

# PHIL 380A: MEASUREMENT AND MODELS

Spring 2021

*Class schedule:* TR 9:30-10:50am  
*Class Instructor:* Dr. Katherine Valde  
*Office:* DB 206

*Class Location:* MONTG 119  
*E-mail:* valdekg@wofford.edu  
*Office Hours:* Tue 11am-1pm

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*Philosophy, though unable to tell us with certainty what is the true answer to the doubts it raises, is able to suggest many possibilities which enlarge our thoughts and free them from the tyranny of custom. Thus, while diminishing our feeling of certainty as to what things are, it greatly increases our knowledge as to what they may be; it removes the somewhat arrogant dogmatism of those who have never traveled into the region of liberating doubt, and it keeps alive our sense of wonder by showing familiar things in an unfamiliar aspect.*

-Bertrand Russell

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## Course Description:

While both measurement and models are central to scientific practice, they are often seen as having drastically different characters. Measurement, on the one hand, is seen as the paradigm of scientific objectivity. Models, on the other hand, are seen as merely useful fictions. This class will explore the nature of measurement and models and their role in knowledge production. The primary goal of this course is to come to a deeper and more critically reflective understanding of both of measurement and modeling and the various roles they play in contemporary debates in the philosophy of science.

## Course Objectives:

This course is designed to both provide an introduction to some questions in the philosophy of science (specifically surrounding measurement and modeling) and to inspire your curiosity for such questions. You will learn to:

- Reflect critically on scientific practice
- Identify and understand assumptions in measurement practices
- Evaluate science in a broader context
- Interpret and analyze philosophical text
- Apply philosophical concepts in original work

Along the way, this course will help you to develop and articulate your own perspective on these issues and inspire an excitement for creativity in approaching problems in the philosophy of science. It is the ultimate goal of this course to help you become a thoughtful consumer of science and more fully appreciate the beauty and complexity of our world.

## Required Text:

All readings will be provided on as PDFs via Moodle.

## Class Expectations:

Do the readings. *Think* about the readings. Our class will not be engaging for you if you do not come prepared. Treat each other and the professor with respect. Be prepared to be challenged. Growth (intellectual and personal) comes from moving beyond our comfort zones!

## GRADING:

### **PARTICIPATION – 10%**

Participation will be assessed on student's active engagement with the material and each other during class periods. Merely showing up and listening respectfully is considered C-level participation. Engagement during project presentation will be especially important to earning your participation grades.

### **PERUSALL – 20%**

Students are expected to complete readings on Perusall. You will be expected to read the entire document, make high quality annotations, and return to reply to other student comments. You make at least 6 high-quality comments/responses per assignment. Annotations are substantive questions, engaging comments, and thoughtful responses to your peers' questions and comments. More meaningful engagement will earn a higher grade.

### **DISCUSSION LEADERSHIP– 20%**

You will be in charge of leading discussion in class on a topic related to your paper project that will be chosen in consultation with your professor. Leading discussion entails selecting topics/readings in consultation with your professor, understanding the text ahead of time, determining the key point to emphasize to your peers, coming up with activities for class, meeting with your instructor to discuss your plans, and facilitating the in-class discussion.

### **PROJECT PRESENTATION– 20%**

You will be presenting your original research to the class. Each student will be expected to prepare a talk to communicate their central argument to the class. Presentations will last 8-10 minutes, and there will be approximately 10 minutes for discussion and questions after each presentation. These presentations must include some sort of teaching aid (PowerPoint, handout, Prezi, etc.).

### **PAPER PROJECT – 30%**

For this paper you will answer a question of your own design relating to some topic from class. These projects will include proposing and presenting an abstract (5%), getting project approval in a one-on-one meeting with your professor (10%), completing peer review of complete drafts of your paper (15%), and a submitting a final paper (70%). Final papers should be approximately 2,500 words.

## COURSE SCHEDULE:

### **KEY PERSPECTIVES ON M&M (WEEKS 1-5):**

Week 1 – WHY ON EARTH SHOULD YOU CARE?

Tuesday 1/5	#168: Happiness Calculator vs. Alex Goldman (ReplyAll – Podcast)
Thursday 1/7	The Miseducation of Larry P (Radiolab – Podcast)

Week 2 – WHAT IS MEASUREMENT? WHY ISN'T IT EASY?

