paper 2: express your current thoughts and beliefs on statistics and modeling.
Tu, Sept 11		
Th, Sept 13	Simple Example of Bayesian Inference: Explaining polling using Bayesian inference in R	Homework 1: Simply download and execute selected code in R and answer a few questions about the Bayesian method Initial Thought Paper 3: What causes people to change their minds?
Tu, Sept 18	What Causes People To Change Their Minds: A brief explanation of social judgement theory	Update Initial Thought Paper 3 Initial Thought Paper 4: What are your thoughts on pineapple on pizza?
Th, Sept 20		
Tu, Sept 25	Professor Presentation: Pineapple and pizza, evaluation/discussion of combined thoughts on presentation criterion	Update Initial Paper 4
Th, Sept 27	The Human Maximum Likelihood Estimator: How much should we change our opinions when introduced to new information?	Initial Thought Paper 5: Presenter 1 Question (Presenter expected to write initial thought paper on how they expect presentation to go)
Tu, Oct 2	Presentation 1	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter
Th, Oct 4	Presentation 2	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter
Tu, Oct 9	Presentation 3	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter

Th, Oct 11	Presentation 4	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter
Tu, Oct 16	NO CLASS: FALL BREAK	None
Th, Oct 18	Presentation 5	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter
Tu, Oct 23	Presentation 6	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter
Th, Oct 25	Presentation 7	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter
Tu, Oct 30	Presentation 8	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter
Th, Nov 1	Presentation 9	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter
Tu, Nov 6	Presentation 10	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter
Th, Nov 8	Presentation 11	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter
Tu, Nov 13	Presentation 12	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter
Th, Nov 15	Presentation 13	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter
Tu, Nov 20	Presentation 14	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter
Th, Nov 22	NO CLASS: THANKSGIVING	
Tu, Nov 27	Presentation 15	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter

Th, Nov 29	Presentation 16	Update Initial Thought Paper (Presenter evaluate their performance vs. expectations) Initial Thought Paper for Next Presenter
Tu, Dec 4	Deep Dive into Bayesian Learning: Potential research topics using Bayesian Inference	Update Paper for Last Presenter Please submit an anonymous class evaluation
Th, Dec 6	Deep Dive into Decision Making: Potential research topics using Social Judgement Theory	Update Initial Thought Paper 1: What are your final thoughts on this class, assign a final grade with reasoning

**Note: This syllabus is based off one given to me by Professor Kauffman in her PSYCH 470 Class**

### **Explanation of Syllabus:**

The impetus for the creation of this syllabus was that I was quite disappointed in my Coll 300 class. Coll 300 classes are supposed to be a replacement for study abroad. They are supposed to introduce new ideas, and explore them with a different perspective than that normally used at William and Mary. My Coll 300 class felt extremely academic and very similar to past classes I had taken at the college. This class is hopefully a conceptual departure from the normal structure of a William and Mary class. This class is structured similarly to Mathematic Connections, which is definitely a unique class relative to all other math classes, with a little more structure and guidance. Techniques and ideas are introduced to the class, similar to many classes, but students are then expected to take and express these techniques in whatever manner they feel appropriate. In their “update” papers they can reference as many or as few class ideas as they want, taking from the class whatever they find most relevant/interesting. In general, I believe Coll 300 classes should have students learning and taking away from the class what they find most relevant to their experience, traditional testing seems inappropriate for such a setting.

Relating this syllabus to my Mathematic Connections presentation, this class combines two of my current interests/studies. Learning about the Bayesian Method and how a Bayesian statistician would approach life’s problems and questions, and Social Judgement theory from my current class “Judgement and Decision Making.” Combining these two interests, sparked the main idea for this class. Exploring why we think the way we do and how that changes as we experience life. I think this class is incredibly relevant to the college experience as we are not only taking in a large amount of intellectual data, but also these years are incredible formative for our person in general. I want this class to not only have students learn some academic ideology, but to also learn about themselves, one of the main general goals of a Coll 300 class or the study abroad programs.

I decided against doing a strictly mathematical class on Bayesian Inference, as I suggested in class, as my current interest lies in the connection of Bayesian thinking to general situations. I also think that the introduction of this ideology to students that are not only math majors, but even to those who have no statistical background would be uniformly engaging. Math majors and statistics students learn that our thinking and judgements are flawed, but I think the exploration of this idea is relevant to everyone.

Overall, I really enjoyed thinking about and creating this class and hope that this was an appropriate and interesting take on the Mathematic Connections Paper #1.

### **Reflection on First Presentation:**

**Strengths:** Reading through other students comments, I think that my primary strength was that my enthusiasm/interest in the topic was evident throughout my presentation. I personally thought my presentation was pretty cool, and tried to best convey what interested me about Bayesian thinking. I think that different people enjoyed different parts of the presentation and I covered a wide variety of topics so that most people at least could write about one of the aspects of my presentation.

**Weaknesses:** Generally, I know that I speak really fast. Many students noted this, and some felt it detracted from the presentation. I plan to speak more slowly in my future presentation. Another point was that certain students felt some parts of the presentation to be confusing/not particularly relevant. I think that I could have done a better job presenting a more logical flow and transition between my slides as well as explaining background information more clearly. I think fully explaining the Rule of Bayes problem, as well as doing a more in depth example explaining Bayesian Inference would have made my presentation more coherent.

**Contested:** One aspect of my presentation that certain students liked but some did not was the lack of text/information on the majority of my slides. This was intentional as I wanted students to pay attention to the presentation itself and not just read the information on the slides. I think if I was better at conveying and explaining the contents of my presentation, this lack of information would turn into an overwhelming strength as it would make my presentation more about the connections and opinions rather than just the text on a slide.

**Overall:** I enjoyed giving my first presentation. I think that there are many small improvements to be made, but I think that for the most part my presentation was enjoyable/interesting to the students.