Tuesday 1/12	<i>Old and New Problems in Philosophy of Measurement</i> (2013) by Eran Tal
Thursday 1/14	<i>Measurement Accuracy Realism</i> (2018) by Paul Teller

Week 3 – HOW DO WE MEASURE?

Tuesday 1/19	<i>Heaps of Moles? – Mediating Macroscopic and Microscopic Measurement of Chemical Substances</i> (2020) by Jo E. Wolff
Thursday 1/21	<i>Sensory Measurements: Coordination and Standardization</i> (2015) by Anne Sophie Barwich and Hasok Chang

Week 4 – HOW DO MODELS RELATE TO MEASUREMENT?

Tuesday 1/26	<i>The evaluation of measurement uncertainties and its epistemological ramifications</i> (2017) by Nadine De Courtenay and Fabien Gregis
Thursday 1/28	<i>Computer Simulation, Measurement, and Data Assimilation</i> (2015) by Wendy Parker

Week 5 – HOW DO MODELS RELATE TO MEASUREMENT?

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Tuesday 2/2	<i>Using models to correct data: paleodiversity and the fossil record (2018)</i> by Alisa Bokulich
Thursday 2/4	<i>Calibration, Coherence, and Consilience in Radiometric Measures of Geologic Time (2020)</i> by Alisa Bokulich

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**PROJECTS BEGIN (WEEK 6):**

Week 6 – Mandatory Individual Meetings with Dr. Valde

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Tuesday 2/9	Project introductions and brainstorming!
Thursday 2/11	<b>Abstracts due by 9am on Moodle– In-Class Topic Pitches!</b>

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**DISCUSSION LEADERSHIP PROJECTS (WEEKS 7-10):**

TOPICS BASED ON STUDENT INTERESTS (SEE BELOW)

Week 7 – Metaphysics and Measurements

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Tuesday 2/16	<i>The Metaphysics of Quantities (2020)</i> by Jo Wolff Ch 4. Realism in measurement
Thursday 2/18	<i>Perspectivism (2017)</i> by Michaela Massimi

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Week 8 – Measuring Well-Being

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Tuesday 2/23	<i>Measuring Well-Being: A Review of Instruments</i> by Cooke, Melchert, and Connor
Thursday 2/25	<i>Do antidepressants work?</i> by Jacob Stegenga

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Week 9 – Measuring Pain & Why Predictions Fail

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Tuesday 3/2	<i>Pain Outcomes: A Brief Review of Instruments and Techniques</i> by Younger, McCue, and Mackey
Thursday 3/4	Selections from <i>The Signal and The Noise: Why So Many Predictions Fail, but Some Don't</i> (2012) by Nate Silver

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Week 10 – Feminist Perspectives & Can we measure athletic greatness?

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Tuesday 3/9	<i>Feminist Perspectives on Sex and Gender</i> (section 3.2) by Mari Mikkola <i>JK Rowling Is Right—Sex Is Real and It Is Not a “Spectrum”</i> by Colin Wright
Thursday 3/11	<i>All-start</i> by Jessica Flack and Cade Massey

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**PROJECT PRESENTATIONS (WEEKS 11-12):**

Week 11 –

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Tuesday 3/16	Dr. Valde’s Demo & presentation prep
Thursday 3/18	Presentation 1, 2, & 3

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Week 12 –

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Tuesday 3/23	Presentations 4, 5, & 6
Thursday 3/25	Presentations 7 & 8

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**FINAL PAPER PROJECTS (WEEKS 13-14):**

Week 13 –

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Tuesday 3/30	Peer review – <b>Completed drafts due by 9am on Moodle</b>
Thursday 4/1	Peer Review

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Week 14

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Wednesday 4/7	<b>FINALL PAPERS DUE AT NOON</b>
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## FINAL PAPER PROJECT

**Audience:** Scholars across the university not necessarily familiar with your field

**Purposes:** To practice drawing on research to enhance your argumentative writing; to hone your skills in the important academic genre of the multi-sourced research paper; to explore the conventions of and motivations for writing up research for a scholarly audience.

**Assignment:** In this class we have seen a variety of questions and different ways of approaching those questions. For this paper you will answer a question of your own design relating to some topic from class. Be sure to consider the strongest objection(s) to your position and respond to the objection(s). Papers should be approximately 2,500 words.

**Project abstract (5%):** You must submit an abstract of approximately 100 words on Moodle by 9am on Tuesday February 16<sup>th</sup>. This 100-word abstract should describe your project – motivate your question, describe your question, and sketch your answer.

**Project approval (10%):** Projects must be approved by Friday February 19<sup>th</sup>. Discussion of projects will occur in mandatory 20-minute meetings with Dr. Valde, which will occur Tuesday February 16<sup>th</sup> and Wednesday February 17<sup>th</sup>. Getting approval is worth 10% of your paper project grade.

**Peer review (15%):** A complete (approximately 2,250-2,500 word) draft of your paper is due on Moodle by 9am Tuesday March 30<sup>th</sup>. You must complete the peer review that is assigned to you by 11am on Thursday April 1<sup>st</sup>. The quality of your submitted draft is worth 5% of your paper project grade, and the quality of the peer review you give is worth 10% of your paper project grade.

**Final Submission (70%):** Use APA style to cite, include an abstract, and add a Works Cited list. Include word count at the end of the submission – neither the abstract nor your works cited should be included in the word count. Paper submission due on Moodle by noon on April, December 7<sup>th</sup>.

## TOPIC IDEAS

### CASE STUDY TOPICS

Polling  
Gerrymandering  
Intelligence Testing (e.g. IQ)  
Standardized Testing  
Temperature  
Moles  
Time  
Weather  
Climate Change  
Pain  
Unemployment  
Well-being

### CONCEPTUAL TOPICS

When or how does measurement count as knowledge?  
How do you measure something?  
Do models explain?  
How do models change measurement?  
Are measurements objective?  
What is a measurement?  
What is a model?  
What is reliability?  
Are models or measurements more reliable?  
Are there things that cannot be measured?  
What is the relationship between measurement and prediction?

## RESOURCES (SCHOLARLY)

### THE NATURE OF MEASUREMENT

*A Model-Based Epistemology of Measurement* (2017) by Eran Tal  
*Measurement Accuracy Realism* (2018) by Paul Teller

### INTERNATIONAL SYSTEM OF UNITS (CASE STUDY)

*Naturalness and Convention in the International System of Units* (2018) by Eran Tal  
*The Reform of the International System of Units (SI): Philosophical, Historical and Sociological Issues* (2019) by de Courtenay et al.

### MEASUREMENT THROUGH ITERATIVE COHERENCE

*Inventing Temperature* (2004) by Hasok Chang

### MEASUREMENT/MODELS AS REPRESENTATION

*Scientific Representation: Paradoxes of Perspective* (2008) by Bas van Fraassen  
*Modeling and Measurement: The Criterion of Empirical Grounding* (2012) by Bas van Fraassen  
*The Metaphysics of Quantities* (2020) by Jo Wolff  
Ch 4. Realism in measurement  
*Perspectivism* (2017) by Michaela Massimi

### EXPLANATION & MODELS

*Moving Beyond Causes: Optimality Models and Scientific Explanation* (2015) by Collin Rice  
*Models and Explanations* (2017) by Alisa Bokulich  
*Minimal Model Explanations* (2015) by Batterman and Rice  
*How the Laws of Physics Lie* (1983) by Nancy Cartwright  
Ch. 8 The Simulacrum Account of Explanation

### UNDERSTANDING THROUGH MODELING

*True Enough* (2017) by Catherine Elgin  
*Idealized Models, Holistic Distortions, and Universality* (2018) by Collin Rice  
*Idealization and the Aims of Science* (2017) by Angela Potochnik

### MODELS FIXING MEASUREMENT

*What Distinguishes Data from Models?* (2019) by Sabina Leonelli

### PREDICTION

*The Signal and The Noise: Why So Many Predictions Fail, but Some Don't* (2012) by Nate Silver  
Topics covered include: Weather, Climate Change, Poker, Baseball, Bayesian Statistics, etc.

## RESOURCES (NON-SCHOLARLY)

RadioLab Presents: G (Podcast series on Intelligence – [link](#))  
The Gerrymandering Project (FiveThirtyEight Podcast – [link](#))  
*A Model World* by Jon Turney  
*The concept of probability is not as simple as you think* by Nevin Climenhaga  
*The Blind Spot* by Adam Frank, Marcelo Gleiser, and Evan Thompson  
*A Happy State* by Benjamin Radcliff (Economics and Well-being)  
*Do antidepressants work?* by Jacob Stegenga  
*All-start* by Jessica Flack and Cade Massey  
*Getting It Right* by Michaela Massimi